

**ANALYSIS OF LIVELIHOOD STRATEGIES OF FARM HOUSEHOLDS IN
SOUTHERN BENIN**

BY

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**A THESIS SUBMITTED TO THE DEPARTMENT OF AGRICULTURAL
ECONOMICS AND AGRIBUSINESS, UNIVERSITY OF GHANA, LEGON, IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE
MASTER OF PHILOSOPHY DEGREE IN AGRICULTURAL ECONOMICS**



DEPARTMENT OF AGRICULTURAL ECONOMICS & AGRIBUSINESS

COLLEGE OF BASIC AND APPLIED SCIENCES

UNIVERSITY OF GHANA, LEGON

July, 2015

DECLARATION

I, Ulysse Israel Wininsou Azannai, the author of this thesis titled **“ANALYSIS OF LIVELIHOOD STRATEGIES OF FARM HOUSEHOLDS IN SOUTHERN BENIN”**, hereby declare that, this work except for past and present literature which have been duly cited was done entirely by me at the Department of Agricultural Economics and Agribusiness, University of Ghana, Legon from August 2014 to June 2015.

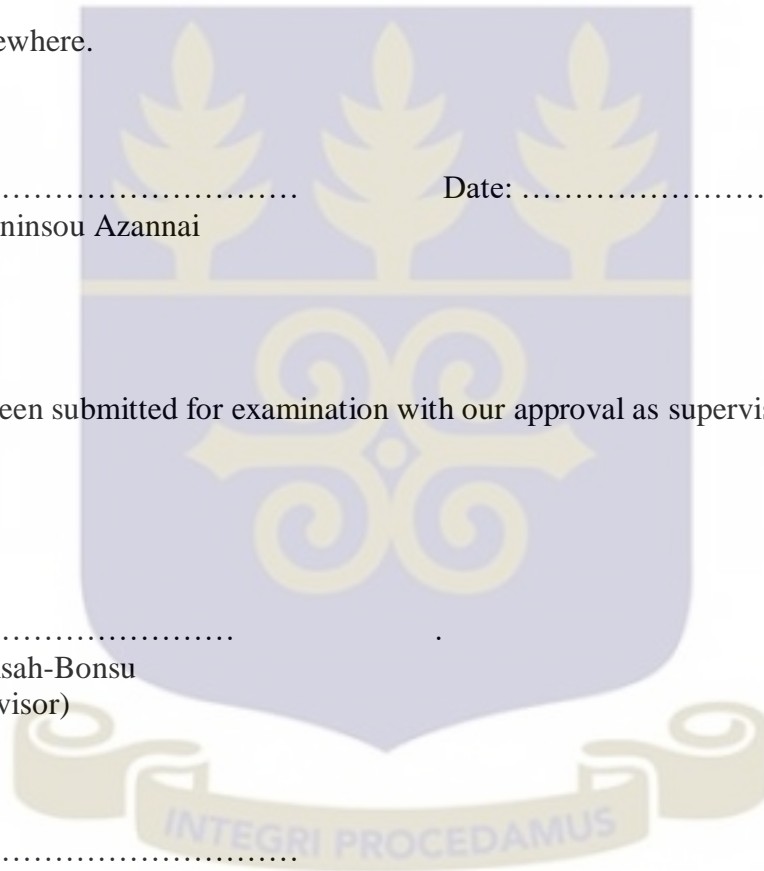
This work has never been presented either in whole or in part for any other degree of this university or elsewhere.

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This thesis has been submitted for examination with our approval as supervisors:

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DEDICATION

This work is dedicated to my family for their unflinching support, love and input in my education.



ACKNOWLEDGEMENTS

Glory and adoration be to the Almighty God for His abundant love, grace and mercies throughout my academic life and particularly in the preparation of this thesis.

I would also like to take this opportunity to express my deepest appreciation and gratitude to Dr. Akwasi Mensah Bonsu and Prof Daniel Bruce Sarpong for their tremendous tutelage, constructive criticisms, suggestions and corrections throughout the preparation of this study. My sincere thanks also goes to all lecturers of the department.

