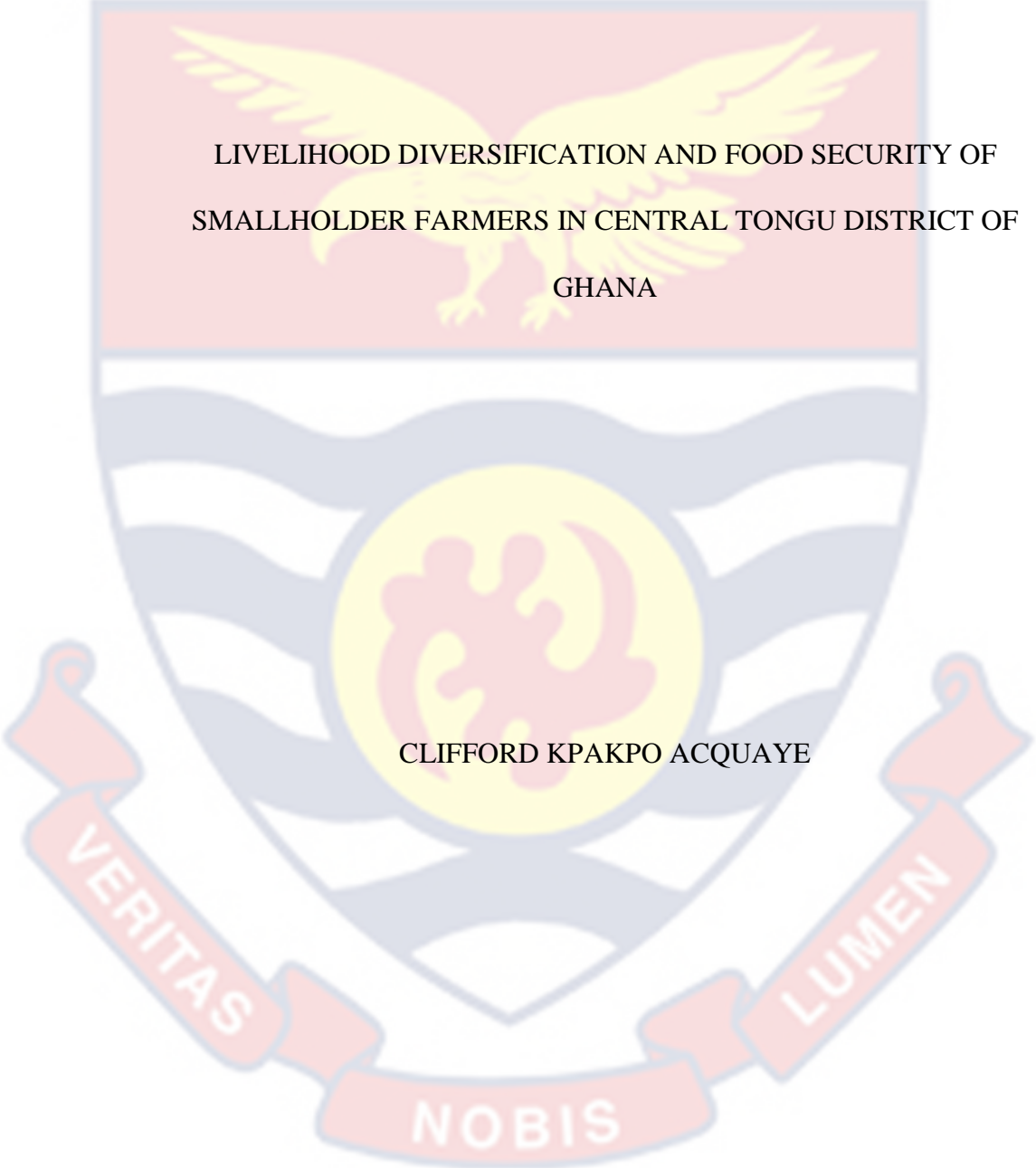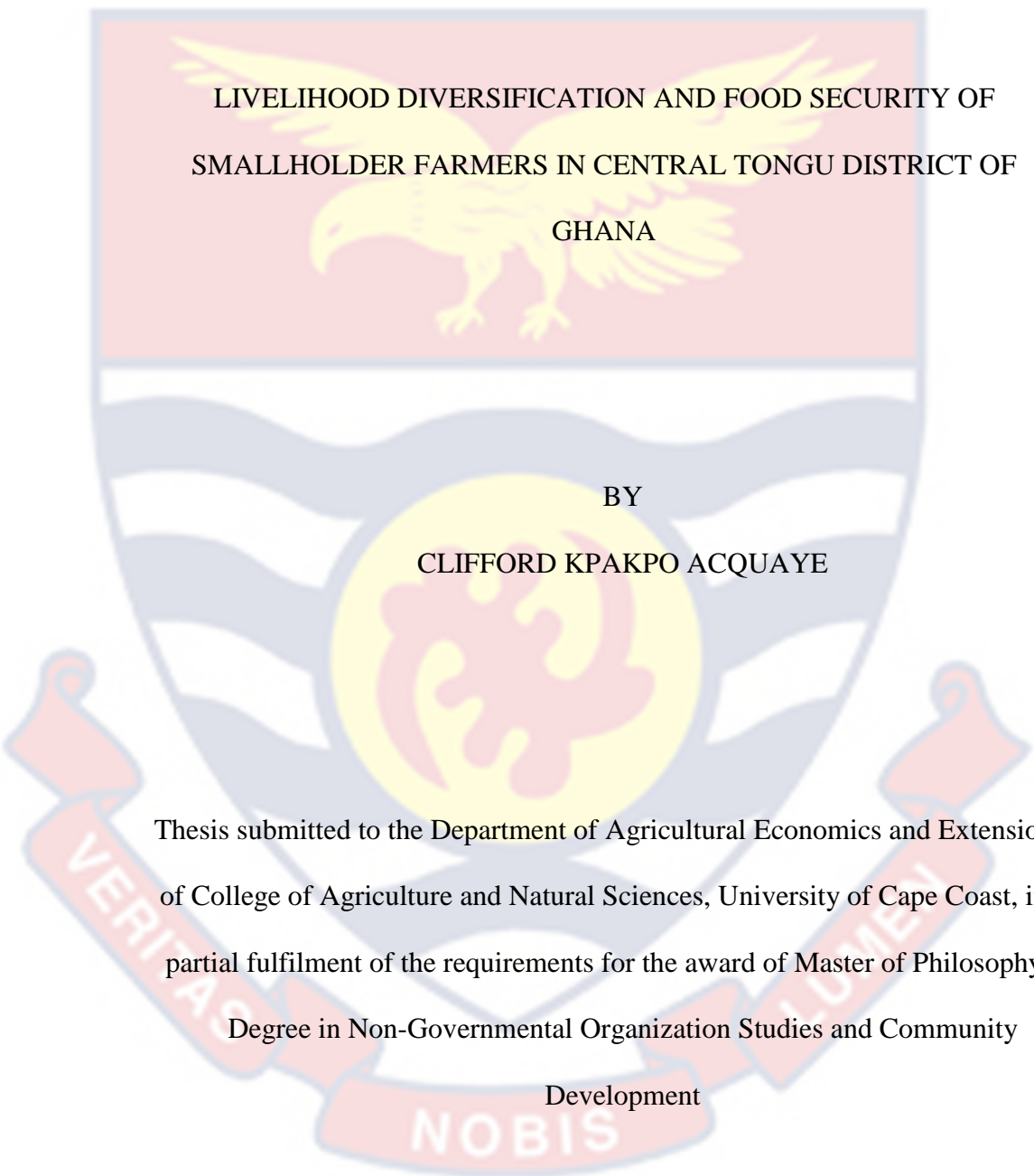UNIVERSITY OF CAPE COAST

LIVELIHOOD DIVERSIFICATION AND FOOD SECURITY OF

SMALLHOLDER FARMERS IN CENTRAL TONGU DISTRICT OF

GHANA

CLIFFORD KPAKPO ACQUAYE

2022

UNIVERSITY OF CAPE COAST

LIVELIHOOD DIVERSIFICATION AND FOOD SECURITY OF

SMALLHOLDER FARMERS IN CENTRAL TONGU DISTRICT OF

GHANA

BY

CLIFFORD KPAKPO ACQUAYE

Thesis submitted to the Department of Agricultural Economics and Extension

of College of Agriculture and Natural Sciences, University of Cape Coast, in

partial fulfilment of the requirements for the award of Master of Philosophy

Degree in Non-Governmental Organization Studies and Community

Development

JUNE, 2022

DECLARATION

Candidate's Declaration

I hereby declare that this thesis is result of my own research work and that no part of it has been presented for another degree in this university or elsewhere.
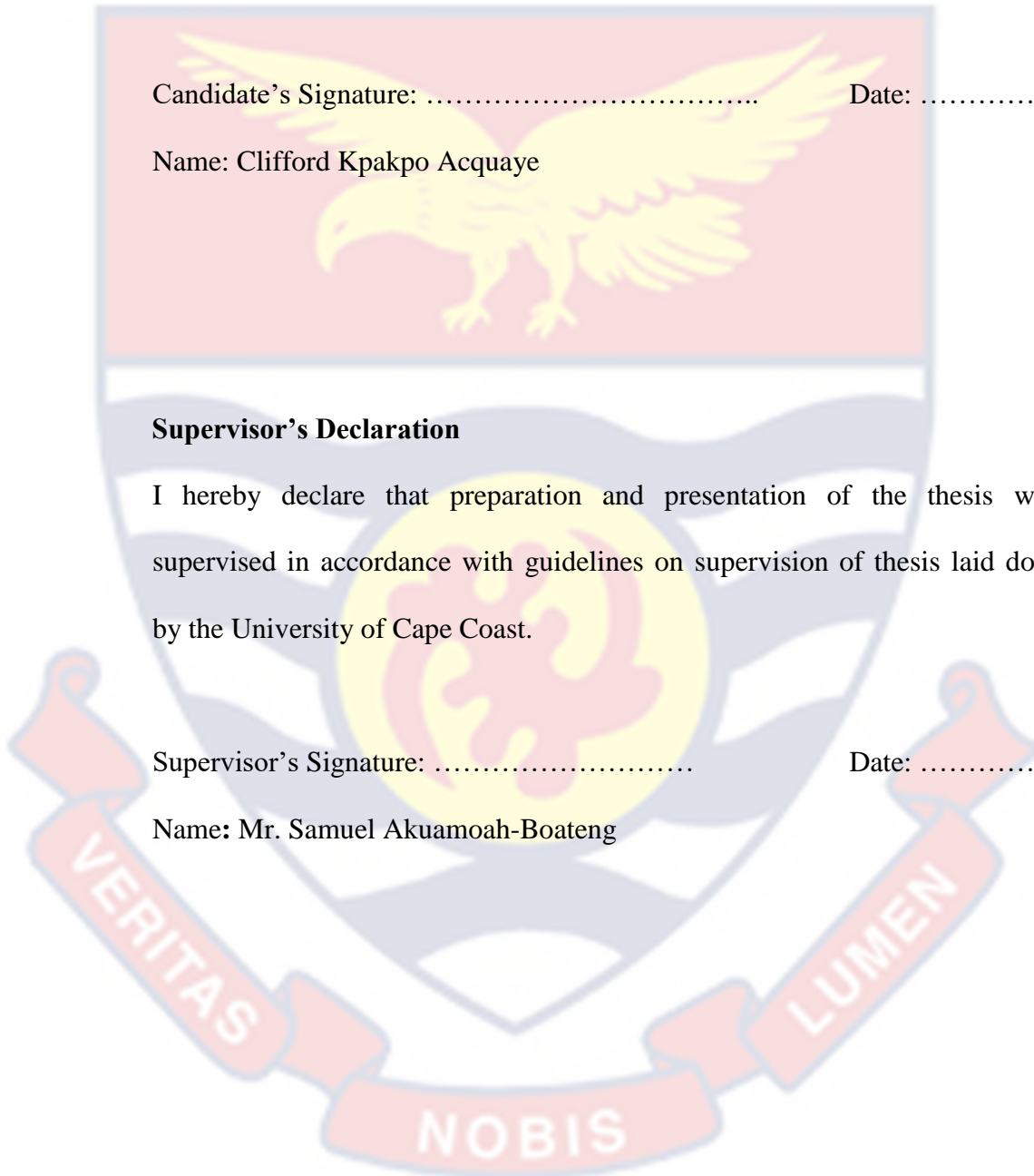
Candidate's Signature: …………………………..   Date: ……………

Name: Clifford Kpakpo Acquaye

Supervisor's Declaration

I hereby declare that preparation and presentation of the thesis were supervised in accordance with guidelines on supervision of thesis laid down by the University of Cape Coast.

Supervisor's Signature: ………………………   Date: ……………

Name**:** Mr. Samuel Akuamoah-Boateng

ABSTRACT

The study examined the livelihood diversification and food security of smallholder farmers in Central Tongu district of Ghana. Cross-sectional descriptive survey design was used to collect data from 270 smallholder farmers in Central Tongu District using multi-stage sampling technique. Data gathered was analyzed using descriptive statistics, Tobit regression model and Simpson's index of diversification. Findings from the study disclosed that mean age of smallholder farmers was about 44 years old, with majority (65%) being males. Mean years of farming was about 22 years and mean household size was 5 people. Smallholder farmers who cultivated cassava as their main farm activity was 37%, those who cultivated maize as subsidiary farm activity was 15.8% and those who were engaged in trading as their subsidiary non-farm activity was 31.8%. The level of livelihood diversification among smallholder farmers was 0.72 which indicated that they were moderately high in their livelihood diversification. Critical factors which positively and significantly influenced livelihood diversification included land size, access to land, access to water and membership of FBO. Few of smallholder farmers (2.2%) attained high food security and majority of smallholder farmers (85.9%) attained moderate food security. However, 10.4% of smallholder farmers attained low food security and 1.5% of smallholder farmers attained very low food security. It is recommended that government and other partners should encourage aged farmers to diversify their livelihood activities. Also, governmental policies and programs should focus on promoting economic development, social protection, innovation and entrepreneurship, access to water and land among smallholder farmers in Central Tongu District.

DEDICATION

To God Almighty my creator and strong pillar, and to my wife, Mrs. Shirley

Louraine Naakowah Acquaye. As well as my sons; Judah Nii Adotey

Acquaye, Israel Nii Adotei Acquaye and Joy Nii Adokwei Acquaye.

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My appreciation goes to the lecturers of Department of Agricultural Economics and Extension of the University of Cape Coast for helping to shape this thesis.

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CILSS	Permanent Inter-State Committee for Drought Control in the Sahel
CTDA	Central Tongu District Assembly
DFID	Department for International Development
FAO	Food and Agriculture Organization
FASDEP	Food and Agriculture Sector Development Policy
FBOs	Farmer Based Organizations
GSS	Ghana Statistical Service
HFSSM	Household Food Security Survey Module
IBM	International Business Machines Corporation
IFAD	International Fund for Agricultural Development
IISD	International Institute for Sustainable Development
IRB	Institutional Review Board
LI	Legislative Instrument
MDGs	Millennium Development Goals
METASIP	Medium Term Agriculture Sector Investment Plan
MoFA	Ministry of Food and Agriculture
NGOs	Non-Governmental Organizations
SDGs	Sustainable Development Goals
SID	Simpson's Index of Diversification
SLA	Sustainable Livelihood Approach
SPSS	Statistical Package for Social Sciences
SSA	Sub-Saharan Africa
UCC	University of Cape Coast

UN   United Nations

WFP   World Food Programme

CHAPTER ONE

INTRODUCTION

Background to the study

Smallholder farmers are category of farmers who grow crops or raise animals on minimum of 1.5 acres of land for sustenance and they rely mainly on family labour. In addition, they have limited resources and utilize simple agricultural technologies which make their households to be prone to food insecurity (Wondimagegnhu, Huluka & Nischalke, 2019). Among livelihood activities of a smallholder farmer is a major one, unto which others get added on through engagement in subsidiary activities to diversify resources and incomes of farming households (Wondimagegnhu, Huluka & Nischalke, 2019). Most of smallholder farmers complain of crop failure as their main challenge due to insufficient and erratic rainfall (WFP, 2012).

As their harvest fail, they become prone to food insecurity because of their sole dependency on agriculture. They have seasonal challenges in getting adequate food as general cost of food keep rising due to food production decline and high inflationary trends. As a result, very impoverish community members that mostly use much of their hard earned resources on food are greatly affected by this general trend of high food prices (WFP, 2012). In Ghana, decline in average yield of agricultural produce over the years, poses a notable rise to food insecurity challenges. In addition, for twenty years now, food importation and food aid have risen up to about 5% of food requirement of the country. This situation has contributed to a rise in occurrence of food insecurity especially among poor and deprived households in the country (Darfour & Rosentrater, 2016). Ministry of Food and Agriculture with

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governmental support developed policies to strategically deal with challenges of food insecurity. In drafting the METASIP policy, three pillars were identified as: food availability, food accessibility and food use. Food availability involved the population getting adequate food available in a consistent way. Food accessibility involved the population getting enough resources for the right nutritious food. Finally, food use involved the right usage of nutritional knowledge to provide balanced diet in a hygienic environment (MoFA, 2010). MoFA defines food security as good quality nutritious food, hygienically packaged and attractively presented, available in sufficient quantities all year round and located at the appropriate places at affordable prices. Essential points of this food security concept include; nutritious food quality, self-sustenance, material and economic availability (MoFA, 2007).

According to MoFA (2007), United Nations defines food security as a situation where all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs. The UN definition of food security was adopted for this study since it gives a consistent and comprehensive accepted framework for measuring food security (Devereux, 2001).