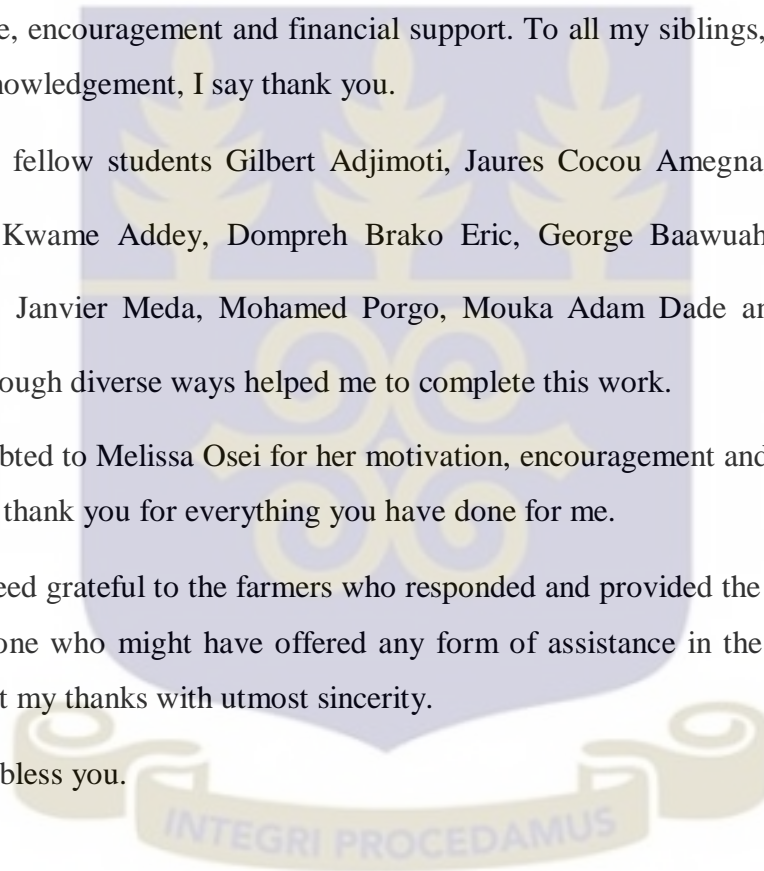
My sincere gratitude goes to my Father Candide Azannai and my Mother Christine Dossou for their love, advice, encouragement and financial support. To all my siblings, for their wonderful prayers and acknowledgement, I say thank you.

I also thank my fellow students Gilbert Adjimoti, Jaures Cocou Amegnaglo, Makafui Ofori, Danley Aidoo, Kwame Addey, Dompreeh Brako Eric, George Baawuah, Mathieu Ayenan, Armel Nonvide, Janvier Meda, Mohamed Porgo, Mouka Adam Dade and the entire MPhil students who through diverse ways helped me to complete this work.

I am highly indebted to Melissa Osei for her motivation, encouragement and support throughout this study. I say thank you for everything you have done for me.

Finally I am indeed grateful to the farmers who responded and provided the needed data for this work and everyone who might have offered any form of assistance in the accomplishment of this study, accept my thanks with utmost sincerity.

May God richly bless you.



ABSTRACT

Gaining insight into the livelihood strategies adopted by farmers is crucial for the success of interventions aiming at improving livelihood in rural areas. This study assessed the livelihood strategies adopted by farm households in southern Benin. The study was carried out in Allada and Bonou, districts located in the southern region of Benin which was purposively selected for their noticeable agrarian and economic activities. A total of 160 farm households were randomly sampled and data was collected through interview with a structured questionnaire. The two-sample t-test was used to compare sources of household income in terms of the livelihood strategies adopted by farmers. The multinomial logit model was applied to investigate the factors influencing the households' choice of livelihood strategies. The Livelihood Vulnerability Index (LVI) was used to estimate the vulnerability level in Allada and Bonou districts. The results revealed that in southern Benin, farming activities produce increasingly higher share of household income. Household age, gender of household, total farm size, membership in cooperative organization, marital status, the use of improved varieties and participation in social leadership were the determinants that significantly influence the adoption of alternative livelihood strategies. The LVI in the southern region was (0.31) with a very critical social network component (0.48). This implied that farm households in southern Benin were less vulnerable but vulnerable with respect to the social network component. Due to the fact that farm households in southern Benin mainly derived their income sources from farming activities, and were also vulnerable with respect to the social network component. The study recommends that livelihood interventions protection and promotion should be considered by all actors; national and international government, NGOs and local institutions.