About 2.5 billion of the world population survives on agricultural related enterprises by producing food and other raw materials with their limited resources (IFAD, 2013). About 795 million individuals living worldwide have insufficient food to eat and are facing hunger. Furthermore, 780 million people out of global figure reside in developing countries including Ghana (FAO, IFAD & WFP, 2015). Inadequate supply of food to

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meet threats posed by hunger and anxiety of not having sufficient food for a family result in food insecurity in poor countries (Argaw & Shewankena, 2018).

In sub-Saharan Africa, food insecurity has brought much suffering and hardship to many households and it is a major challenge because of conditions such as increasing population, economic crisis, climate change and conflicts. Governmental policies in these countries which seek to promote cultivation of cash crops over food crops have created challenges with accessibility and availability of food in certain areas (CILSS, 2015).

The General Assembly of the United Nations in September 2015 officially unveiled seventeen Sustainable Development Goals for mostly developing countries and adopted them. Goals of the SDGs are to eliminate both hunger and poverty, preserve planet earth and actively encourage prosperity by year 2030. Notwithstanding, the SDGs were accepted within the period where most studies focused on new trends in developmental issues on the international scene. Accompanying the SDGs were 169 targets and 330 indicators which will shape global policy formulation in the next fifteen years. SDGs one and two talk about ending poverty and hunger by year 2030 and with successful implementation it will improve on global food security. The SDGs replaced Millennium Development Goals which were rolled out in year 2000 to mobilize governmental support in overcoming global challenges like hunger, gender issues, environmental issues, poverty, diseases and inequality (Arhin, 2016).

There is increased effort globally to end hunger but a greater portion of households still do not have adequate food needed for sustenance. Challenges

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encountered in the fight against hunger over the last ten years include upsurge in prices of commodities such as food and energy, increasing rate of joblessness and also, result of economic meltdown in the world. Additionally, climate change and natural disasters have added greatly by impeding efforts in ensuring food security in many vulnerable nations especially in sub-Saharan Africa. Political instability and civil war have brought untold hardship on many human lives with majority being displaced from their original countries to search for food and shelter (FAO, IFAD & WFP, 2015).

Livelihood diversification is identified as a major contributor to reducing food insecurity since it can increase the income of smallholder farmers (Abbeam et al., 2021). Livelihood is the process of obtaining a living and it includes capabilities, assets and activities needed for existence (Olayiwola, 2013). Livelihood is sustainable when it can cope with stresses and shocks and maintains its capabilities and assets (Karki, 2021).

Livelihood diversification is an act in which communities build numerous profiles of enterprises and communal base capacity to endure hardship and enhance their living standards. In Sustainable Livelihood Framework, livelihood diversification is acknowledged as one of livelihood strategies that help farming households to eradicate poverty and subsequently, improve their lives. It is broadly separated into two forms; on-farm and non-farm diversification. For on-farm diversification, it involves producing various animals and crops as business enterprises. For non-farm diversification, it involves doing business related activities which are not agricultural (Olayiwola, 2013).

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Non-farm diversification activities are relevant in helping rural households to reduce poverty by giving them a cushion against risks of farming. Empirical evidence showed that non-farm activities generate an income between 40–45% of total households' income. However, non-farm income may vary from community to community because of various environmental factors (Gebru, Ichoku & Eze-Phil, 2018).

Problem statement

Majority of smallholder farmers in Central Tongu District of Ghana are mostly dependent on rainfall for their agricultural activities which are therefore drastically influenced by fluctuations in environmental conditions (GSS, 2014). High proportion of population (80%) in the district were engaged in smallholder farming and most of farming households (96.4%) were into crop production while 3.6% were into animal rearing (GSS, 2014). Central Tongu district is predominantly an agrarian economy and smallholder farmers face numerous threats in attaining household food security. One key challenge is the limited income and resources available to them and this often results in low agricultural productivity and insufficient access to food. They find it difficult to take care of daily needs of their families due to use of old farm implements, adoption of indigenous farming practices, inability to market their produce, rainfall dependent; which is not adequate, reliable and evenly distributed. Besides, there is non-availability of irrigation technology and high post-harvest losses resulting into low productivity and output (CTDA, 2014).

About 1.2 million farmers in Ghana, which represents 5% of the country's population are food insecure and it is projected that about 2 million

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farmers, representing 8.3% of the country's population are most likely to be food insecure (Darfour & Rosentrater, 2016). Additionally, those who were food insecure reside in both villages and towns across different regions of Ghana and 7% are in Volta Region (Darfour & Rosentrater, 2016). Moreover, result from many studies still indicate situation of rising food insecurity for farming households in Ghana (Darfour & Rosentrater, 2016). Ghana and the current study area were challenged with delayed effect in achieving food security because average yields of agricultural produce have not increased (Manu, Akuamoah-Boateng & Akaba, 2013). Farming is a risky venture and it is a major livelihood activity of most communities in Central Tongu District. This situation makes rural households to be prone to food insecurity (Afodu, Afolami, Akinboye, Ndubuisi-Ogbonna, Ayo-Bello, Shobo & Ogunnowo, 2019).

Food insecurity is a primary developmental threat in sub-Saharan Africa which is caused by innumerable circumstances in international, national or local aspects of human existence; currently climate change impacts (Darfour & Rosentrater, 2016).

Generally, many vigorous attempts have been made to minimize the menace of food insecurity globally. However, the situation is still persistent and its impact on contemporary human society is increasingly being felt and cannot be overemphasized (Salifu & Funk, 2010). For the past twenty years, there has been formation of Farmer Based Organizations in various districts of Ghana, including Central Tongu District to promote smallholder farming. These initiatives have come from both governmental and non-governmental projects seeking to improve livelihood of smallholder farmers in Central

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Tongu District (Salifu & Funk, 2010). However, farming households in the district continue to be impoverished. Among interventions by different development agencies over the years has been diversification of livelihoods (Salifu & Funk, 2010). Livelihood diversification is understood to include processes whereby agricultural households build a profile of different enterprises and communal support systems in their efforts to survive, reduce poverty and enhance food security status all towards improving their living standards (Olayiwola, 2013). In the last ten years, livelihood diversification has been a major concern for policy makers and other stakeholders by promoting the concept among rural households to lower poverty and grow economies in sub-Saharan Africa (Afodu et al., 2019).

Empirical evidence from other studies depicted significance of livelihood diversification as a major component in reducing food insecurity and poverty among agricultural households (Abera, Yirgu & Uncha, 2021 and Abbeam, Dagunga, Ehiakpor, Ogundeji, Setsoafia & Awuni, 2021). Furthermore, other studies conducted on livelihood diversification and food security of smallholder farmers have shown varied outputs. Thuo (2011) and Hanazaki, Berkes, Seixas and Peroni (2013) corroborate the universal assertion that livelihood diversification enhances food security of smallholder farmers. However, the level of livelihood diversification of smallholder farmers in Central Tongu District remains unclear (GSS, 2014).

It is therefore relevant to examine the livelihood diversification and food security of smallholder farmers in Central Tongu District of Ghana.

Research objectives

The general objective of the study was to examine the livelihood diversification and food security of smallholder farmers in Central Tongu District of Ghana.

The specific objectives of the study were to:

i. Describe the demographic and farm related characteristics of respondents.

ii. Determine the level of livelihood diversification among respondents.

iii. Examine the factors that influence livelihood diversification of respondents.

iv. Determine the food security status of respondents.

Research questions

The research questions of the study were as follows:

1. What are the demographic and farm related characteristics of respondents?

2. What is the level of livelihood diversification among respondents?

3. What are the factors that influence livelihood diversification of respondents?

4. What is the food security status of respondents?

Variables of the study

The following were the variables of the study;

Dependent variable: The dependent variable of the study was food security of smallholder farmers.

Independent variables: The independent variables of the study were as follows:

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a) The vulnerabilities of smallholder farmers (shocks and stresses)

b) The demographic and farm related characteristics of smallholder farmers.

c) The livelihood diversification among smallholder farmers

d) The factors that influence livelihood diversification of smallholder farmers.

Significance of the study

The study outcome could be used by appropriate bodies including MoFA to contribute to interventions in the district to offset challenges of food insecurity to enhance livelihood. Also, the outcome would provide important source of information for academia and serve as an additional source of reference material for other organizations including NGOs and FBOs working within Central Tongu District of Ghana.

Finally, recommendations from the study will help decision makers in tackling food security issues within Central Tongu District and the country.

Delimitation

The study focused specifically on smallholder farmers in 15 communities of Central Tongu District due to the resources available.

Limitation

The study depended on the memory recall of the smallholder farmers for data due to the absence of accurate record keeping by most of them.

Definition of key terminologies

This section gives the operational definitions for terminologies employed in the study.

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Food: Substance containing nutrients needed for growth and maintenance of human life.

Food insecurity: State of individuals lacking means to get sufficient quantity and good quality food for growth and development.

Food availability: Supply of good quality and adequate quantity of food in a country.

Food accessibility: Adequate resources needed to produce or purchase food for a household.

Food utilization: Ability of individuals to put food into proper use.

Food stability: When individuals have access to food at all times.

Smallholder farmers: Producers of agricultural related commodities on minimum of 1.5 acres of land for sustenance.

Livelihood: Means of securing the basic necessities of life.

Diversification: Ability of rural farmers to participate in other forms of income generating activities.

Assets: Resources that are owned individuals or organizations which can be used to generate income.

Financial assets: Resources in form of money owned by an individual or organization.

Physical assets: Tools, machinery and other equipment owned by an individual or organization.

Human assets: Worth of a person's skills and expertise.

Social assets: Level of relationship among people living in a particular society.

Natural assets: Renewable resources owned by an individual or organization.

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Coping strategies: Immediate reaction of a household to unusual food stress.

Susu: Regular saving of certain amount of money by a group of people.

Organization of the study

The study is organized into five main chapters, with each separate chapter explaining certain aspect of study. In chapter one, study highlighted background of study, problem statement, objectives of study, significance of study and organization of study. Chapter two reviewed both theoretical and empirical literature related to study. Chapter three looked at study design, population, sample and sampling techniques, research instrument, data collection procedures, data analysis and ethical considerations. Chapter four delved into analysis and discussion of study findings. Finally, chapter five summarized findings, drew conclusions based on objectives and offered relevant policy recommendations.

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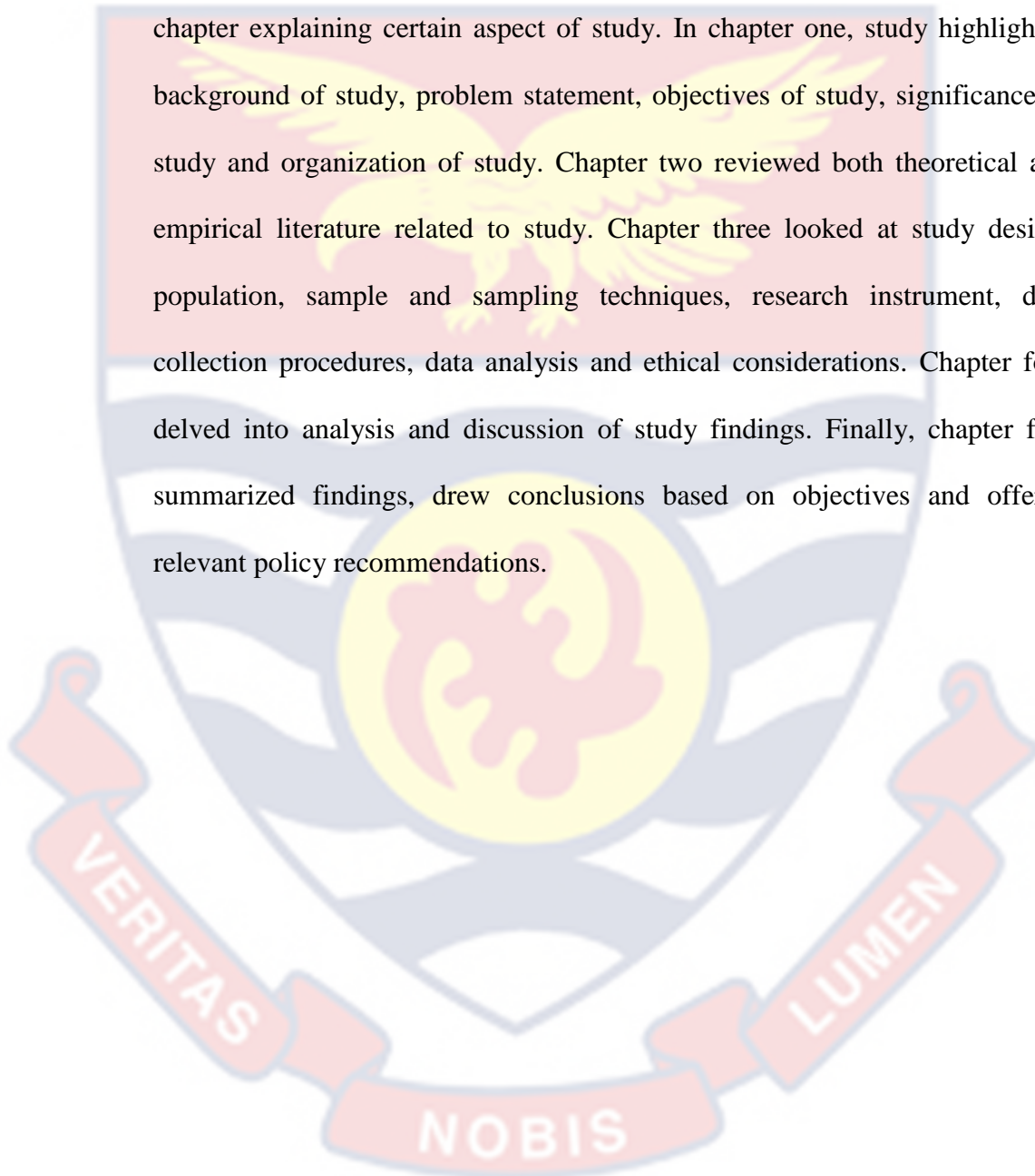
CHAPTER TWO

LITERATURE REVIEW

Introduction

This chapter focuses on review of literature, highlighting important concepts and theories that linked to the research. It further provides theoretical foundation and empirical evidence of research work. It highlights different concepts and schools of thoughts related to concepts of smallholder farmers, livelihoods, livelihood diversification and food security which were widely used in study. Finally, it contains conceptual framework of the research work.

Concept of smallholder farmers

Smallholder farmers are a category of farmers who grow crops on little plots of land for sustenance and rely mainly on family labour. They have limited resources and utilize simple agricultural technologies which make their households to be prone to food insecurity (Wondimagegnhu et al., 2019). However, smallholder farming is main engine pushing most economies in the African continent. Besides, potentials of these farmers are mostly unrecognized and these make agricultural sector to remain exposed to external factors (Wondimagegnhu et al., 2019).

In developing nations of the world, most communities engage in farming for their livelihood that provides household income to help reduce food insecurity. However, farming in sub-Sahara African countries has flopped in giving assurance to these households. This situation is as a result of reduction in sizes of farm, low yield per plot and great level of subsistence agriculture (Yizengaw, Okoyo & Beyene, 2015).

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Concept of livelihoods

According to Scoones (2009) numerous definitions are provided for 'Livelihood' by different people in literature. He defined livelihood as 'process of obtaining a living' or 'blending of the used assets and enterprises undertaken in order to live'. In addition, he explained that concept of livelihood is made up of assets, capacities and enterprises needed for sustainable life of households and also involved strategies required for coping and recoveries from hardship.

In the last ten years, concept of livelihoods has been channeled into every development agenda and it begins with different perspectives in relation to how individuals live their lives in different locations. In addition, livelihoods concept has been given a totality of human focused structure for getting an understanding of how vulnerable and complex human lives are in relation to food security (Løvendal, Knowles & Knowles, 2004).

Livelihood Diversification

Livelihood diversification is understood to include processes whereby agricultural households build a profile of different enterprises and communal support systems in their efforts to survive, reduce poverty and enhance food security status all towards improving their living standards (Olayiwola, 2013). Livelihood diversification also refers to efforts put in by particular person and communities to discover modern methods to generate earnings and minimize susceptibility to various livelihood shocks (Khatun & Roy, 2012).

Livelihood diversification is a livelihood strategy for farming communities to reduce poverty and improve upon their lives. It is broadly divided into two forms; on-farm and non-farm diversification. For on-farm

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diversification, it involves producing various animals and crops as business enterprises. For non-farm diversification, it involves doing business related activities which are not agricultural (Olayiwola, 2013). Livelihood diversification is achieved by participating in both farm enterprises and non-farm enterprises (Khatun & Roy, 2012).

Measurement of Livelihood Diversification

Numerous methods are used to compute livelihood diversification, they include: Simpson's index of diversification, Herfindahl index, Ogive index and Entropy index (Khatun & Roy, 2012). At farm level, diversification is the production of more than one crop to attain self-sustenance. However, diversification at national level goes beyond production because extra inputs and care are needed to generate optimum benefit for a country (Adjimoti, Tsey & Kwadzo, 2018).

Simpson's Index of Diversification

Simpson's index of diversification (SID) is an indicator used widely in estimating extent of diversification. It was operationalized in 1949 to evaluate focusing level in group formation (Adjimoti, Tsey & Kwadzo, 2018). Research conducted by Afodu et al. (2019) on livelihood diversification and technology adoption on food security status of rice farming households in Ogun State of Nigeria, employed SID in measurement of livelihood diversification.

Herfindahl Index

The Herfindahl index (HI) is an indicator mostly used to estimate diversification of income sources. As degree of diversification rises, the index assumes value of one and as degree of diversification reduces, the index

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assumes value of zero (Adjimoti, Tsey & Kwadzo, 2018). Study conducted by Oni and Fashogbon (2011) on food security and livelihood activities in rural Nigeria used HI in measuring level of concentration of diverse income sources for rural households. Also, research conducted by Baba and Abdulai (2021) in Northern Ghana employed HI in measuring extent of crop diversification.

Ogive Index

Ogive index (OI) is an indicator used to assess the speciality and focus of a nation. It involves approximation of diversification at farm level (Adjimoti, Tsey & Kwadzo, 2018).

Entropy Index of Diversification

Entropy Index of Diversification (DIE) is an indicator used to assess numeric portion of farm enterprises. Index is mostly used in diversification of crops (Adjimoti, Tsey & Kwadzo, 2018).

Concept of food security

The concept of food security emerged from 1960s to 1970s in books related to development. Its definition has gone through drastic changes over the years resulting in about 200 definitions and 450 indicators (Gebrehiwot & Veen, 2014). Concept has changed and increased in scope over the years to allow variety of food-related issues, and to show the function of food in various communities. Previous definitions of food security concentrated on national level consideration, which involved a nation providing sufficient food all year round at detriment of household level food access. Incidentally, influence of the concept of "food entitlement" which recognizes food as a basic right in early 1980s, led to adjustment of concept of food security (Gebrehiwot & Veen, 2014).

There are four pillars of food security which are interrelated and it is required that all issues related to them must be addressed before food security can be achieved. The four pillars of food security include food availability, food accessibility, food utilization and food stability. Food availability refers to sufficient supply of food to meet the needs of a population. It involves having enough food production, distribution and storage systems in place to ensure that everyone obtains adequate nutritious food at all times. Food accessibility is the capacity of individuals to obtain food. It involves having the financial resources, transportation and infrastructure necessary to access food. Food utilization is the means by which individuals obtain and use food of sufficient quality and quantity to ensure healthy life through appropriate feeding and caring practices. Food stability is the capacity of food systems to provide reliable and consistent access to food over time, even during encounter with shocks and stresses such as price fluctuation, economic instability and conflicts (MoFA, 2007).

Household Food Security

For households to be food secured means that they have wherewithal to give adequate and safe food required for their members. Household food security has limitations on individual members of household. Firstly, means of getting sufficient food would not transform into real food provision and households would not prefer getting food over other essential commodities. Secondly, sharing of food within household may not conform to an individual's need especially within a large household size. Usually, household food insecurity is categorized into two forms, and these are transitory and permanent food insecurity (Pinstrup-andersen, 2009).

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Transitory food insecurity

This is the inability to obtain safe and sufficient food for a short term resulting in periodic and seasonal food insecurity (Pinstrup-andersen, 2009).

Permanent food insecurity

This is the inability to obtain safe and sufficient food for a long term resulting into permanent food insecurity (Pinstrup-andersen, 2009).

Measurement of Food Insecurity

The methods employed for measuring food security include, FAO method for estimating energy in food obtain per head, household income and expenditure surveys, individual's dietary intake, anthropometry and finally, experience-based food insecurity measurement (Pérez-Escamilla & Segall-Correa, 2008).

FAO method

This method was introduced by the FAO and it involves estimation of calories per capita on national basis. It uses data obtained from a study conducted on income and expenditure of households (Pérez-Escamilla & Segall-Correa, 2008).

Household income and expenditure surveys

This involves estimation of mean calories used daily by each member of a house. It is done by conducting an interview for selected members of a household. Information is given by participants for their expenditure on food and other necessary commodities (Pérez-Escamilla & Segall-Correa, 2008).

Individual's dietary intake

This involves measurement of dietary intake of individuals to determine their food security status. Food consumed is estimated by various

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techniques including 24-hour recall, food frequency questionnaires and food records kept by respondents, and they are all conducted within a referential time frame. The 24-hour recall and food frequency questionnaire techniques depend on ability of respondents to remember while the food records technique rely on recording foods which are consumed by the respondents (Pérez-Escamilla & Segall-Correa, 2008).

Anthropometry

Anthropometry is the scientific study of measurement of the human body. It involves the estimation of height, weight and body proportions of the human body. It measures impact of food insecurity as well as health standing regarding diet of individuals (Pérez-Escamilla & Segall-Correa, 2008).

Experience-based food insecurity measurement scales

This involves direct estimation of food insecurity where the scales of measurement are pivoted on experiences and perceptions provided by selected individuals. Investigators from two American universities and a non-profit organization piloted experience-based food insecurity measurement scales. Additionally, Department of Agriculture of the United States of America ended up promoting this scale and it led to the evolution of HFSSM (Pérez-Escamilla & Segall-Correa, 2008).

Demographic characteristics of households

The household food security is influenced by demographic characteristics which include marital status, education, age and sex of household head (Iram & Butt, 2004). Study by Faridi and Wadood (2010) showed that food security of household was very notably correlated with head of household's educational level. This implies that educational level of

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household head has huge consequence on household food security. Households which have illiterate heads were more food insecure in contrast to households which have literate heads because with the latter, since household head may influence most of household members to be educated. They were theoretically likely to make more informed decisions including strategic planning to ensure a better living condition.

Empirical Evidence

A study in Ghana showed that factors which affected diversification decisions were size of farm, access to extension, marital status, household size, age and educational level of household heads (Baba & Abdulai, 2021). A study in Western Region of Ghana proved that extent of livelihood diversification among farming communities was not high indicating that they produce their earnings from few livelihood enterprises. It also indicated that educational level, access to extension, marital status, age and sex of household heads determine livelihood diversification. Finally, older household heads were less diversified because they have less strength to engage in diverse farming activities (Agyeman, Asuming-Brempong & Onumah, 2014).

A survey conducted in Ethiopia revealed that agriculture is major profitable enterprise that makes up almost 90% of income of smallholder farmers (Yizengaw et al., 2015). A research finding in India depicted that non-farm sector has considerable means of improving income of poor and their households depend more on wages for their livelihood (Birthal, Negi, Jha & Singh, 2014). A study in Brazil showed that shortage in agricultural produce have severe impact on households that depend on it for their livelihood (Hanazaki et al., 2013).

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Kassegn and Endris (2021) posit that activities which are not related to farming can be used as strategy for diversifying livelihood and it played major part in enhancing food security of communities in Ethiopia. A research finding in Ethiopia revealed that predictors of household livelihood diversification were minimal and as such increased food insecurity and vulnerability (Fekadu et al., 2021). Mixed farming has been traditionally adopted by Indian farmers to supplement their income and growth of non-farm activities (Singh, 2013).

A study in India revealed that rural households were easily diversified in their livelihood with more experience in terms of their age, years of farming, when they were more trained in terms of skills, when they have higher educational level, when they have tangible properties and finally, when they easily borrow money for their enterprises (Khatun & Roy, 2012). A research finding in Nigeria revealed that venturing into livelihood enterprises decreases poverty among agricultural households and that gender of household head, household size, land size, years of farming, hunting and assets influence poverty status of agricultural households (Awotide et al., 2010). Empirical analysis in Ghana showed that age of household heads impacts notably on food security of the household (Manu et al., 2013).

A research finding in Kenya indicated that education at least at basic level is a major determinant in enhancing food security of smallholder farmers because education increases farmers' ability to diversify income sources therefore, improving farm profitability (Thuo, 2011). Coping strategies are adopted by vulnerable to help them react to unfavourable conditions in relation to food shortage. Coping strategies are 'sine qua non' to livelihood of smallholder farmers because they survive on incomes which are not enough

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for their daily sustenance and they lack means of keeping buffer stocks (Devereux, 2001). Agricultural production is full of risks and uncertainties including drought, flooding, bush fires, diseases and prevalence of pest. These factors lead to crop failures resulting into famine, which increases incidence of food insecurity (Elahi, 2018). In addition, food price risks affect households which are poor and are deficit food producers (Devereux, 2001).

A survey conducted in Ethiopia revealed that vulnerability occurs because livelihood diversification is limited due to absence of infrastructural systems and amount of livelihood diversification is notably affected by diverse features of communities which include age of household head, social assets, extension visitation, access to farm, market and credit (Dinku, 2018). A study in Ghana showed that crop-livestock diversification is important because it improves on food security of households (Abbeam et al., 2021). A research finding in Benin revealed that livelihood diversification leads to household food security and the following variables including education, extension visitation, access to credit and warehouse facilities affect household food security (Adjimoti et al., 2018).

A research conducted in Ghana divulged that, elements which influenced crop-livestock diversification are use of plough tillage, sex, age, income, labour, size of land, access to credit and extension visitation (Asante, Villano, Patrick & Battese, 2017). A study in Ghana showed that more than 96% of smallholder farmers that were used in a research were food insecure (Quaye, 2008).

A survey conducted in Ethiopia concluded that mixed farming is a vital source of income for rural households. Also, non-farm enterprises are

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additional sources of income for most households so depending on only income from farming can increase vulnerabilities of smallholder farmers (Asfaw, Simane, Hassen & Bantider, 2017).

A survey conducted in Ghana depicted that size of household, age, size of land, credit facilities, marital status and crop output notably improves households' food insecurity (Tanko & Alidu, 2016). A research conducted by Abera et al. (2021) on rural livelihood diversification strategies among Chewaka resettlers' communities in Ethiopia, revealed that mean land size of 5 acres helped households in diversifying their livelihood activities.

A study conducted on livelihood activities and income portfolios in Botswana revealed that access to assets especially, financial, physical and human assets were limited in study areas and this negatively affected livelihood of smallholder farmers (Kgathi & Motsholapheko, 2011)

Theoretical Framework

This section of thesis provides various definitions and variables used in study. It starts by delving into concept of smallholder farmers, food security and livelihood diversification.

Theoretical framework is a design for any investigative work which is usually grounded on prevailing hypothesis in a field of inquiry which reflects research questions of research. It is the basis on which research is conducted and it is usually adopted by researchers to build their own research inquiry (Adom, Hussein & Adu Agyem, 2018).

Sustainable Livelihood

Livelihood is sustainable when stresses and shocks can be managed and subdued. Sustainable livelihood is a concept of poverty reduction which

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goes further than regular approaches in poverty reduction that were limited. The regular approaches centred on few features of poverty and neglected others and so it was not elaborate. For instance, they did not put social exclusion and vulnerability into consideration. However, concept of sustainable livelihood gives possibility of a logical and consolidated way of dealing with poverty (Karki, 2021). Sustainable livelihood was brought into use by Brundtland Commission on Environment and Development in 1987 but made more extensive during a UN conference on Environment and Development in 1992. It is mostly used to fathom poor individual's livelihood and it is a rational way of eradicating poverty (IISD, 2013).

Approach and Framework of Livelihood

The numerous approaches and frameworks of livelihood have been put forward by intellectuals to reduce poverty among impoverished communities and they include;

- Capability Approach – It is a tool for assessing the welfare of individuals and it was propounded by Amarthya Sen in 1979. This approach evolved through multidisciplinary engagement of intellectuals and it provides basis for extension through innovative explanation and field application (Karki, 2021).

- Sustainable Livelihood Approach – It is a technique for examining livelihoods of the needy and offers a useful roadmap for analyzing livelihoods which suggests that livelihood includes capabilities, assets and activities needed for existence (Olayiwola, 2013). It brings about profound comprehension of livelihood strategies of poverty reduction and allows

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poor people to take part in decisions that address their livelihood needs by making them focus of the strategy (Karki, 2021).

- Sustainable Livelihood Framework – It is core of the Sustainable Livelihood Approach and made up of a number of livelihood approaches which has been synthesized. The foci of framework are livelihood assets by which households construct their livelihood and vulnerability context which indicates their insecurity, it comprises of shocks, trends and seasonality. In addition, livelihood assets included the following; human assets, natural assets, financial assets, social assets and physical assets.
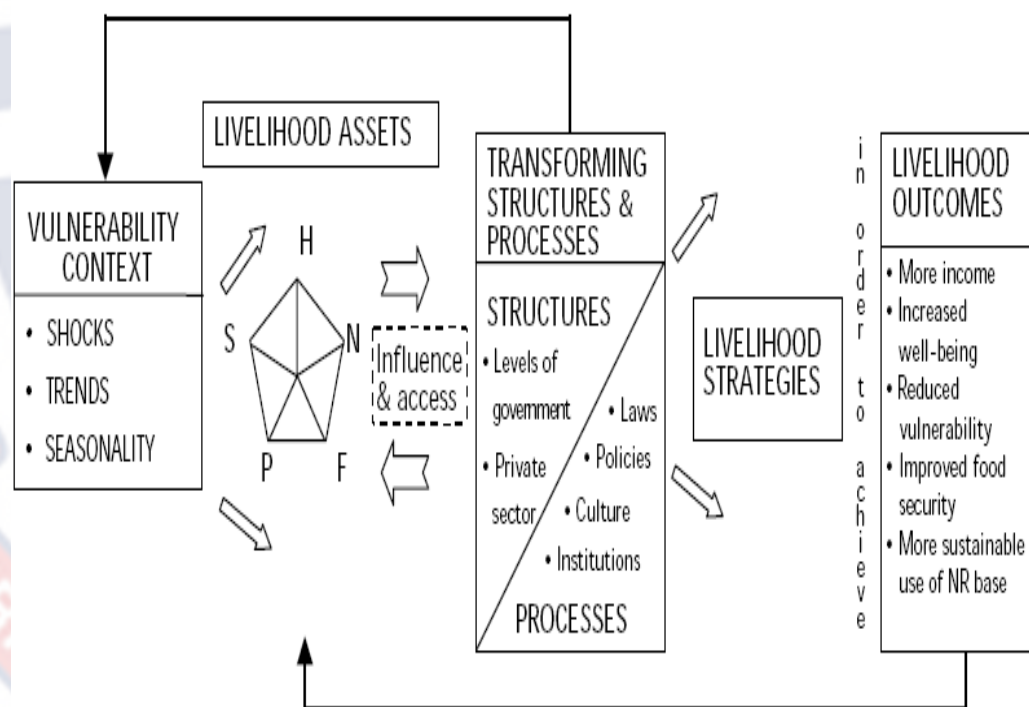
Figure 1: Sustainable Livelihood Framework
Source: DFID Guidance Sheets (1999)

In figure 1; H = human assets, N = natural assets, F = financial assets,

P = physical assets and S = social assets.

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DFID's Sustainable Livelihood Framework

This gives a systematic and logical approach to enhance comprehension of livelihood assets, constraints and their relationships. It makes use of five concepts on which it functions, these are; vulnerability context, livelihood assets, transforming structures and processes, livelihood strategies and livelihood outcomes. It is constructed on five vital areas of livelihood assets, which are shown as a pentagon in Figure 1 above and it provides information on individual's access to various assets which are depicted along five axes. More so, at core of pentagon, where axes intercept, this point amount to no means of gaining an asset.

Five key areas are linked to portray that livelihood rely on multiple assets rather than just one. The framework also contains an essential aspect of investigating individual's means of gaining the five types of assets (physical, human, financial, natural and social) and how they set them into economic usage. It also gives mode of evaluating the contributions of organizations, policies, institutions and cultural towards livelihoods which are made up of the structures and processes in the framework. Structures are likened to 'hardware' which is made up of organizations and institutions set up basically for policy implementation. Processes are likened to 'software' which outline the procedures to follow in achieving organizational goals. The structures and processes, therefore transforms livelihood strategies into livelihood outcomes (DFID, 1999).

Food Entitlement Theory

This theory was propounded by Amartya Sen in 1981 and it is also known as Entitlement Theory of famine. It posits that because food is

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available globally or within a country does not lead to household food security. Most people starve at threshold level because food is not available at household and national level. As population increases there is famine and starvation due to decrease in availability of food (Elahi, 2018). There is a possibility for a household to experience food shortage although there is sufficient food available in that country because they lack purchasing power.

This means that enough food may be available but not accessible to everybody (Devereux, 2001). More so, increase in local production of food may not automatically keep hunger or famine from happening because food is not distributed equally. Also, means to access food is not same for every household and this result into category of people to be vulnerable to food insecurity. Finally, theory gives strategies adopted by smallholder farmers to prevent household food insecurity (Devereux, 2001).

Conceptual Framework

Conceptual framework is the structure that describes natural development of phenomenon being explored by a researcher. It is mostly connected with concepts, empirical evidence and essential theories used in synthesizing knowledge adopted by researcher (Adom et al., 2018). Sustainable Livelihood Framework and Food Entitlement Theory were adopted for this study because concepts of food security and livelihood diversification are some major drivers in the Sustainable Livelihood Framework. Also, food availability and food accessibility were the main concepts in the Food Entitlement Theory. Livelihood diversification is one of livelihood strategies whilst food security is one of livelihood outcomes. It

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means that livelihood diversification plays a central part in ensuring food security.

The researcher posits that food security of smallholder farmers (Dependent Variable) is dependent on four main factors (Independent Variables) namely:

1. The vulnerabilities of smallholder farmers (shocks and stresses).

2. The demographic and farm related characteristics of smallholder farmers.

3. The livelihood diversification among smallholder farmers

4. The factors that influence livelihood diversification of smallholder farmers.

Demographic and farm related characteristics

The study considered the following demographic and farm related characteristics: age, sex, education, marital status, type of crops, total yield, size of farm, source of finance and access to extension services.

Food security of household is influenced by demographic characteristics such as marital status, gender of household head, level of education and age of household head (Iram & Butt, 2004).

Factors that influence livelihood diversification of smallholder farmers

Livelihood diversification is keeping of multiple agricultural enterprises which are connected among actors in diverse methods (Olayiwola, 2013). Study conducted by Faridi and Wadood (2010) showed that household food security was notably correlated with head of household educational level. This study therefore considered the following livelihood activities:

1. Farm activities (crop, livestock, fishing, non-traditional).

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2. Non-farm activities (trading, weaving, sewing, hunting, artisanal work, civil service, commercial driving and riding).