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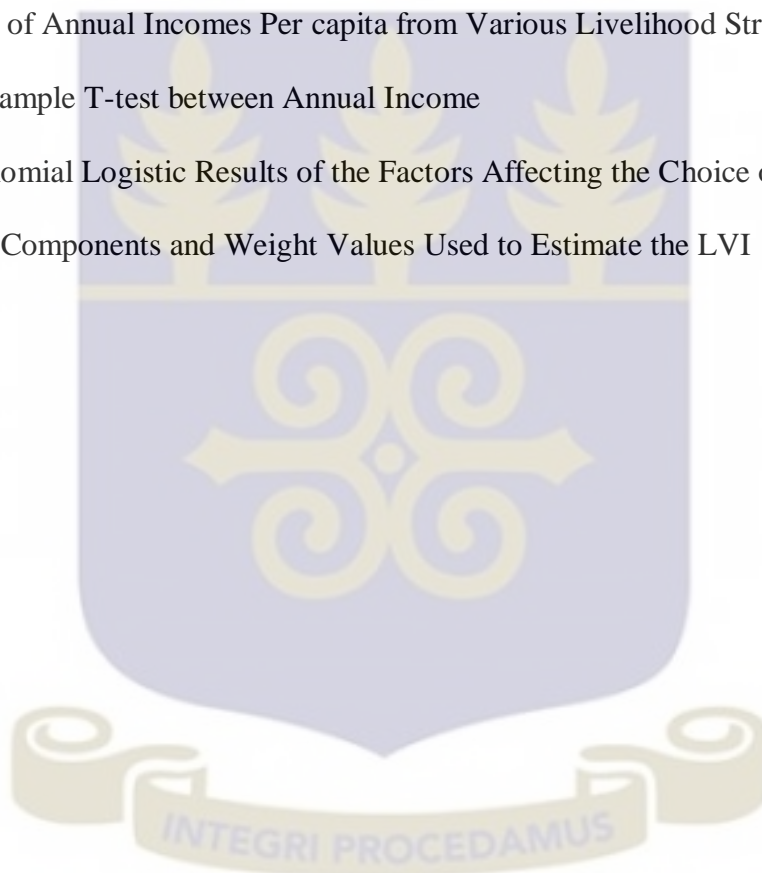
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LIST OF ABBREVIATIONS

AFDB	African Development Bank
FBO	Farmer Based Organization
GDP	Gross Domestic Product
GOB	Government of Benin
IAHS	Income of Agricultural Households Sector
IFAD	International Funds for Agricultural Development
ILO	International Labour Organization
INSAE	Institut national de Statistiques Appliquées (National Institute of Statistics and Economic Analysis)
Km	Kilometer
LVI	Livelihood Vulnerability Index
MNL	Multinomial Logit
NGO	Non-Governmental Organization
OECD	Organization for Economic Cooperation and Development
RGPH	Recensement General de la Population et de l'Habitat (General Census of Population and Housing)
SDP	Socio-Demographic Profile
SL	Sustainable Livelihood
SLA	Sustainable Livelihood Approach
SLF	Sustainable Livelihood Framework
Sq.Km	Square Kilometer
SSA	Sub Saharan Africa

CHAPTER ONE

INTRODUCTION

1.1 Background

According to the World Development Report (2008), agriculture is the predominant activity for most rural households in Sub-Saharan Africa (SSA), and it offers a strong option for spurring growth, overcoming poverty, and enhancing food security as stressed. This sector in SSA is mainly characterized by smallholder farms and contributes about 29% to Gross Domestic Product (GDP) and employs up to 65% of the labour force (World Bank, 2007).

Agriculture contributes about 35 percent of Benin's GDP and 80 percent of export income. African Development Bank (AfDB) and Organization for Economic Cooperation and Development (OECD) in 2008 also backed the fact that agriculture is the main driver of growth in Benin. The country has huge potential in terms of farmland that is well suited to the needs of diversified agriculture.

In Benin, cotton is the main agricultural product that brings revenue to the state. It contributes about 40% of the country's GDP. According to Alia (2014), its importance increased consistently from the 1980s into the 2000s. In 2010, more than 237,500 agricultural households were directly involved in cotton production, with almost 1 million direct agricultural jobs and over 2.5 million people indirectly dependent on cotton revenue (2014). Other export and foreign exchange generating commodities apart from cotton are cashews, shea butter, textiles, palm products and seafood with major export partners being China, Indonesia, India, Netherlands, Niger, Togo and Nigeria.

AfDB and OECD (2008) further indicated that while the Government of Benin (GoB) aims to diversify its agricultural production, the country remains underdeveloped and its economy is

underpinned by subsistence agriculture. About 93% of total agricultural production goes into food production. The proportion of the population who are considered poor is about 35.2%, with more rural households in poverty (38.4%) than urban households (29.8%). Rural Farm households play an important role in Benin agricultural sector. It has been estimated that 36% of households depend solely upon only crop production for income, and another 30% depend on crop production, livestock rearing and fishing for income (Vodounou, 2008).

According to Gecho *et al.* (2014), it is increasingly becoming clear that the agricultural sector alone cannot be relied upon as the core activity for rural households as a means of improving livelihood and reducing poverty. Reardon (1997), it is unusual for the rural people in Africa to specialize in livestock, crop or fish production to the total exclusion of other income generating activities. A majority of rural producers have historically diversified their productive activities to encompass a range of other productive areas. Motivations for such diversifications are linked with the availability of wide range of alternative activities. However these are associated with both positive and negative outcomes (Hussein and Nelson, 1996). Adugna *et al.* (2008) indicated that livelihood alternatives are at the center of development, however very little attention has been given to it. Various literatures have outlined a wide range of alternative livelihood strategies. Gecho *et al.* (2014) listed seasonal migration, handicraft production, trading and processing of agricultural produce and provision of agricultural services among others, as alternative livelihood strategies.

The present study examines the different livelihood strategies used by farm households in southern Benin to improve their income and reduce their vulnerability level.

1.2 Problem Statement

Recent studies in Sub-Saharan Africa (SSA) indicate that rural households are increasingly diversifying their income sources by combining farm and non-farm activities to sustain their livelihoods (Losch *et al.*, 2011; Ellis, 2005; De Janvry *et al.*, 2002; Barrett *et al.*, 2001). That asset, activity and income diversification characterize the livelihood strategies of rural households in rural Africa (Barrett, Reardon and Webb, 2001). Incomes from non-farm sources have grown in importance and account for between 35–50% of rural household incomes in SSA (Haggblade *et al.*, 2010; Reardon, 1997).

In Benin, while recognizing the urgent need to maintain a robust agricultural sector, it is increasingly becoming clear that agricultural sector alone cannot be relied upon as core activity for rural households as a means of improving livelihood and reducing poverty. One phenomenon that is gaining prominence in the rural development literature is the promotion and support for nonfarm diversification opportunities (Stifel, 2010). Non-farm economic activities including seasonal migration off the farm to engage in wage employment, handicraft production, trading and processing of agricultural products, provision of agricultural services, etc. Such non-farm activities provide a way of off-setting the diverse form of risks and uncertainties (relating to climate, finance, markets, etc) associated with agriculture and creates a way of smoothing income over years and seasons. The relative importance of non-farm activities in rural areas is well documented in Reardon (1997), Reardon *et al.* (2001) and Barrett *et al.* (2001).

The economic importance of (non-farm) activities in Benin is not well documented, leading to lack of understanding of their relevance within the livelihood strategies of rural communities. Rural livelihoods are linked to socio-economic characteristics of households, e.g. household wealth, household composition (e.g. share of women) and percentage of adults with formal

education as well as external factors like access to forest, markets and infrastructure, amongst other (Timko *et al.*, 2010).

Distilling from the above, there is the need to assess the specific livelihood strategies of farm households in Southern Benin. This will inform policy towards implementing appropriate policies to raise the living standards of farm households in Southern Benin. The present study throws light on that issue, through the following questions:

1. What are the sources of household income in terms of livelihood strategies adopted by farm households?
2. What are the determinants of the choice of alternative livelihood strategies?
3. What is the vulnerability level of Farm households in Southern Benin?

1.3 Objectives of the Study

The main objective of the study is to analyse the livelihood strategies adopted by Benin farm households in the southern Region to improve household income. Specially, the study aims to:

1. Identify farm households' income sources in terms of livelihood strategies adopted in southern Benin
2. Estimate the determinants of the choice of alternative livelihood strategies and
3. Estimate the vulnerability levels of the farm households.