This study also considered the following factors that influence livelihood diversification: land size, household size, livelihood assets and community related factors. According to Devereux (2001), community related factors in the Central Tongu District includes; social networks, climate variations, access to land, access to market, access to credit, access to extension, infrastructure available, cultural norms and education. In conducting a comprehensive study that covers all the factors that influence livelihood diversification will require significant resources. However, due to limited resources, the research focused on specific factors which are most relevant to the research questions. The conceptual framework for this study is presented in Figure 2.
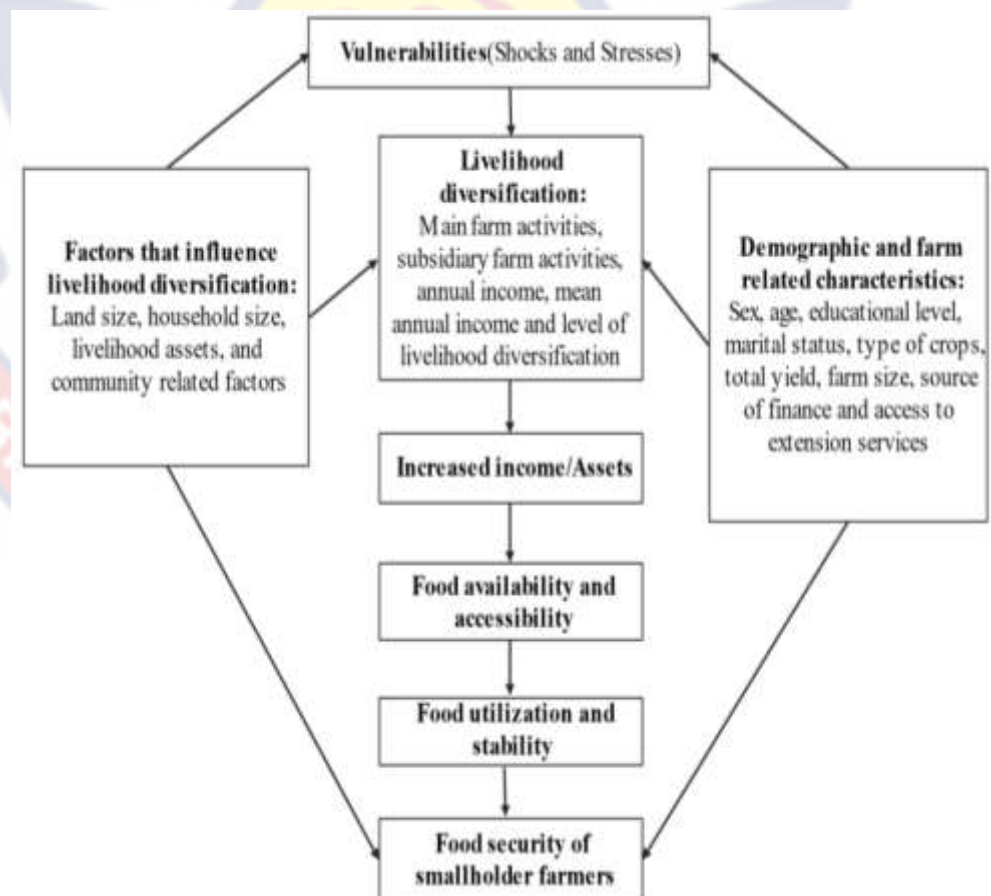
Figure 2: Conceptual Framework
Source: Author's construct (2022)

Interrelationships among variables

In sub-Saharan Africa, smallholder farmers are vulnerable to shocks and stresses since farming is their main livelihood activity, and they basically grow crops or raise animals on small plots of land. Additionally, they highly depend on rain-fed agriculture which is full of risk and uncertainty. Demographic and farm related characteristics as well as factors affecting livelihood diversification influence vulnerabilities of households and income generating activities of households. With efforts by smallholder farmers to overcome these vulnerabilities, they diversify their livelihood by engaging in two or more income generating activities. These initiatives will enable smallholder farmers to overcome risk associated to these vulnerabilities and increase their asset base or income. This will increase ability of smallholder farmers to have food available and accessible to their households which will consequently, enhance the food security status of their households.

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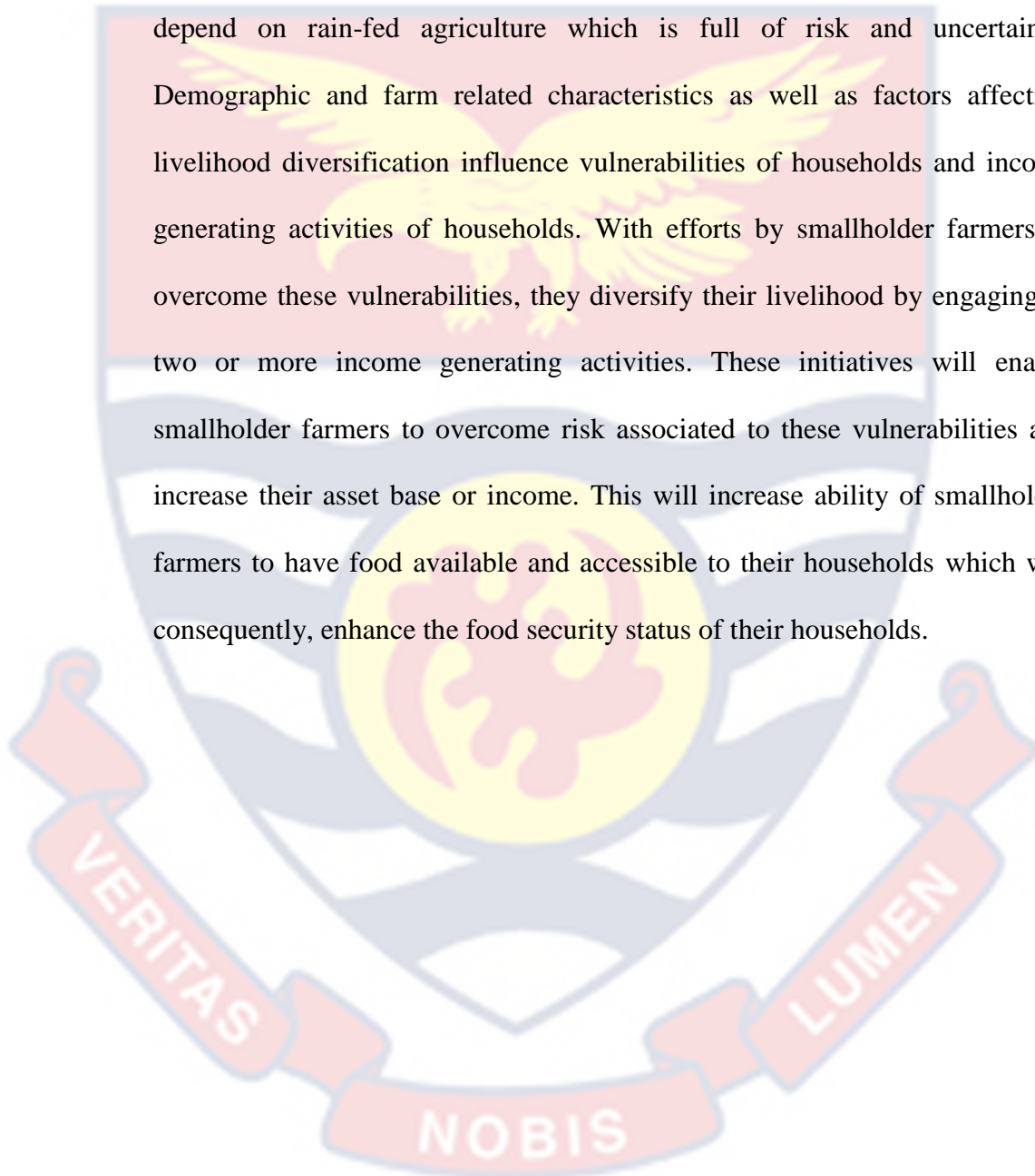
CHAPTER THREE

METHODOLOGY

Introduction

This chapter describes the research methods used for the study. It is made up of study area, study population, research design, sampling method, instrumentation, data collection procedure and data analysis. Finally, it provides reasons for selecting methods and procedures for study.

Study area

The study was done in Central Tongu District of Ghana (Figure 3) and it was selected because the district is known for its rich agricultural resources which include fertile land and water bodies including the Volta River. Agriculture is a major economic venture in the district and significant portions (80%) of the population are smallholder farmers (GSS, 2014). The district was formed through a Legislative Instrument (LI. 2077) in February, 2012, thus only ten years ago. It has Adidome as capital town. It is one of twenty-five municipalities and districts in Volta Region with a population of 59,411 of which 10,187 are smallholder farmers (GSS, 2014).

Boundaries of Central Tongu District

The Central Tongu District is bounded by the following districts; to the south-east is South Tongu, to the west is North Tongu, to the east are Akatsi South and Akatsi North, to the north is Ho West and Adaklu Districts of Volta Region, and to the south-west Ada East District of Greater Accra Region (GSS, 2014).

Vegetation

The district is located within the tropical savannah grassland zone with some trees such as mangoes, oil palm, silk cotton, acacia, baobab and neem. The vegetation around the River Volta is dense because of fertile soils and adequate subsoil moisture available. The vegetation can influence livelihood diversification of smallholder farmers in the district by enhancing the availability of resources, improving soil fertility, regulating climate and supporting biodiversity conservation (GSS, 2014).

Topography

The topography of the land is gentle and it ranges from almost sea level to 18 meters above sea level. The gentle topography of land can influence livelihood diversification of smallholder farmers in the district by improving water availability, agricultural productivity, land utilization, access to markets and services such as roads, transport and agricultural extension (GSS, 2014).

Soil types

The areas around River Volta have alluvial soils which are not favourable for crop production because the soil has low water holding capacity. However, it can be used for some crops including rice and sugarcane, which could be based on irrigation technology. In addition, other areas for example, around Adidome, Anfoe, Kpedzeglo, Mafi Kumase, Sasekpe and Bakpa Avedo have sandy loam soils which are well drained and suitable for vegetable and arable crop production. Generally, the soil type is good for agricultural related activities and this can influence livelihood

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diversification of smallholder farmers in the district by enhancing crop suitability, livestock rearing and non-farm income opportunities (GSS, 2014).

Climate

The climate of the district is tropical, mostly subjected to south-west monsoon from South Atlantic Ocean and dry harmattan winds from Sahara Desert. The district experiences two rainy seasons per year, with major season starting from April and ending in July, and minor season starts from September and ends in November. Average annual rainfall ranges from 900 mm to 1100 mm and it is usually not enough even during main season. This situation influences crop and livestock production negatively in the district (GSS, 2014). There is little variation in temperature and relative humidity throughout the year and mean temperature is 27º C. Usually, month of March is hottest and month of July through to August is very cold. Finally, average relative humidity is 80% which makes weather conducive for farming activities. Changes in climatic patterns influence livelihood diversification of smallholder farmers in the district by affecting availability of water, soil quality and other natural resources that are critical to agricultural and non-agricultural activities (GSS, 2014).

Drainage

The district is drained by Aklakpa, Gblor, Nyifla and Kolo streams and their tributaries into the River Volta. Todze stream and its tributaries drain eastern part of the district into Avu lagoon located in South Tongu district. The district is well drained which facilitates land use change, such as the conversion of wetlands into agricultural and non-agricultural activities which

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reduces biodiversity and ecosystem services that support livelihood diversification (GSS, 2014).

Marketing

The marketing of agricultural products are facilitated because of district's proximity to Accra and Ho which are major market centers. The district capital is 66.2 kilometers and 130.3 kilometers from Ho and Accra respectively. Marketing can influence livelihood diversification of smallholder farmers in the district by creating new economic opportunities, entrepreneurship, promoting value addition and processing of agro and non-agro products (GSS, 2014).

Figure 3: Map of study area: Central Tongu District
Source: GSS (2014)

Research Design

The research design is a guideline used by researchers to obtain solutions to problems set by the research in a precise, profitable, unbiased and logical way (Kumar, 2019). It is an outline for accomplishing research objectives and providing answers to research questions. It deals with how factors for collecting and analyzing data are arranged to make research relevant and economical. It is therefore a plan for collecting, measuring and analyzing data. It also indicates specific data analysis techniques that are intended to be used (Kothari, 2004). There are many kinds of research design that are relevant for specific research works and the problems identified in the research determine the selection of a particular design to be used by researcher (Walliman, 2011).

Positivism is the research philosophy used for the study because it emphasizes the use of unbiased and quantitative data for answering research questions to make generalization of the population. The positivist approach assumes that there is an unbiased reality that can be examined and understood through empirical observation and measurement (Neuman, 2014).

In this study, cross-sectional survey design in a descriptive nature was used to examine the livelihood diversification and food security of smallholder farmers in the study area since information was collected at just one point in time (Fraenkel, Wallen & Hyun, 2012). Survey design was adopted for this study because it gives an edge of sampling many people to make inference on entire population (Vanderstoep & Johnston, 2009). Descriptive survey was also adopted for this study because it describes attributes of specific

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individuals or groups (Kothari, 2004) and it also began with a properly stated problem and made effort in describing it precisely (Neuman, 2014).

Population for the study

Population is an entire set of cases from which a researcher selects a sample (Taherdoost, 2016). Population consists of any well-defined set of elements with the most important point about it being that in principle, it can be enumerated (Adams, Khan, Raeside & White, 2007). Study population of smallholder farmers in Central Tongu District of Ghana was 10,187 and it is predominantly an agrarian economy (GSS, 2014). Smallholder farmers in the study area were mainly engaged in arable crop, vegetable crop and livestock production. They mostly relied on family labour, use of old farm implements, adoption of indigenous farming practices, rainfall dependent; which was neither adequate, reliable nor evenly distributed. Besides, there was non-availability of irrigation technology and high post-harvest losses resulting in low productivity and output (CTDA, 2014).

Sample Size Determination

Sample size determination primarily depends on study design and intended outcome which would have been considered prior to start of the study (Chander, 2017). There was no clear number of cases to select for a sample, however, for appropriate sample size, it depended on motive of study and characteristics of population under investigation (Cohen, Manion & Morrison, 2007). According to Fisher, Laing, Stoeckel and Townsend (1998) two factors were considered in arriving at sample size to use in this study. They included;

a) Attainability of resources, which sets upper limit of sample size.

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b) Requirement of proposed plan of analysis, which sets lower limit of sample size.

Formula proposed by Fisher, Laing, Stoeckel and Townsend (1998) was adopted for this study and it was as shown below:

$$n = \frac{Z^2 pq}{d^2}$$

Where; n = desired sample size

z = standard normal deviation, set at 1.96, which corresponds to 95% confidence level.

p = proportion in target population estimated to have a particular characteristic. It refers to the portion of the population of Central Tongu district who are smallholder farmers. According to GSS (2014), smallholder farmers are made up of 80% of the population of Central Tongu district. Therefore p was estimated as 80% = 0.80

q = complement of p, representing the proportion of the population that do not have the characteristic of interest.

Therefore, $q = 1 - p$

d = degree of accuracy desired, here set at 0.05 corresponding to 1.96.

In computing these into sample size formula, result is presented below:

$$n = \frac{1.96^2 (0.80)(1 - 0.80)}{(0.05)^2}$$

$$n = 245.86$$

Non-response rate from respondents was anticipated at 10%. (i.e., 10% of 245.86 is 24.59 hence, 245.86 + 24.59 = 270.45). Therefore, a sample size of 270 was approximately used in this study. (See Appendix C for distribution of study sample).

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Sampling technique

A sample in research is basically a group on which information is obtained (Fraenkel et al., 2012). Multi stage sampling technique was used to select 270 respondents that participated in the study. When multi stage sampling technique is used, there is elimination of complete list of all units in the population. At first stage of sampling, simple random sampling was used in selecting 15 communities in the Central Tongu District through a random draw method based on the resources available. Secondly, systematic random sampling was used in selecting 18 households each from the 15 communities selected to make up 270 households which formed the sample size. Finally, simple random sampling was used in selecting 270 household heads that participated in the study. (See Appendix D for systematic sampling interval of selected communities in Central Tongu District).

Data collection instrument

Instrumentation is the process of gathering data and it entails selection of instruments, procedures and conditions under which instruments will be administered (Fraenkel et al., 2012). Structured interview schedule was employed to gather primary data for the study because it is a valuable tool for collecting quantitative data in a research. Also, it provides a standardized and structured approach for collecting data from a large sample size (Fraenkel et al., 2012). Face and content validity of instrument was ensured by researcher and supervisor respectively. Face validity was ensured by relating questions included in research instrument to objectives of study and content validity was ensured by scrutinizing questions in research instrument to ascertain degree of areas covered under study.

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The research instrument for this study consisted of 4 main sections: A, B, C and D. Section A was designed to gather data on the demographic and farm related characteristics of smallholder farmers. The items contained mainly closed ended questions with few open-ended questions and one item was in a tabular form. Variables measured of smallholder farmers in this section included; Sex, age, educational level, marital status, type of crops produced, total yield, size of farm enterprise, source of finance and access to extension services.

Section B was designed to collect data on the level of diversification among smallholder farmers. The items in this section were in a tabular form for main farm activity, subsidiary farm activities and subsidiary non-farm activities. Variables measured for main farm activity included; activity, annual and mean annual incomes. Variables measured for subsidiary farm activities included; activities, annual and mean annual incomes. Variables measured for subsidiary non-farm activities included; activities, annual and mean annual incomes. Also, some of the items contained mainly closed ended questions and variables measured included; Age of household head, number of livelihood activities, farm size, household size and educational level.

Section C was designed to collect data on the factors that influence livelihood diversification of smallholder farmers. The items were contained in a tabular form and variables measured included; sex of household head, education of household head, age of household head, household size, farm size, livelihood assets, participation in community related programs and membership of FBO.

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Finally, Sections D was designed to gather data on the food security status of smallholder farmers. The items contained mainly closed ended questions and variables measured included; High food security of smallholder farmers, moderate food security of smallholder farmers, low food security of smallholder farmers and very low food security of smallholder farmers.

Source of data

According to Saunders and Rojon (2012), data refers to collated and documented belief, evidence, and statistical information use for referrals. For this study, only primary data was used to gain insight into livelihood diversification and food security of smallholder farmers. The primary data was acquired by issuing structured interview schedule to smallholder farmers.

Operationalization of livelihood diversification

In operationalizing the livelihood diversification for the study, the method where the number of livelihood enterprises the respondents was involved in with their respective income was used. The respondents were asked number of livelihood enterprises they partook in, then enterprises were grouped into main and subsidiary activities. In evaluating influential factors of livelihood diversification, number of livelihood enterprises was regarded as a dummy variable. Value of *1* was allotted to households which indulged in diverse livelihoods and value of *0* was allotted to households whose livelihood was sole enterprise. Tally of household incomes was used to bring out percentages of total income.

The study used Simpson's index of diversification to determine level of livelihood diversification among respondents. It was used due to ease of computation and extensive application (Afodu et al., 2019).

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The formula of Simpson's index of diversification was;

$$SID = 1 - \sum_{1}^{n} P_i{}^2$$

Where; n = number of income sources.

P_i = proportion of income generated from each source.

Value for SID was between zero and one.

SID model was expressed as;

$$SID = 1 - \sum_{1}^{5}\left(\left(\frac{mfi}{ti}\right)^2 + \left(\frac{cfi}{ti}\right)^2 + \left(\frac{lfi}{ti}\right)^2 + \left(\frac{ntfi}{ti}\right)^2 + \left(\frac{nfi}{ti}\right)^2\right)$$

Where; mfi = main farm income

cfi = crop farm income

lfi = livestock farm income

$ntfi$ = non-traditional farm income

nfi = non-farm income

ti = total income

Table1: Guide for assessing scores of Simpson's index of diversification

Simpson's score	Assessment
0.00	Absence of diversification
0.01 – 0.40	Low diversification
0.41 – 0.60	Moderate diversification
0.61 – 0.80	Moderately high diversification
0.81 – 0.99	High diversification
1.00	Perfect diversification

Source: Guajardo (2015)

Table 1 shows the guide for assessing the scores of Simpson's index of diversification. According to Guajardo (2015), Simpson's index of diversification is a count of diversity that is used to evaluate the representation

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of different groups. A score of 0.00 indicates absence of diversification. Scores of 0.01–0.40, 0.41–0.60, 0.61–0.80 and 0.81–0.99 indicate low, moderate, moderately high and high diversifications respectively. Finally, a score of 1.00 indicates perfect diversification.

Tobit Regression Model

Tobit regression model was used in identifying elements which influence livelihood diversification. Tobit regression model is used in modeling censored data such as income where some observations have value below certain threshold. This approach was used by Schwarze and Zeller (2005) in finding determinants of income diversification and in predicting how households assign various income derived from enterprises in Indonesia. According to Schwarze and Zeller (2005), in studying livelihood diversification activities, Tobit regression is a useful technique for analyzing the determinants of income and expenditure patterns for households with multiple income sources. Also, in the livelihood diversification activities, some households may have a minimum income threshold below which they do not record their income. Tobit regression allows for the inclusion of these households in the analysis by accounting for the probability that they are below the threshold, while still incorporating the available data on the other households. The model was given as;

$$SID = \beta_0 + \beta_1 sex + \beta_2 age + \beta_3 edu + \beta_4 farm + \beta_5 house + \beta_6 credit + \beta_7 asset + \varepsilon_i$$

Where; SID = Simpson's index of diversification

β_i = estimates for independent variables

sex = sex of household head

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age = age of household head

edu = highest educational qualification of household head

$farm$ = total land size for farming

$house$ = household size

$credit$ = access to credit

$asset$ = type of household assets

Table 2: Description of independent variables specified in livelihood diversification model

Variable	Meaning	Type of measurement	A priori expectation with respect to livelihood diversification	Source
Sex	Sex of household head	Dummy (male = 1, otherwise = 0)	+	(Oni & Fashogbon, 2011)
Age	Age of household head	Continuous (years)	±	(Oni et al., 2011)
Education	Highest education level of household head	Ordinal	+	(Sultana & Kiani, 2011)
Farm size	Total size of farm under cultivation	Continuous (acres)	+	(Pankomera, Houssou & Zeller, 2009)
Household size	Number of dependents in household	Continuous		
Credit	Access to credit	Dummy (having access = 1, otherwise = 0)	+	(Arene & Anyaeji, 2010)
Asset	Type of household asset		+	

Source: Field survey (2022)

As shown in Table 2, independent variables used in livelihood diversification model for study have been described.

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Operationalization of food security

Experience-based food insecurity measurement was modified and adopted for this study because it is basic way of measuring of food insecurity and its adjustment is officially accepted over wide range of cultures including sub-Saharan Africa (Pérez-Escamilla & Segall-Correa, 2008).

Questions in food insecurity scale were rearranged into two groups (yes and no). A score of one is allocated to an item that is answered yes and it indicated food insecurity status of respondent. A score of zero is allocated to an item that is answered no and it indicated food security status of the respondent. Conceptual food security score was between one and nine with summation of scores computed to determine food security status. Households were categorized into four levels of food security by applying these set of rules; High Food Security (score: 0), Moderate Food Security (score: 1–3), Low Food Security (score: 4–6) and Very Low Food Security (score: 7–9) (Pérez-Escamilla & Segall-Correa, 2008).

Pre-testing of instrument

A pre-test is an important stage of developing an instrument for a study. The essence of pre-testing is to corroborate that respondents understand questions on instrument that is made available to them. In addition, responses from respondents meet expectation of researcher. The usual problems associated to instruments are vague questions, poor response and words that are foreign to participants (Perneger, Courvoisier, Hudelson & Gayet-Ageron, 2014).

Pre-testing for this study was done to find out suitability of questions captured in interview schedule. It was done in Adidome, capital of Central

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Tongu District because of cost consideration. During pre-testing, 30 household heads were interviewed between 28th March, 2022 and 1st April, 2022 by researcher.

In conducting research, a sample size of 30 respondents (n=30) is accepted for pre-testing (Perneger et al., 2014). IBM Statistical Product and Service Solutions (SPSS) version 22.0 was used to code the responses. Cronbach Alpha Coefficient can be used to assess the internal consistency of dichotomous or Likert-type scale instrument. For a reliable instrument, the Cronbach Alpha Coefficient must score a value which is between zero and one (George & Mallery, 2003). Table 3 shows the results of the reliability coefficient of the research instrument.

Table 3: Reliability Coefficient of Subscale of the Research Instrument

Subscale	Number of items	Cronbach's Alpha
Level of livelihood diversification	6	0.761
Food security status	9	0.776

n = 30
Source: Field survey, (2022)

Cronbach alpha coefficient obtained for subscale level of livelihood diversification and subscale food security status were 0.761 and 0.776 respectively. According to George and Mallery (2003), Cronbach alpha value greater or equal to 0.70 and less than 0.80 has acceptable internal consistency. Therefore, the research instrument used for the study was reliable.

Data collection procedures

Data was gathered using structured interview schedule from 12th April, 2022 to 10th May, 2022. Interview was supposed to be conducted by researcher personally to ensure that data is safe. However, two Extension

Officers from Department of Agriculture in Central Tongu District offered to help as enumerators in data collection process. On 11[th]April, 2022, the two enumerators were trained and given guidelines to ensure effective data collection and confidentiality of information obtained from respondents. In addition, interview was done at respondents' convenient time to allow for adequate information to be solicited from them and it took between 30–35 minutes to finish an interview session.

Data Analysis

The primary data that was collected during interview was analysed by statistical tools such as frequency, percentage, standard deviation, mode, mean and Tobit regression from IBM SPSS version 22.0.

The four specific objectives were analysed as follows:

a) Objective one which was to describe the demographic and farm related characteristics of respondents. Frequency, percentage, standard deviation, mean and cross-tabulation were used in the analysis.

b) Objective two which was to determine the level of livelihood diversification among respondents. Frequency, percentage, mean, cross-tabulation and Simpson's index of diversification (SID) were used in the analysis.

c) Objective three which was to examine the factors that influence livelihood diversification of respondents. Tobit regression model was used in the analysis.

d) Objective four which was to determine the food security status of respondents. Frequency and percentage were used in analysis.

Table 4 shows the specific objectives and the specific application of analytical tools for the study.

Table 4: Specific Application of Analytical Tools

No.	Specific Objective	Analytical Tool(s) Used
1	Describe demographic and farm related characteristics of respondents.	Frequency, percentage, standard deviation, mean and cross-tabulation
2	Determine level of livelihood diversification among respondents.	Frequency, percentage, mean, cross-tabulation and Simpson's index of diversification
3	Examine factors that influence livelihood diversification of respondents.	Tobit regression model
4	Determine food security status of respondents.	Frequency and percentage

Source: Author's Construct (2022)

Ethical consideration

The ethics examine rules of engagement, moral and standard behaviour, and this gives scholars a standard of moral guidelines in conducting studies in a highly accepted approach (Cohen et al., 2007). The research ethics can be defined as the code of behaviour in conducting research in a proper and lawful manner. It helps researcher in differentiating between accurate and inaccurate as well as legal and illegal conducts in research process (Parveen & Showkat, 2017).

In conducting this study, researcher followed ethical guidelines spelt out by the University of Cape Coast. Firstly, ethical clearance (UCCIRB/CANS/2021/36) was obtained from Institutional Review Board at the University of Cape Coast to enable researcher to carry out the study in Central Tongu District of Ghana. Data collection was done in houses of

respondents and I strictly adhered to COVID-19 Protocols during data collection by initially providing nose masks and sanitizers to respondents who do not have them. Then I ensured wearing of nose masks by researcher and respondents, hand washing with soap under running water by researcher and respondents, use of hand sanitizers by researcher and respondents and observation of social distancing between researcher and respondents. With ethical clearance, rationale of study and all other ethical issues were explained to household heads, and it also elicited respondent's voluntary consent.

Secondly, researcher sent an introductory letter from the Agricultural Economics and Extension Department to the Department of Agriculture in Central Tongu District. Also, each potential respondent was notified about their right to refuse to participate in study and guaranteed of anonymity regarding any information provided before interview is started.

The informed consent was one of many ethical issues considered and with that, an explanation of the research purpose, processes and expected period of the respondent's engagement were outlined. This helped to have the consent of the respondents before the interview began.

The participation in the study was on voluntary basis and any respondent had freedom to quit anytime without adverse effect. Interview schedule and consent forms of respondents who do not speak or understand English was translated into Ewe language. The respondent's confidentiality of any information they gave during interview will be guaranteed. No names were included on the data collection instrument and completed interview questions were kept in a lockable place accessible to researcher and supervisor only to ensure highest level of confidentiality and privacy.

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CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This chapter presents findings of survey conducted among smallholder farmers in Central Tongu District of Ghana. It provides results and discussion for demographic and farm related characteristics of respondents, level of livelihood diversification among respondents, factors that influence livelihood diversification of respondents and food security status of respondents. The results and discussion are presented according to objectives of the study.

Demographic and farm related characteristics of respondents

The first objective was to describe the demographic and farm related characteristics of respondents.

Demographic characteristics of respondents

The results and discussion on demographic characteristics of respondents was done in terms of; age, sex, marital status and educational level.

Age of respondents

The age of respondents is an essential element influencing diversification of farming enterprises. Older age provides a lot of experience to respondents and younger age provides a lot of energy to respondents. Therefore, a blend of experience and energy is required for respondents to efficiently diversify their farming enterprises. The age composition and mean age of respondents are presented in Table 5.

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Table 5: Age composition and mean age of respondents

Age group	Frequency	Percentage
25 – 34	27	10
35 – 44	73	27
45 – 54	81	30
55 – 64	54	20
65 and above	35	13
Total	270	100

Variable	Sample Size (N)	Minimum	Maximum	Mean	Standard Deviation
Age	270	25.00	75.00	43.90	11.84
Valid N	270				

Source: Field survey (2022)

The results in Table 5 show that 30% of respondents were within the age group of 45–54 years and 27% of respondents were within the age group 35–44 years which indicated that most of the smallholder farmers in Central Tongu district are agile to participate in farming and other business related activities. The mean age of respondents was about 44 years old, this mean age is close to 41 years mean age obtained by Anang (2018), who conducted a research to find out how smallholder farmers adopt farm technology in Ghana and 45 years mean age obtained by Tanko and Alidu (2016), they undertook a study on determinants of household food insecurity in Northern Region of Ghana. This also suggested that, population of smallholder farmers is made up of people who are active and energetic for agricultural related activities. Minimum and maximum ages of respondents were 25 and 75 years respectively, and standard deviation of age was 11.8 years.

Sex, marital status and educational level of respondents

Other demographic characteristics of respondents which included; sex, marital status and educational level are presented in Table 6.

Table 6: Sex, marital status and educational level of respondents

Variable		Frequency	Percentage
Sex	Female	94	35
	Male	176	65
	Total	270	100
Marital status	Married	165	61
	Not Married	51	19
	Separated	21	8
	Widow	12	4
	Widower	21	8
	Total	270	100
Educational level	Tertiary	22	8
	GCE 'A' Level	6	2
	GCE 'O' Level	3	1
	SHS	63	23
	JHS	49	18
	Primary	78	29
	No formal education	49	18
	Total	270	100

Source: Field survey (2022)

As shown in Table 6, majority of respondents (65%) were males and remaining (35%) were females. This finding is almost in line with Tanko & Alidu (2016), who estimated that population of males farmers were 82% and female farmers were 18% in a study conducted in Northern Region of Ghana. This confirmed the assertion that male farmers in Ghana were in the majority and the 82% of male farmers in Northern Region of Ghana could be associated to their culture, where males always play a leading role in most out of home

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economic activities. Also, this finding is similar to 61% males and 39% females obtained by Afodu et al. (2019) in a research conducted in Nigeria. They argued that more males participate in agricultural activities than females due to energy involved in farm work.

Majority of respondents (61%) were married and 19% of respondents were not married. 8% of respondents each were widowers and separated and 4% of respondents were widows. This implies than 61% of respondents were married and 39% of respondents were single. This is in line with findings from a research by Baba & Abdulai (2021) in Northern Ghana, who opined that household heads who are married tend to be more diversified in their enterprises. This is because of responsibility to supply household needs, therefore engaging in many income generating activities.

For educational level, 29% of respondents had primary education and this was followed by 23% of respondents who had Senior High School education. However, 18% of respondents each had Junior High School education and no formal education respectively. This means that few of respondents (18%) had no formal education and majority (82%) had some formal education, and that could help them in taking good decisions in subsistence farming which is consistent with a research conducted in Kenya by Thuo (2011). He indicated that education at least at basic level is a major determinant in enhancing food security among smallholder farmers because education increases farmers' ability to diversify household resources hence, improving farm productivity.

Farm related characteristics of respondents

The results and discussion on farm related characteristics of respondents was done in terms of; years of farming, household size, land size, access road to farm, savings in financial institution, access to credit, source of funding and access to extension.

Years of farming, household size and land size characteristics of respondents are presented in Table 7.

Table 7: Farm related characteristics of respondents

Activity	Mean	Minimum	Maximum	Standard Deviation
Years of farming	22.4	1.0	60	12.3
Household size	5.0	1.0	17	4.0
Land size (acres)	3.1	1.5	5.0	1.2

Source: Field survey (2022)

As shown in Table 7, maximum farming years by any of the respondents was 60 years and mean years of farming was about 22 years. So, considering the years of farming, it was expected that respondents might gain enough experience to engage in alternative sources of income for their families. This indicates that smallholder farmers in study area have been farming for a long time and this is in consonance with study conducted in India by Khatun & Roy (2012). They concluded that rural households are easily diversified in their livelihood with more experience in terms of their age, years of farming and when they are more trained in terms of skills. Another research conducted by Awotide et al. (2010) disclosed that length of years of farming and other factors influence livelihood diversification which decreases poverty in Nigeria. The maximum household size for respondents was 17 and the mean household size was five, which is close to mean household size of six obtained

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by Afodu et al. (2019) in a study conducted in Nigeria and four obtained by Abera et al. (2021) in research conducted in Ethiopia. They concluded that household size is one of the elements that influences livelihood diversification strategies which are pursued by farming households. Research conducted in Ghana by Tanko and Alidu (2016) revealed that size of household and other factors notably influenced households' food insecurity. Another study conducted in Ghana by Baba and Abdulai (2021) concluded that household size was included in factors which affected diversification decisions of farming households.

The maximum size of land cultivated by any of respondents was 5 acres and the mean size of land cultivated was 3.1 acres. This could help smallholder farmers in diversifying their livelihood activities and it is almost in line with research conducted by Abera et al. (2021) in Ethiopia, who concluded that mean land size of five acres helped resettlers' communities in diversifying their livelihood activities. Also, Asante et al. (2017) argued in study conducted in Ghana, that land size is one of the elements that influences livelihood diversification.

Other farm related characteristics of respondents

Access road to farm, savings in financial institution, access to credit, source of funding and access to extension are other farm related characteristics which are presented in Table 8.

Table 8: Other farm related characteristics of respondents

Activity		Frequency	Percentage
Access road to farm	Yes	152	56.3
	No	118	43.7
Savings in financial institution	Yes	135	50.0
	No	135	50.0
Access to credit	Yes	99	36.7
	No	171	63.3
	Own	156	58.2
Source of funding	Friends	34	12.7
	Money lenders	37	13.8
	Financial institution	41	15.3
Access to extension services	Yes	150	55.8
	No	119	44.2

Source: Field survey (2022)

As shown in Table 8, majority of respondents (56.3%) had access road to their farms, whilst remaining 43.7% had no access road to their farms. This result is in consonance with research conducted by Dinku (2018) on determinants of livelihood diversification strategies in Borena pastoralist communities in Ethiopia. He asserted that access road to farm and market were some of factors that influence livelihood diversification among pastoralists.