1.4 Relevance of the Study

In rural communities livelihood diversification through non-farm activities and other sources of income are very important for poverty reduction. This study helps to understand the livelihood diversification strategies that are suitable for rural farmers.

By assessing the determinants affecting the choice of alternative livelihood strategies and the vulnerability level of farm households in southern Benin, the findings of the study is expected to facilitate the provision of public goods by the state. This support will increase the avenues from which farmers collect their incomes. Moreover, the study would serve as a tool kit for development agencies and other stakeholders. It would also provide policy makers with information on suitable sustainable livelihood strategies that could be used to address the problem of income diversification in rural areas. Consequently the research findings would contribute to literature related to livelihood strategies.

1.5 Organization of the Study

This thesis is organized into five chapters. The first chapter is the introductory chapter which introduces the subject matter of the present study. The second chapter presents a review of literature relevant for the study. The third chapter presents the research methodology which is adopted for the study, touching on issues such as data description and definition, and model specifications. The fourth chapter presents the results and discussion of the study. The research is concluded in chapter five, with a summary of major findings, policy implications of results, and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter is organized under these main themes. Section 2.2 discusses the concept of livelihood. Section 2.3 emphasizes on the concepts of farm households, food security and poverty reduction. Section 2.4 gives an idea of the relationship between livelihood and income diversification. Section 2.5 helps to know the approaches to conceptualize livelihood diversification. Section 2.6 discusses the alternative livelihood strategies adopted by farmers. Section 2.7 highlights on the determinants of the choice of alternative livelihood strategies. Section 2.8 emphasizes on the livelihood vulnerability index.

2.2 Understanding the Concept of Livelihood

Understanding the concept of livelihood is a key feature to find out the various livelihood strategies, reasons why farmers adopt specific livelihood strategies and the outcomes of adopting specific livelihood strategies.

A livelihood consists of capabilities, assets (including material and social resources and sometimes even spiritual) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks to maintain or enhance its capabilities and assets, while not undermining the natural resource base (Tao *et al.*, 2009). Assets commonly used by the poor include financial income, access to credit, human health, education and other skills, natural, physical housing, livestock, economic and social infrastructure, social support mechanism, information base and other assets (Meikle *et al.*, 2001). Thinking in terms of assets and livelihoods suggests that there are multiple paths out of poverty (Ellis, 2000). Anti-poverty measures should then place emphasis on building the asset base of the poor to shift average income (Nega *et al.*, 2010).

2.3 Farm Households, Food security and Poverty

The main objective of food security is to enable the individual obtain adequate food needed at all times and be able to utilize the food to meet the needs of the body. Asanso-Okyere et al., 1997, in the analysis of food security issues at the individual level, the households are considered because decisions about production and consumption are taken at this level. These households level decisions are usually taken by farm households since a higher percentage of the active population are involved in agriculture in West Africa.

Poverty and food insecurity are closely related. These concepts are therefore high on the agenda of rural development issues (Oni *et al.*, 2011). According to Dixon *et al.*, (2001), the poor living in rural communities are dependent on agriculture for their livelihood. Schwarze and Zeller (2005), found poverty index to have a positive influence on the income share derived from outside the agricultural sector, making the better off households diversify more out of agriculture. Moreover, Lanjouw (2001), found out that rural farm households in El Salvador to be associated with acute poverty than their urban counterparts. It is therefore obvious that farm households continue to find means to exit poverty and food insecurity concerns especially through non-farm income generating activities and cash crop production (Lanjouw and Feder, 2001 and Knudsen and Tidsskrift, 2007)

2.4 Livelihood Strategies and Income Diversification

According to Barrett and Reardon (2000), there are four ways of classifying the alternative livelihood strategies adopted by farmers. The classification is as follows:

Farm or agricultural sources refer to all activities in the agriculture sector, regardless of location or functional classifications.

Non-farm or Non- agricultural sources refer to all activities outside the agricultural sector, regardless of location or function.

On-farm or at home sources refer to all activities on one's own property, regardless of sectoral or functional classification; almost always self-employment.

Off-farm or away from home sources refer to all activities away from one's own property, regardless of sectoral or functional classification. This could be wage or self-employment sources (Barrett *et al.*, 2001, Reardon *et al.*, 2001).