Half of respondents (50%) had savings in financial institution and majority (63.6%) had no access to credit. Majority of respondents (58.2%) had their own source of funding. Also, majority of respondents (55.8%) had access to extension service.

Level of livelihood diversification among respondents

The second objective was to determine the level of livelihood diversification among respondents. The results were presented as follows; main farm

activities, subsidiary farm activities, subsidiary non-farm activities, annual incomes with mean annual incomes and level of diversification.

Main farm activities of respondents

The main farm activities and the relative importance of crops produced by percentage of respondents are presented in Table 9.

Table 9: Main farm activities of respondents

Main farm activity	Frequency	Percentage
Cassava	100	37.0
Pepper	79	29.0
Maize	72	27.0
Okra	6	2.2
Groundnut	5	1.8
Cowpea	4	1.5
Rice	4	1.5
Total	270	100

Source: Field survey (2022)

As shown in Table 9, high proportion of respondents (37%) cultivated cassava as their main farm activity and 29% of respondents cultivated pepper as their main farming activity. This is followed by 27% of respondents who cultivated maize, 2.2% of respondents cultivated okra and 1.8% of respondents cultivated groundnut as their main farm activities. Remaining 1.5% of respondents cultivated cowpea and rice as their main farm activities respectively. Therefore, main crops produced in the study area were seven and their importance was arranged from cassava to rice by frequency and percentage of respondents.

Subsidiary farm activities of respondents

The subsidiary farm activities involved the cultivation of the same crops under the main farm activities. However, subsidiary farm activities

included livestock rearing and non-traditional farm. The subsidiary farm activities of respondents are presented in Table 10.

Table 10: Subsidiary farm activities of respondents

Subsidiary farm activities	Commodities	Frequency	Percentage
	Maize	149	15.5
	Cassava	139	14.4
	Pepper	123	12.8
Crop farming	Okra	111	11.5
	Cowpea	80	8.3
	Groundnut	64	6.6
	Rice	3	0.3
Total		669	69.4
	Pigs	90	9.3
Livestock farming	Sheep & Goats	85	8.8
	Poultry	64	6.7
	Cattle	47	4.9
Total		286	29.7
Non-traditional farming	Bee-keeping	8	0.8
Grand Total		963	100

Source: Field survey (2022)

As shown in Table 10, high proportion of respondents (69.4%) were engaged in crop farming as their subsidiary farm activity. 15.5% of respondents cultivated maize as their subsidiary farm activity and 14.4% of respondents cultivated cassava as their subsidiary farm activity. 12.8% of respondents cultivated pepper as their subsidiary farm activity and 11.5% of respondents cultivated okra as their subsidiary farm activity. 8.3% of respondents and 6.6% of respondents cultivated cowpea and groundnut respectively as their subsidiary farm activities. Finally, low proportion of respondents (0.3%) cultivated rice as their subsidiary farm activity. For livestock farming as subsidiary farm activity, 9.3% of respondents were into

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pig rearing. This is followed by 8.8% of respondents who were into sheep and goat rearing, and 6.7% of respondents were into poultry rearing. Finally, 4.9% of respondents were into cattle rearing as subsidiary farm activity. For non-traditional farming as subsidiary farm activity, less than 1% of respondents were engaged in bee-keeping.

Subsidiary non-farm activities of respondents

Respondents, in addition to their main and subsidiary farm activities, were also found to be engaged in subsidiary non-farm activities. The subsidiary non-farm activities of respondents are presented in Table 11.

Table 11: Subsidiary non-farm activity of respondents

Subsidiary non-farm activity	Frequency	Percentage	Cumulative Percentage
Trading	89	31.8	31.8
Commercial driving	51	18.2	50.0
Weaving	40	14.3	64.3
Hunting	38	13.6	77.9
Sewing	29	10.4	88.3
Artisanal work	22	7.9	96.2
Civil service	11	3.9	100.0
Total	280		

Source: Field survey (2022)

As shown in Table 11, 31.8% of respondents were engaged in trading as their subsidiary non-farm activity. This is followed by 18.2% of respondents who were engaged in commercial driving and 14.3% of respondents engaged in weaving as their subsidiary non-farm activities. 13.6% of respondents were engaged in hunting as their subsidiary non-farm activity, 10.4% of respondents were engaged in sewing as their subsidiary non-farm activity and 7.9% of respondents were engaged in artisanal work as their

subsidiary non-farm activity. Low proportion of respondents (3.9%) was engaged in civil service as their subsidiary non-farm activity.

The current work shows that agricultural enterprises constituted main income generating activity of smallholder farmers and non-agricultural enterprises constituted minor income generating activity of smallholder farmers as depicted in Tables 9, 10 and 11. This confirm results of several previous studies including those of Yizengaw et al. (2015), who conducted the study in Ethiopia. They concluded that, for most families in rural areas of sub-Saharan Africa, agriculture continues to be the main livelihood activity. They also revealed that agriculture is a major profitable enterprise that makes up almost 90% of the income of smallholder farmers.

Annual income from main farm activities

The income generated from main farm activities of respondents in a year with the mean annual income are presented in Table 12.

Table 12: Annual income and mean annual income of main farm activities

Main farm activities	Frequency	Annual income (GH₵)	Percentage of annual income	Cumulative Percentage
Pepper	79	217550.00	30.3	30.3
Cassava	100	212400.00	29.6	59.9
Maize	72	186950.00	26.1	86.0
Groundnut	5	38000.00	5.3	91.3
Rice	4	33800.00	4.7	96.0
Cowpea	4	22800.00	3.2	99.2
Okra	6	5400.00	0.8	100.0
Total	270	716900.00		

Mean annual income of main farm activities

	Mean	Minimum	Maximum	Standard Deviation
Income (GH₵)	2655.20	200.00	25000.00	3315.60

Source: Field survey (2022)

As shown in Table 12, annual income derived from pepper farming was GH₵217,550.00 with frequency of 79 respondents and earned the highest proportion (30.3%) of income to respondents. Cassava farming accrued an annual income of GH₵ 212,400.00 with frequency of 100 respondents and earned an income proportion of 29.6% to respondents. This is followed by maize farming with an annual income of GH₵ 186,950.00, frequency of 72 respondents and an income proportion of 26.1% to respondents. Groundnut farming accrued an annual income of GH₵ 38,000.00, frequency of 5 respondents and an income proportion of 5.3% to respondents. Rice and cowpea farming had frequencies of 4 respondents each, however, their annual income were GH₵33,800.00 and GH₵22,800.00 respectively. Also, rice farming earned an income proportion of 4.7% to respondents and cowpea farming earned an income proportion of 3.2% to respondents. Finally, okra farming accrued annual income of GH₵ 5,400.00 with frequency of 6 respondents and earned an income proportion of 0.8% to respondents.

The mean annual income derived from main farm activities of respondents was GH₵ 2655.20, the maximum annual income was GH₵ 25,000.00 and minimum annual income was GH₵ 200.00. This finding is in line with research conducted in Ethiopia by Yizengaw et al. (2015) who revealed that agriculture is major profitable enterprise that makes up almost 90% of income of smallholder farmers.

Annual income from subsidiary farming activities

The income generated from subsidiary farm activities of respondents in a year with the mean annual income are presented in Table 13.

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Table 13: Annual income and mean annual income of subsidiary farm activities

Subsidiary farm activities	Frequency	Annual income (GH₵)	Percentage of annual income	Cumulative Percentage
Maize	149	167090.00	15.0	15.0
Cassava	139	155220.00	14.0	29.0
Pepper	123	157170.00	14.1	43.1
Okra	111	71940.00	6.5	49.6
Cowpea	80	52610.00	4.7	54.3
Groundnut	64	34750.00	3.1	57.4
Rice	3	3600.00	0.3	57.7
Total	669	642380.00		
Pigs	90	102800.00	9.3	67.0
Sheep & Goats	85	101070.00	9.1	76.1
Poultry	64	95500.00	8.6	84.7
Cattle	47	160900.00	14.5	99.2
Total	286	460270.00		
Bee-keeping	8	8100.00	0.7	100.0
Grand total	963	1110750.00		

Mean annual income of subsidiary farm activities

	Mean	Minimum	Maximum	Standard Deviation
Income (GH₵)	1149.38	50.00	20000.00	1566.22

Source: Field survey (2022)

As shown in Table 13, annual income derived from maize farming as subsidiary farm activity was GH₵ 167,090.00 with highest frequency of 149 respondents and an income proportion of 15.0% to respondents. Also, the annual income derived from rice farming as subsidiary farm activity was GH₵ 3,600.00 with lowest frequency of three respondents and an income proportion of 14.0% to respondents. For livestock farming as subsidiary farm activity, the annual income derived from cattle rearing was highest (GH₵ 160,900.00) but with lowest frequency of 47 respondents and an income proportion of 14.5% to respondents. Also, the annual income derived from pig rearing was GH₵ 102,800.00 but with highest frequency of 90 respondents and an income proportion of 9.3% to respondents. For non-traditional farming as subsidiary

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farm activity, the annual income derived from bee-keeping was GH₵ 8100.00 with frequency of eight respondents and an income proportion of 0.7% to respondents.

The mean annual income derived from subsidiary farm activities of respondents was GH₵ 1149.38, the maximum annual income was GH₵ 20,000.00 and minimum annual income was GH₵ 50.00. This finding is in line with research conducted by Singh (2013) on income and livelihood issues of farmers in India. He asserted that mixed farming has been traditionally adopted by Indian farmers to supplement their income in order not to be poor.

Annual income from subsidiary non-farm activities

The income generated from subsidiary non-farm activities of respondents in a year with the mean annual income are presented in Table 14.

Table 14: Annual income and mean annual income of subsidiary non-farm activities

Subsidiary non-farm activity	Frequency	Annual income (GH₵)	Percentage of annual income	Cumulative Percentage
Trading	89	87980.00	34.0	34.0
Commercial driving	51	56200.00	21.8	55.8
Weaving	40	37850.00	14.7	70.5
Hunting	38	26430.00	10.2	80.7
Civil service	11	19500.00	7.6	88.3
Sewing	29	19350.00	7.5	95.8
Artisanal work	22	10820.00	4.2	100.0
Total	280	258130.00		
Mean annual income of subsidiary non-farm activities				
	Mean	Minimum	Maximum	Standard Deviation
Income (GH₵)	921.89	20	9000	909.66

Source: Field survey (2022)

As shown in Table 14, annual income derived from trading was GH₵ 87,980.00 with frequency of 89 respondents and an income proportion of 34.0% to respondents. The annual income derived from commercial driving was GH₵ 56,200.00 with frequency of 51 respondents and an income proportion of 21.8% to respondents. This is followed by weaving with annual income of GH₵ 37,850.00 with frequency of 40 respondents and an income proportion of 14.7% to respondents. Hunting accrued annual income of GH₵ 26,430.00 with frequency of 38 respondents and an income proportion of 10.2% to respondents. Civil service as subsidiary non-farm activity accrued annual income of GH₵ 19,500.00 with frequency of eleven respondents and an income proportion of 7.6% to respondents. Finally, sewing and artisanal work had frequencies of 29 and 22 respondents each with accrued annual income of GH₵ 19,350.00 and GH₵ 10,820.00 respectively. Also, sewing earned an income proportion of 7.5% to respondents and artisanal work earned an income proportion of 4.2% to respondents.

The mean annual income derived from subsidiary non-farm activity of respondents was GH₵ 921.89, the maximum annual income was GH₵ 9,000.00 and the minimum annual income was GH₵ 20.00. This confirms study by Asfaw et al. (2017) that non-farm activities also provide alternative sources of income for most households in Ethiopia. They argued that depending on only income from farming can increase vulnerabilities of smallholder farmers.

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Table 15: Level of livelihood diversification among respondents

Livelihood activity	Total Income (GH₵)	Income Proportion	Income Proportion Squared
Main farm activity	716900	0.34371	0.1181354
Subsidiary Crop farm	642380	0.30798	0.0948521
Subsidiary Livestock farm	460270	0.22067	0.0486954
Subsidiary non-traditional farm	8100	0.00388	0.0000151
Subsidiary non-farm activity	258130	0.12376	0.0153158
Total	2085780	1.0	0.2770139
SID		$1 - 0.28 = 0.72$	

Source: Field survey (2022)

As shown in Table 15, level of livelihood diversification as estimated by Simpson's index of diversification using income derived from their livelihood activities was 0.72. This implied that when two smallholder farmers in Central Tongu District are selected at random, there is 72% chance that their household is well diversified in their livelihood. Beside main farm activity, income generated from subsidiary crop farm was higher than other subsidiary activities. Other livelihood activities included subsidiary livestock farm, subsidiary non-traditional farm and subsidiary non-farm activity.

Rural households that rely on a single farm activity are more likely to be poor than those that diversify their farm. This confirms the assertion by Singh (2013), that mixed farming has been traditionally adopted by the Indian farmers to supplement their income and growth of non-farm activities in order not to be poor.

Factors that influence livelihood diversification of respondents

The third objective was to examine the factors that influence livelihood diversification of respondents. Access to assets has huge influence on

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livelihood diversification of respondents. Types of assets that were accessible to respondents are presented in Table 16.

Table 16: Types of assets accessible to respondents

Type of asset		Frequency	Percentage	Cumulative Percentage
Financial asset	Bank savings	63	24.3	24.3
	Cash	85	32.8	57.1
	Susu	111	42.9	100.0
	Grand Total	259	100.0	
Natural asset	Access to land	151	60.9	60.9
	Access to water	97	39.1	100.0
	Grand Total	248	100.0	
Human asset	Education	29	11.9	11.9
	Good health	127	52.3	64.2
	Technical know-how	87	35.8	100.0
	Grand Total	243	100.0	
Physical asset	Building	117	45.7	45.7
	Motor cycle	65	25.4	71.1
	Access to tractor	74	28.9	100.0
	Grand Total	256	100.0	
Social asset	Membership of FBO	152	60.3	60.3
	Participation in community programs	100	39.7	100.0
	Grand Total	252	100.0	

Source: Field survey (2022)

As shown in Table 16, in terms of financial assets, 42.9% of respondents were involved in susu, 32.8% had cash and remaining 24.3% had bank savings. For natural assets, majority of respondents (60.9%) had land asset and remaining (39.1%) had water asset. For human assets, majority of respondents (52.3%) enjoyed good health, 35.8% had technical know-how in their livelihood activities and almost 12% had education. For physical assets, 45.7% of respondents had building, 25.4% had motorcycle and 28.9% had access to tractor. Finally, for social assets, majority of respondents (60.3%) were

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members of FBOs and remaining (39.7%) participated in developmental programs in the community.

The result of Tobit regression of the factors that influence livelihood diversification of respondents is presented in Table 17.

Table 17: Factors influencing livelihood diversification of respondents

Variable	Coefficients:	Std. Error
Sex	-0.00488	0.130
Age	0.00314	0.00583
Land size	0.0334***	0.0113
Household size	0.0269	0.0170
Access to credit	0.103	0.112
Bank savings	-2.66	0.332
Cash	-0.130	0.331
Susu	-0.285	0.327
Access to land	0.581**	0.250
Access to water	0.475*	0.261
Education	0.126	0.272
Good health	0.365	0.233
Technical know-how	0.368	0.242
Building	-0.170	0.247
Motor cycle	-0.300	0.258
Access to tractor	0.0738	0.261
Member of FBO	0.414*	0.227
Participates in programs	0.348	0.230

Source: Field survey (2022) '***' significant at 0.01; '**' significant at 0.05; '*' significant at 0.1
Number of observations = 270. Pseudo R^2 = 0.641.

The result from Table 17 shows that, land size was positive and significantly (β =0.0334; $p < 0.05$) related to livelihood diversification. This means that a unit increase in land size translates into 0.03 unit increase in diversification of smallholder farmers. This finding is in consonance with a study conducted in Ghana by Asante et al. (2017) who revealed that size of land is one of the elements that influence diversification of smallholder farmers. Also, a research conducted by Awotide et al. (2010) in Nigeria identified land size as a major contributor to diversification of smallholder farmers.

Having access to natural asset such as land was positive and significantly ($\beta = 0.581$; p < 0.05) related to livelihood diversification. This means that a unit increase in access to land translates into 0.58 unit increase in diversification of smallholder farmers. Also, having access to natural asset such as water was positive and significantly ($\beta = 0.475$; p < 0.1) related to livelihood diversification. This means that a unit increase in access to water translates into 0.48 unit increase in diversification of smallholder farmers. This findings confirmed assertions by Babatunde and Qaim (2009), that possession of natural assets facilitates entry of farmers into more businesses and hence, leading to diversification of their livelihood.

Another positive and significant factor in livelihood diversification was smallholder farmers who were members of FBO ($\beta = 0.414$; p < 0.1). This means that a unit increase in membership of FBO translates into 0.41 unit increase in diversification of smallholder farmers. When smallholder farmers join groups and associations, interaction with other members help them to make inform decisions which help them to diversify their livelihood activities. This finding is in accordance to a survey conducted by Dinku, (2018) in Ethiopia, who argued that social asset such as belonging to FBO influences livelihood diversification of farming households.

The factors which influenced livelihood diversification positively and significantly were arranged in order of significance as follows: land size ($\beta = 0.033$) > access to land ($\beta = 0.414$) > access to water ($\beta = 0.475$) > membership of FBO ($\beta = 0.581$). Where > denotes more significant than.

Food security status of respondents

The fourth objective was to determine the food security status of respondents and it was measured by using food security scale presented in Table 18.