In developing countries, livelihoods are basically based on agricultural or small-scale entrepreneurial activities: Self-employed petty trades, which offer income on the subsistence level. Besides the farm household is exposed to strong production risks and economic constraints hence, the farm household reacts to these challenges by choosing varied adaptation- and coping strategies in order to smoothen income and consumption (Giesbert, 2007, Barrett *et al.*, 2001)

Rural livelihoods and diversification concepts are major issues of concern to the rural development literature on farm households which link assets, activities and income as well as the role of institutions in determining the use of and return to assets (Ellis, 2000). Therefore, to fully study the income diversification concept, is to look at it from asset, activity or the income view point.

2.5 Approaches to the Conceptualisation of the Study of Livelihood Strategies

The approaches used to conceptualize the study of livelihood strategies are discussed. These are asset, activity, and the income approaches.

2.5.1 Assets Approach

Assets basically refer to what a farm household owns in the form land, capital, and machinery among others which could either appreciate or depreciate overtime. They could be productive (human capital, land) or unproductive: household luxuries not used in income generation (Barett *et al.*, 2001). Some disadvantages accrue to the usage of the assets approach in assessing the diversification strategies pursued by farm households.

Thus not all assets could be put across productivities and moreover, calculating the true value of some assets is difficult due to insufficient development of asset markets in most developing countries or rural economies like in the case of Benin where the situation of market failures is persistent (Reardon *et al.*, 1998 and Barrett *et al.*, 2001).

2.5.2 Activity Approach

The activity approach takes into consideration the means to which productive assets are put. For example, land as an asset could be put into crop production or pasture for grazing animals; similarly, a taxi cab can be put into hiring and renting services as an activity. The usage of this approach is also associated with some deficiencies. According to Barrett and Reardon (2000), the activity to which assets are employed, are difficult to value and the results of unearned income sources could easily be completely ignored which may result in inability of unearthing the relationship between the choice of alternative livelihood strategies and poverty reduction.

2.5.3 Income Approach

The income approach avoids the difficulties associated with the asset and activity approaches. Therefore the income approach come relatively best among the three and has been used in several studies on livelihood strategies (Abdulai and CroleRees, 2001; Zvyagintsev *et al.*, 2007; Babatunde and Qaim, 2009; Idowu *et al.*, 2011). Thus, the income approach is widely used since the primary intent of diversification to a major extent is maximization of income and/or stabilization of income (Ellis 2000, Barrett *et al.*, 2001). Moreover, income is the outcome of any activity or venture of farm households of which assets are employed. There, it is easier to convert in-kind payments into monetary value due to higher development of goods market compared with asset market (Barrett *et al.*, 2001). Thus, income is closely related to the concept of absolute poverty as it is more or less used to define the poverty line and measure household wealth (Arimah, 2004 and Rhoe *et al.*, 2008).

2.6 Determinants in the Choice of a Livelihood Strategy

With the multinomial logit regression of household characteristics on three slightly broader classifications of livelihood strategy choice (low, medium and high return) Brown *et al.*, (2006) highlighted key household attributes-geographic location, family size, farming experience, access to credit and remittances-that statistically differentiate households pursuing low, medium and high return livelihood strategies. He specifically identified the agro-ecological location, household size (numbers) farm size (acres), Total Livestock Units (TLU), age of household head (years), Household head's experience in farming (years), Access to credit, remittances received and education level of household head.

Ellis (2000) enumerated six determinants of household income diversification, which include seasonality, risk, labor markets, credit markets, asset strategies, and coping strategies. The study concluded that under the precarious conditions that characterize rural survival in many low-

income countries, diversification has positive attributes for livelihood security that outweigh negative connotations it may possess. Policy should facilitate rather than inhibit diversity because diversified rural livelihoods are less vulnerable than undiversified ones.

Eneyew *et al.*, (2001) by employing the Multinomial Logistic Regression identified gender, educational level and age of household head, family size, agro ecology, land size owned, frequency of extension contacts, credit, dependency ratio, inputs used, membership of cooperatives and remittances as determining factors that influence the decision of a rural household to adopt non-farm activities, farming activities, off-farm activities and the set of combinations. Gender was found to affect diversification options, including the choice of income-generating activities (both farm and non-farm) due to culturally defined roles, social mobility imitations and differential ownership of / access to assets. The study further indicated that farmers participate in non-farm activities at a decreasing rate as they age. The study further stated that family size was found to have positive and significant relations to diversification of livelihood strategies into the combination farming, off-farm and non-farm. Remittance refers to money sent from inside and outside the country. The likelihood of a household receiving remittance increases choice of diversification into off farm and nonfarm activities.