Table 18: Food security scale

Food security items	Yes (%)	No (%)
Worried of running out of food	34	66
Experience food shortage	28	72
Run out of money	27	73
Consume less food	24	76
Reduce or skip meals	37	63
Eat less	37	63
Ever felt hungry	37	63
Lost weight	18	82
Eat just a meal a day	30	70

Source: Field survey (2022)

As shown in Table 18, majority of respondents (66%) indicated that they had never worried of food shortage because they were able to buy or receive more food, and remaining (34%) indicated that they had worries of food shortage. Also, majority of respondents (82%) indicated that they did not lose weight because they have enough money to buy food. In similar manner, majority of respondents (72%) indicated that they did not experience food shortage.

Respondents scored zero for 'No' responses to food security items and one for 'Yes' responses to food security items. Respondents were distributed in all the four categories of food security. Households were categorized into four levels of food security by applying these set of rules; High Food Security (score: 0), Moderate Food Security (score: 1–3), Low Food Security (score: 4–

6) and Very Low Food Security (score: 7–9). Food security status of respondents is presented in Table 19.

Table 19: Food security status of respondents

Food security status	Frequency	Percentage
High food security (0)	6	2.2
Moderate food security (1–3)	232	85.9
Low food security (4–6)	28	10.4
Very low food security (7–9)	4	1.5
Total	270	100

Source: Field survey (2022)

As shown in Table 19, overwhelming majority (85.9%) of respondents were moderately food secured. 10.4% of respondents were lowly food secured and 1.5% of respondents were very lowly food secured. Finally, 2.2% of respondents were highly food secured. Result is at variance with studies conducted by Quaye (2008), that more than 96% of smallholder farmers used in a research in Ghana were food insecure and Manu et al. (2013), that 73.4% of vegetable farmers used in a research in Ghana were food insecure. Result shows that food security is not a challenge for smallholder farmers in study area because level of livelihood diversification among them is 72% as depicted in this study. As high as almost 86% of respondents were moderately food secured because they scored within one to three on the items used to measure food security. Few of respondents (2.2%) who have appreciable level of assets were highly food secured because they scored zero on the items used to measure food security. This is in consonance with a survey in Ethiopia by Dinku (2018), which revealed that vulnerability occurs because livelihood diversification is limited due to absence of infrastructural systems. Another

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research finding in Ethiopia by Fekadu et al. (2021), depicted that predictors of household livelihood diversification were minimal and as such increased food insecurity and vulnerability.

The findings suggest a positive linkage between the level of diversification and household food security among smallholder farmers in Central Tongu District of Ghana. Specifically, the moderately high level of livelihood diversification (0.72) is associated with relatively high level of food security with 12% of smallholder farmers experiencing low to very low food security. This suggests that livelihood diversification or engaging in multiple income generating activities can help to improve food security among smallholder farmers in the district. By having multiple sources of income, smallholder farmers may be better equipped to purchase food for their household when their own production falls short or invest in inputs that can improve their food production.
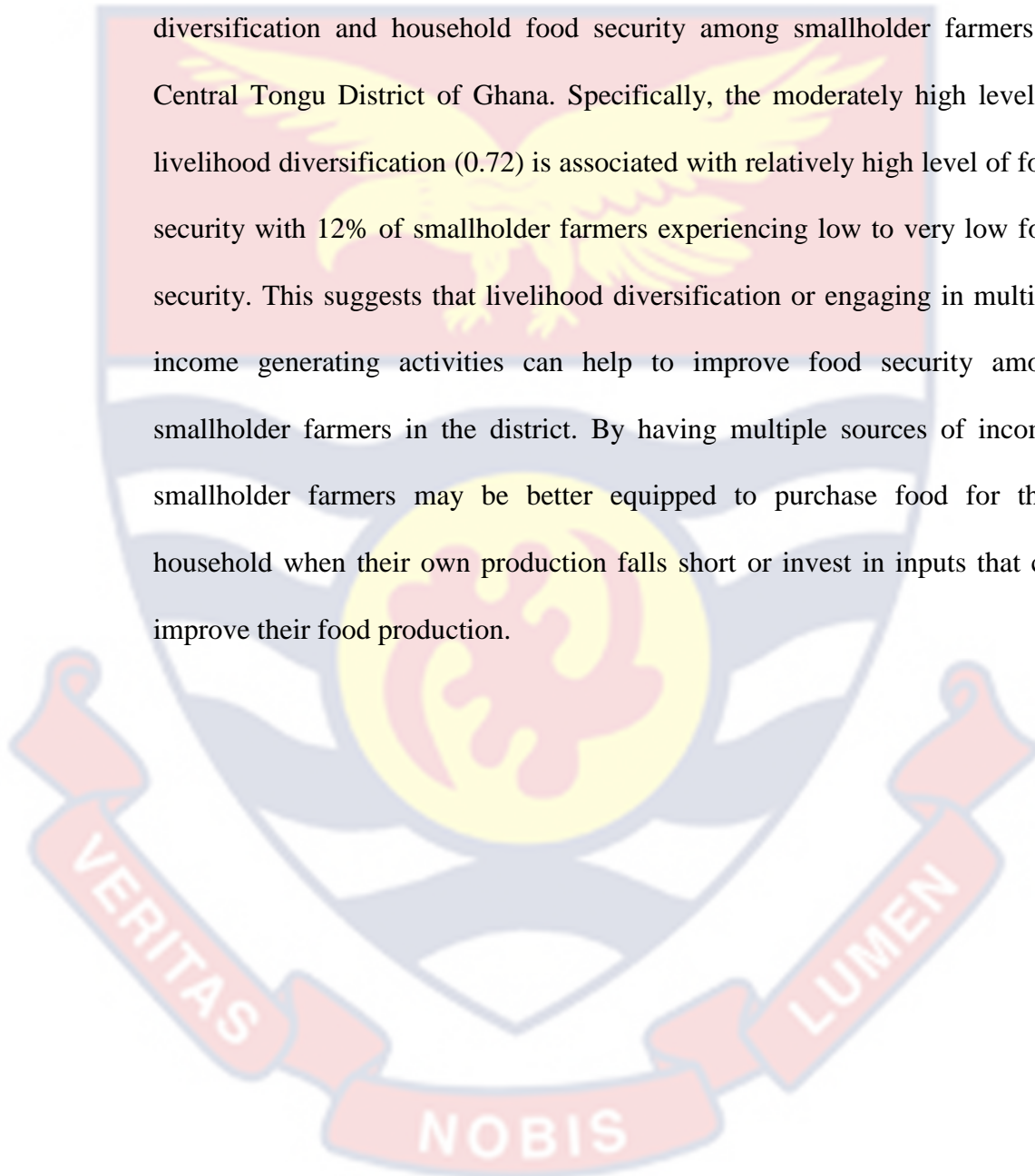
CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter presents a summary, conclusions and recommendations derived from findings of the study. The summary of the results and conclusions have been organized based on the specific objectives and research questions of the study. This section also presents suggested areas for further research.

Summary

The general objective of the study was to examine the livelihood diversification and food security of smallholder farmers in Central Tongu District of Ghana.

Specific objectives of the study were to:

1. Describe the demographic and farm related characteristics of respondents.

2. Determine the level of livelihood diversification among respondents.

3. Examine the factors that influence livelihood diversification of respondents.

4. Determine the food security status of respondents.

This study used descriptive cross-sectional survey design to collect data from 270 smallholder farmers in 15 communities within Central Tongu District of Ghana with structured interview schedule. The data was analyzed using descriptive statistics, Tobit regression model and Simpson's index of diversification. Summary of main findings were presented according to specific objectives of the study.

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Demographic and farm related characteristics of smallholder farmers

The first objective was to describe the demographic and farm related characteristics of smallholder farmers. From the study, minimum and maximum ages of smallholder farmers interviewed were 25 and 75 years respectively with a mean age of about 44 years. This implied that the population had people who were still active and energetic for farm activities. Male and female proportions of smallholder farmers sampled were 65% and 35% respectively. Majority of smallholder farmers (82%) had some formal education and 18% had no formal education. This situation helped them in making good decisions in their farming activities. Smallholder farmers had been engaged in farming for a maximum of 60 years with a mean farming period of about 22 years. The data suggested that number of years of farming influenced engagement in alternative livelihood activities. Household size was a maximum of 17 people and a minimum of one person with a mean of five people. Total land size cultivated per household was maximum 5 acres, minimum 1.5 acres and a mean size of 3.1 acres. Majority of smallholder farmers (56.3%) had access road to their farms, whilst remaining 43.7% had no access road to their farms. Half of smallholder farmers (50%) had savings in financial institutions. However, the majority (63.6%) had no access to credit and also, majority of smallholder farmers (58.2%) had their own source of funding. Finally, 55.8% of smallholder farmers had access to extension service.

Level of livelihood diversification of smallholder farmers

The second objective was to determine the livelihood diversification of smallholder farmers. High proportion of smallholder farmers (37%) cultivated

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cassava as their main farming activity, 29% of smallholder farmers cultivated pepper, 27% of smallholder farmers cultivated maize, 2.2% of smallholder farmers cultivated okra and 1.8% of smallholder farmers cultivated groundnut as their main farming activities. Rest of smallholder farmers (1.5%) cultivated cowpea and rice as their main farming activities respectively. Maximum and minimum annual incomes from main farming activity were GH₵ 25,000.00 and GH₵ 200.00 respectively with mean income of GH₵ 2655.20. Majority of smallholder farmers (69.4%) were engaged in crop farming as their subsidiary farm activity. In addition, 15.8% of smallholder farmers cultivated maize, 14.4% of smallholder farmers cultivated cassava, 12.8% of smallholder farmers cultivated pepper, 11.5% of smallholder farmers cultivated okra, 8.3% of smallholder farmers cultivated cowpea, 6.6% of smallholder farmers cultivated groundnut and 0.3% of smallholder farmers cultivated rice as their subsidiary farming activities. For livestock farming as subsidiary farm activity, 9.3% of smallholder farmers were into pig rearing, 8.8% of smallholder farmers were into sheep and goat rearing, 6.7% of smallholder farmers were into poultry rearing and 4.9% of smallholder farmers were into cattle rearing as subsidiary farm activity. For non-traditional farming as subsidiary farm activity, less than 1% of smallholder farmers were engaged in bee-keeping. Maximum and minimum annual income from subsidiary farm activity was GH₵ 20,000.00 and GH₵ 50.00 respectively with mean income of GH₵ 1149.38. 31.8% of smallholder farmers were engaged in trading as their subsidiary non-farm activity. 18.2% of smallholder farmers are engaged in commercial driving, 14.3% of smallholder farmers are engaged in weaving, 13.6% of smallholder farmers are engaged in hunting, 10.4% of smallholder

farmers are engaged in sewing, 7.9% of smallholder farmers are engaged in artisanal work and 3.9% of smallholder farmers are engaged in civil service as their subsidiary non-farm activities. Maximum and minimum annual income from subsidiary non-farm activity was GH₵ 9,000.00 and GH₵ 20.00 respectively with mean income of GH₵ 921.89.

Livelihood diversification in this study was simply explained as the number of livelihood activities engaged in by a household of a smallholder farmer. Operationally, this study used the Simpson's index of diversification to determine the level of livelihood diversification of smallholder farmers and it estimated that smallholder farmers were 0.72 diversified in their livelihood activities. This implied that there was 72% chance that household income was diversified and result showed that smallholder farmers in study area had well diversified income sources for their families. Beside main farming activity, income generated from subsidiary crop farming was higher compared to other subsidiary activities and this means that they rely more on crops than others for their livelihood. Other livelihood activities included subsidiary livestock farm, subsidiary non-traditional farm and subsidiary non-farm activity. Finally, rural households that relied on a single farming activity were more likely to be poor in contrast to those that diversified their income activities.

Factors that influence livelihood diversification of smallholder farmers

The third objective was to examine the factors that influence livelihood diversification of smallholder farmers. Tobit regression model was employed in examining factors that influence livelihood diversification of smallholder farmers and it revealed land size was positively and significantly ($\beta = 0.0334$; $p < 0.05$) related to livelihood diversification. This implied that an increase in

land size resulted into possible increase in number of commodities to be cultivated by a smallholder farmer. Possession of natural asset such as land generally increased potential number of diversified commodities, as the estimate is positive and significant ($\beta = 0.581$; $p < 0.05$). Smallholder farmers who had natural asset such as water also had a positive and significant estimate ($\beta = 0.475$; $p < 0.1$) in livelihood diversification. Another positive and significant estimate in livelihood diversification was respondents who were membership of FBO ($\beta = 0.414$; $p < 0.1$). This implied that as smallholder farmers participated in FBOs, they were more likely to diversify their livelihood activities.

Food security status of smallholder farmers

The fourth objective was to determine food security status of smallholder farmers. Nine food security items were used in determining the food security status of smallholder farmers in Central Tongu District of Ghana. On the food security items, majority of smallholder farmers (66%) indicated that they had never worried of food shortage and remaining (34%) indicated otherwise. Majority of smallholder farmers (82%) indicated that they did not lose weight because they had enough money to buy food when it got finished in their house. Also, majority of smallholder farmers (72%) indicated that they did not experience food shortage. On the food security items, a score of zero was assigned to 'No' responses from smallholder farmers while a score of one was assigned to 'Yes' responses from smallholder farmers. The food security score was between one and nine with summation of scores computed to determine food security status. By applying the following set of rules, which included; High Food Security (score: 0), Moderate Food Security (score: 1–3), Low

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Food Security (score: 4–6) and Very Low Food Security (score: 7–9), the households of smallholder farmers were categorized into four levels of food security to determine their food security status. For the food security status, few of smallholder farmers (2.2%) were highly food secured and overwhelming majority (85.9%) of smallholder farmers were moderately food secured. However, 10.4% of smallholder farmers were lowly food secured and very few smallholder farmers (1.5%) were very lowly food secured.

Conclusion

The following conclusions were drawn based on the specific objectives and findings of the study. The first conclusion drawn is that smallholder farmers in Central Tongu District were made up of individuals who were in their prime ages, active and energetic to engage in more livelihood diversification activities as suggested by their age composition and mean age. In addition, majority of the smallholder farmers were males, married, well-educated and have been farming for a long time so they have the experience and skills to diversify their livelihood.

The second conclusion drawn is that smallholder farmers were engaged in multiple income generating activities and they were moderately high in their level of livelihood diversification. This suggested that many smallholder farmers participate in diverse livelihood activities, which may helped them to reduce their vulnerability to shocks and stresses but there is still room for improvement. The income generating activities engaged in by the smallholder farmers included crop farm, livestock farm, non-traditional farm and non-farm activities.

The third conclusion drawn is that factors such as land size, access to land, access to water and membership of FBO positively and significantly influenced livelihood diversification of smallholder farmers. This suggested that smallholder farmers with larger land sizes are more likely to diversify their livelihood which may improve resilience and well-being. Also, smallholder farmers having access to natural resources such as land and water are better positioned to diversify their livelihood and adapt to changing circumstances. Finally, it suggested that FBOs played an important role in supporting smallholder farmers to diversify their livelihood through the access to information, resources and networks.

The last conclusion drawn is that majority of the smallholder farmers in Central Tongu District were moderately food secured. This suggested that majority of smallholder farmers have adequate access to food, although they may still face some challenges in ensuring food security for their households.

Recommendations

Based on the conclusion of the study, the following recommendations were made:

1. Government and other stakeholders should make conscious effort in supporting smallholder farmers who are aged to diversify their livelihood.

2. Municipal and District Assemblies should foster innovation and entrepreneurship to promote value chain development, collaboration and support development of new products among smallholder farmers.

3. Municipal and District Assemblies must implement programs that promote land reforms, irrigation infrastructure and water management to improve access to land and water resources by smallholder farmers.

4. Governmental policies and programs should focus on promoting economic development and social protection for smallholder farmers.

Suggestions for Further Research

1. Further studies should be conducted to focus on other community related factors that influence livelihood diversification.

2. Further studies should be conducted using longitudinal study to provide more insight.

3. Further studies should be conducted using mixed methods for purposes of running triangulations of the responses.

4. The data on income of smallholder farmers were based on only word of mouth which could be biased, so more objective data such as annual financial tracking could provide more reliable information about farmers' income.

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APPENDICES

APPENDIX A: Interview schedule for smallholder farmers
UNIVERSITY OF CAPE COAST
DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION

Title: Livelihood diversification and food security of smallholder farmers in Central Tongu District of Ghana

Preamble: Smallholder farmers are a category of farmers who, relying mainly on family labor, cultivate crops on small plots of land as their livelihood for their food security and sustenance. Usually, the primary livelihood activity gets added on to through engagement in subsidiary activities to augment and diversify resources by farmer and his or her family. Livelihood diversification is understood to include processes by which rural families construct a portfolio of different activities and social support capabilities in their efforts to survive, reduce poverty and enhance food security status all towards improving their living standards. Subsidiary activities of smallholder farmers include, sale of food material from their farm, rearing of animals such as pigs, poultry, sheep and goats and occasional hunting. These activities engaged in addition to augmenting live support incomes, increase diversity of incomes with additional advantage of being available when farm produce may not satisfy all needs. Food insecurity is one of the primary developmental challenges in sub-Saharan Africa which is caused by innumerable circumstances in international, national or local aspects of human existence, currently climate change impacts. It is expected that as livelihoods of smallholder farmers are diversified, the more likely their incomes will increase which will help them to overcome challenges to food insecurity.

Goal of study: Goal of this study is to better understand the livelihood diversification and food security of smallholder farmers, what activities are principally involved in the diversification and to bring out recommendations that could help farmers to improve upon their lives.

Confidentiality Statement: Data from respondents would be treated confidentially. Only the study team including, principal investigator, supervisors and the enumerators will have access to the data. Respondent's personal identity will be shielded from any other persons or organizations.

SECTION A: DEMOGRAPHIC AND FARM RELATED CHARACTERISTICS OF SMALLHOLDER FARMERS

Telephone No.---

1. a) Region------------------------ District. ----------------------

   b) Village/Town-------------------------------------

2. Sex of household head: a) Male [   ]   b) Female [   ]

3. Age of household head ---------------- (in years)

4. Marital status of household head. a) Married [   ]   b) Not Married   [   ]

c) Separated [   ] d) Widow   [   ]   e) Widower [   ]

5. Highest educational qualification of household head. Please tick [√]

    a) No formal education[   ]

    b) Primary Education   [   ]

    c) Junior High School (JHS)   [   ]

    d) Senior High School (SHS)   [   ]

    e) GCE 'O' level   [   ]

    f) GCE 'A'' level   [   ]

    g) Tertiary   [   ]

    h) Others (specify) ---

 6. How long have you been working as a farmer? ------------- (in years).

 7. Number of dependents (household size) ----------------

 8. Total size of land under cultivation -------------------- (Acres)

 9. Do you have access road to your farm? a) Yes [   ]   b) No   [   ]

10. Do you save some of your income in a financial institution? a) Yes [   ]

   b) No [   ]

11. If yes, how much of your income do you save? ....

12. Did you have access to credit for the past 2 years? a) Yes [   ]   b) No

   [   ]

13. What is your main source of funding for farm?

   a) Own   [   ]

   b) Friends   [   ]

   c) Money Lenders   [   ]

   d) Financial institutions   [   ]

 14. Have you had access to extension services in the past year? a)Yes [   ]

   b) No   [   ]

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SECTION B: LEVEL OF LIVELIHOOD DIVERSIFICATION AMONG RESPONDENTS

15. How many commodities do you farm?......................................

16. Main farm activity you engage in as a smallholder farmer.

Main farm activity	Income for last year

17. **Subsidiary farm activities** you engage in as a smallholder farmer. (Tick as many as applicable)

Subsidiary farm activity	Tick	Income for last year
Crop farming		
Maize		
Pepper		
Cassava		
Okra		
Groundnut		
Cowpea		
Rice		
Livestock farming		
Pigs		
Poultry		
Sheep & goats		
Cattle		
Rabbits		
Fishing		
Non-traditional farming		
Bee-keeping		
Snail		
Grasscutter		
Mushroom		

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18. **Subsidiary non-farm activities** you engage in as a smallholder farmer. (Tick as many as applicable).

Subsidiary non-farm activity	Tick	Income for last year
Trading		
Weaving		
Sewing		
Commercial driving and riding		
Hunting		
Artisanal work		
Civil Service		

19. Response to the questions in this section is about how livelihood diversification and food security status of households are linked. Please tick [√] where applicable.

a. Do you have large household dependents? 1. Yes [ ]   2. No [ ]

b. If yes, are you able to meet the household basic needs?   1. Yes [ ]   2. No [ ]

c. Do you borrow money to meet basic household needs? 1. Yes [ ]   2. No [ ]

d. Are you engaged in non-farm activities to be able to meet basic household needs?

 1. Yes [ ]   2. No [ ]

e. If yes, how many are you engaged in? 1) 5 [ ] 2) 4[ ] 3) 3[ ] 4) 2 [ ]   5) 1[ ]

f. Does your family have access to land easily for cultivation? 1. Yes [ ]   2. No [ ]

g. Do you and your household experience high food prices? 1. Yes [ ]   2. No [ ]
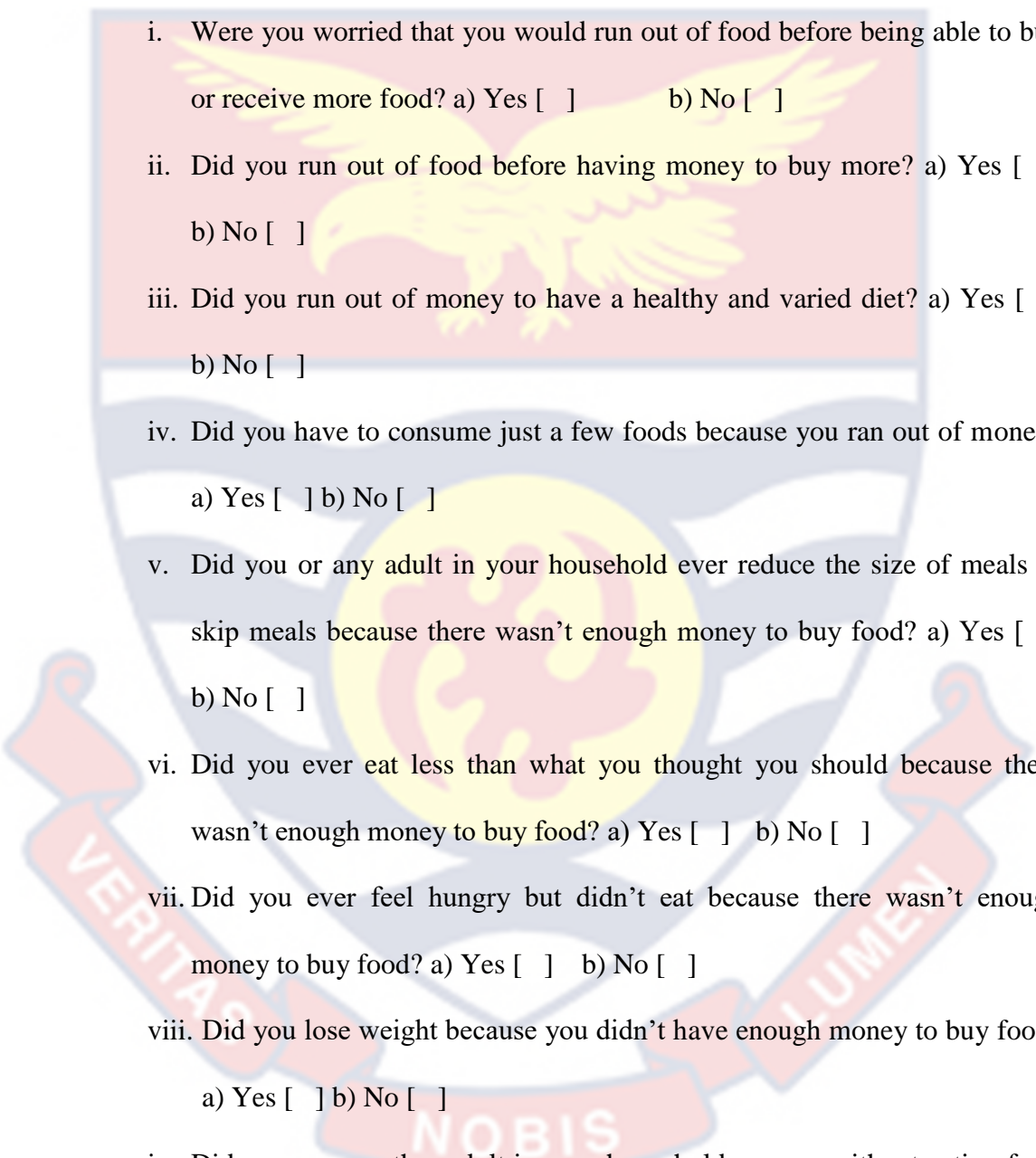
SECTION C: FACTORS THAT INFLUENCE DIVERSIFICATION OF SMALLHOLDER FARMERS

20. Type of household assets. Please tick as many as applicable [√]

Type of asset	Tick
Financial asset	
Bank savings	
Cash	
Susu	
Natural asset	
Access to water	
Access to land	
Human asset	
Education	
Technical know-how	
Good health	
Physical asset	
Access to tractor	
Motor cycle	
Building	
Social Asset	
Member of Farmer Based Organization (FBO)	
Participates in community development programs	

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SECTION D: FOOD SECURITY STATUS OF SMALLHOLDER FARMERS

21. Response to the following questions relate to food security. Tick where applicable.

i.   Were you worried that you would run out of food before being able to buy or receive more food? a) Yes [   ]   b) No [   ]

ii. Did you run out of food before having money to buy more? a) Yes [   ]
     b) No [   ]

iii. Did you run out of money to have a healthy and varied diet? a) Yes [   ]
     b) No [   ]

iv. Did you have to consume just a few foods because you ran out of money?
     a) Yes [   ] b) No [   ]

v.   Did you or any adult in your household ever reduce the size of meals or skip meals because there wasn't enough money to buy food? a) Yes [   ]
     b) No [   ]

vi. Did you ever eat less than what you thought you should because there wasn't enough money to buy food? a) Yes [   ]   b) No [   ]

vii. Did you ever feel hungry but didn't eat because there wasn't enough money to buy food? a) Yes [   ]   b) No [   ]

viii. Did you lose weight because you didn't have enough money to buy food?
     a) Yes [   ] b) No [   ]

ix. Did you or any other adult in your household ever go without eating for a whole day or have just 1 meal in a whole day because there wasn't enough money to buy food? a) Yes [   ]   b) No [   ]

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APPENDIX B: Population by number of households, houses and sex for

selected communities in Central Tongu District

No.	Community	Households	Houses	Sex		
				Male	Female	Total
1	Adidome	1,959	1,162	3,377	4,210	7,587
2	Mafi Kumase	709	375	1,105	1,356	2,461
3	Kpodiwlor	373	318	796	909	1,705
4	Avekpedome	257	252	671	735	1,406
5	Wuti Adzenheta	227	193	593	622	1,215
6	Dove	255	284	533	626	1,159
7	New Bakpa	130	115	562	496	1,058
8	Venu	186	174	494	478	972
9	Mafi Mebiawoe	207	123	403	461	864
10	Mafi Akyemfo	175	151	410	445 445	855
11	Adalekpoe	202	194	410	431	841
12	Mafi Asiekpe	194	141	424	414	838
13	Tsirinyikope	170	140	382	424	806
14	Mafi Kpedzeglo	162	142	398	406	804
15	Bakpa-Agortakpo	171	129	377	417	794
16	Sadekpe	185	120	358	427	785
17	Mafi Tsawla	163	157	352	431	783
18	Mafi Srekpe	158	115	359	413	772
19	Meyikpor	161	111	359	407	766
20	Dekpevie	143	167	356	394	750

Source: GSS (2014)

APPENDIX C: Distribution of study sample

Community	Frequency	Percentage	Cumulative percentage
Avekpedome	18	6.67	6.67
Bakpa Agortakpo	18	6.67	13.34
Dekpevie	18	6.67	20.01
Kpodiwlor	18	6.67	26.68
Mafi Akyemfo	18	6.67	33.35
Mafi Asiekpe	18	6.67	40.02
Mafi Kpedzeglo	18	6.67	46.69
Mafi Kumase	18	6.67	53.36
Mafi Mebiawoe	18	6.67	60.03
Mafi Srekpe	18	6.67	66.70
Mafi Tsawla	18	6.67	73.37
Meyikpor	18	6.67	80.04
New Bakpa	18	6.67	86.71
Venu	18	6.67	93.38
Wuti Adzenheta	18	6.67	100.0
Grand Total	270	100.0	

Source: Field survey (2022)

APPENDIX D: Systematic sampling interval of selected communities in

Central Tongu District

Community	Number of houses	Formula for calculating sampling interval = Population size (number of houses) divided by sample size	Approximate sampling interval
Mafi Kumase	375	375÷18=20.8	21
Kpodiwlor	318	318÷18=17.7	18
Avekpedome	252	252÷18=14.0	14
Wuti Adzenheta	193	193÷18=10.7	11
Venu	174	174÷18=9.7	10
Dekpevie	167	167÷18=9.3	9
Mafi Tsawla	157	157÷18=8.7	9
Mafi Akyemfo	151	151÷18=8.4	8
Mafi Kpedzeglo	142	142÷18=7.9	8
Mafi Asiekpe	141	141÷18=7.8	8
Bakpa-Agortakpo	129	129÷18=7.2	7
Mafi Mebiawoe	123	123÷18=6.8	7
New Bakpa	115	115÷18=6.4	6
Mafi Srekpe	115	115÷18=6.4	6
Meyikpor	111	111÷18=6.2	6

Source: Field survey (2022)

APPENDIX E: Cronbach alpha values with corresponding internal

consistency

Cronbach's Alpha Coefficient (α)	Internal Consistency
$\alpha \geq 0.90$	Excellent
$0.80 \leq \alpha < 0.90$	Good
$0.70 \leq \alpha < 0.80$	Acceptable
$0.60 \leq \alpha < 0.70$	Questionable
$0.50 \leq \alpha < 0.60$	Poor
$\alpha < 0.50$	Unacceptable

Source: George & Mallery (2003)
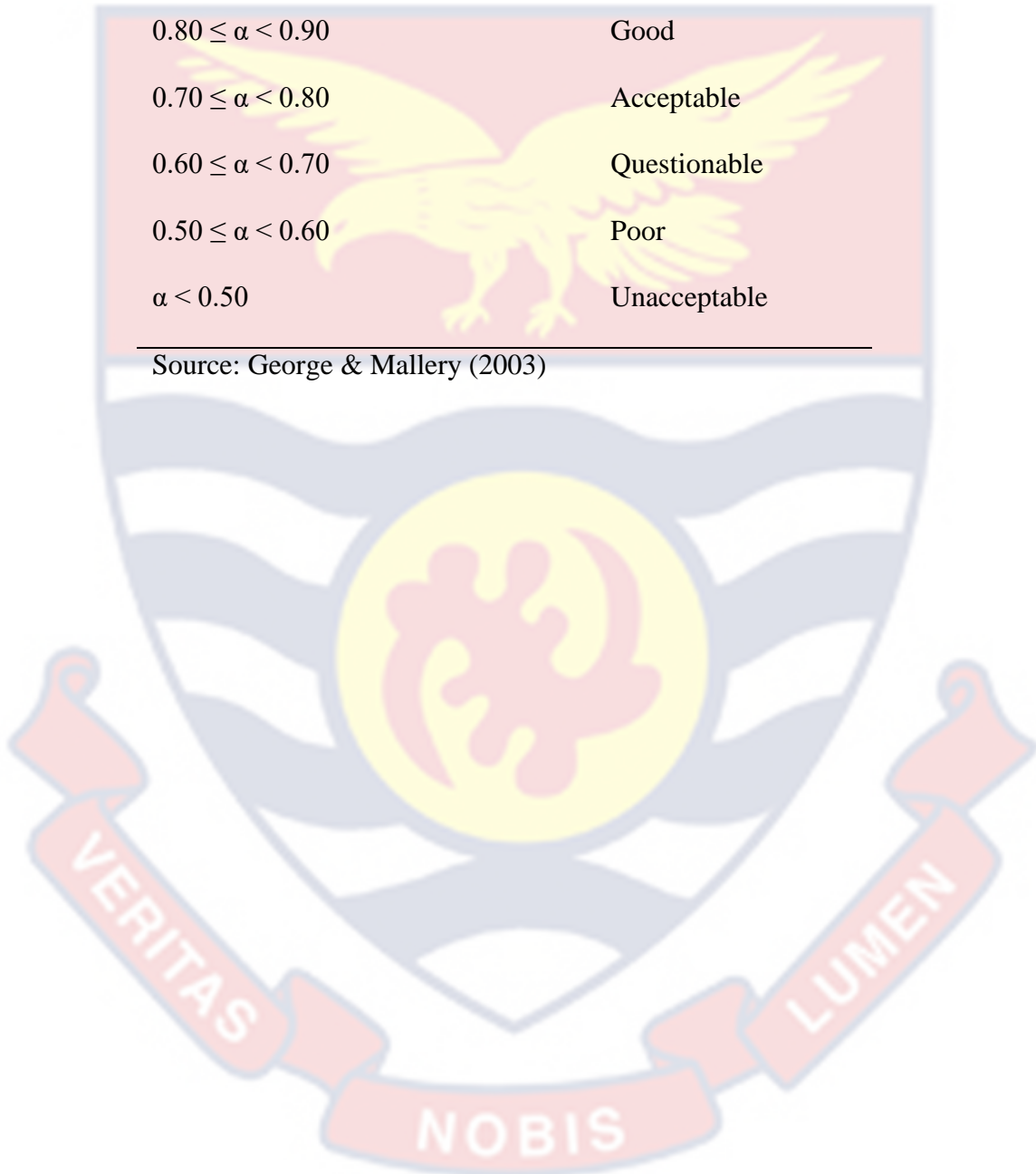
APPENDIX F: A Copy of Ethical Clearance

UNIVERSITY OF CAPE COAST

INSTITUTIONAL REVIEW BOARD SECRETARIAT

TEL: 0558093143 / 0508878309
E-MAIL: irb@ucc.edu.gh
OUR REF: UCC/IRB/A/2016/1290
YOUR REF:
OMB NO: 0990-0279
IORG #: IORG0009096

28TH MARCH, 2022

Mr. Clifford Kpakpo Acquaye
Department of Agricultural Economics and Extension
University of Cape Coast

Dear Mr. Acquaye,

ETHICAL CLEARANCE – ID (UCCIRB/CANS/2021/36)

The University of Cape Coast Institutional Review Board (UCCIRB) has granted Provisional Approval for the implementation of your research **Effect of Livelihood Diversification on Food Security of Smallholder Farmers in Central Tongu District of Ghana.** This approval is valid from 28th March, 2022 to 27th March, 2023. You may apply for a renewal subject to submission of all the required documents that will be prescribed by the UCCIRB.

Please note that any modification to the project must be submitted to the UCCIRB for review and approval before its implementation. You are required to submit periodic review of the protocol to the Board and a final full review to the UCCIRB on completion of the research. The UCCIRB may observe or cause to be observed procedures and records of the research during and after implementation.

You are also required to report all serious adverse events related to this study to the UCCIRB within seven days verbally and fourteen days in writing.

Always quote the protocol identification number in all future correspondence with us in relation to this protocol.

Yours faithfully,

Samuel Asiedu Owusu, PhD
UCCIRB Administrator

ADMINISTRATOR
INSTITUTIONAL REVIEW BOARD
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