According to Wanyama *et al.*, (2010), a farm household is likely to hold at least one or more livelihood strategies depending on socio-economic, business and biophysical characteristics environment.

They further elaborated that livelihood diversification can be explained in household consumer behaviour as the decision to be engaged in a given livelihood alternative strategy, which is influenced by a number of factors (Barrett *et al.*, 2000). Livelihood choice can be modelled within frameworks that explain individual choice behaviour (Reardon *et al.*, 2006).

Wanyama *et al.*, (2010) again showed that, the decision to choose a given livelihood strategy to supplement farm income is a behavioural response arising from a set of alternatives and constraints facing the farmer.

In the present study, the number of options for household alternative livelihood strategies necessitates for the use of a discrete choice theory in analyzing the livelihood strategies in farm households. Indicatively, the choice of a strategy stems from the probability that the utility gained from selecting an option is subjectively higher than that from all the options that are not selected. In that respect, the determinants of the livelihood strategy selected can be gained by the use of the multinomial logit model, which is generally used in econometrics to explain the choice of an alternative among a set of exclusive alternatives, which exceeds two. This model is based on the random utility theory.

Multinomial Logit Specification

Let A_i be the random variable representing adoption decision choosing by an individual, the study assumed that each individual faces a set of discrete, mutually exclusive choices. These measures are assumed to depend on a number of adoption attributes, demographic characteristics and other factors X. According to Greene (2003), the multinomial logit model for adaptation choice specifies the relationship between the probability of choosing option A_i and the set of independent variables X.

The model is specified as follows;

$$Prob(A_i = j) = \exp(x\beta_j) / \left[1 + \sum_{k=1}^J (\exp x\beta_k) + \varepsilon, j = 0,1,\dots,J \right] \dots\dots\dots 1$$

Where β_j is a vector of coefficients on each of the explanatory variables X. Equation (1) can be normalized to remove indeterminacy in the model by assuming that $\beta_0 = 0$ and the probabilities can be estimated as;

$$\text{Prob}(A_i = j / x_i = \frac{e^{\beta_j x_i}}{1 + \sum_{k=1}^J e^{\beta_k x_i}}, j = 0, 2, \dots, J, \beta_0 = 0 \dots \dots \dots 2$$

Estimating equation (2) produces the J log-odds ratios

$$\text{Ln}\left(\frac{P_{ij}}{P_{ik}}\right) = x_i'(\beta_j - \beta_k) = x_i' \beta_j, \text{ if } k = 0 \dots \dots \dots 3$$

The dependent variable is therefore the log of one alternative relative to the base alternative.

The MNL parameters are difficult to interpret, and associating the β_j with the *j*th outcome is misleading. Therefore to interpret the effects of independent variables on the probabilities, marginal effects are usually derived (Greene, 2003). The marginal effect is specified as follows;

$$\delta_j = \frac{\partial P_j}{\partial x_i} = P_j \left[\beta_j - \sum_{k=0}^J P_k \beta_k \right] = P_j (\beta_j - \bar{\beta}) \dots \dots \dots 4$$

The marginal effects measure the expected change in probability of particular choice being made with respect to a unit change in an independent variable (Greene, 2000).

2.7 Estimation of Livelihood Vulnerability

Livelihood Vulnerability Co-ordinates

Hahn *et al.*, (2009) enumerated three contributing factors to vulnerability of a household as;

1. Exposure the extent to which a household encounters natural disaster and climate variability.
2. Sensitivity to the exposure-this deals with the severity as a result of the exposure in relation to its Health, Food and Water access and capacity
3. Coping or adaptive strategies or capacity-the ability of the household to regain sustainable live afterwards by virtue of its Socio-Demographic, Livelihood Strategies, and Social Networks.

Livelihood Vulnerability Assessment

Vulnerability assessment describes a diverse set of methods used to systematically integrate and examine interactions between humans and their physical and social surroundings. Through the use of the Livelihood vulnerability framework, Sallu *et al.*, (2010) was able to frame discussions about vulnerability and resilience as a means of identifying broader vulnerability insights.

A common trend is an attempt to quantify multidimensional issues using indicators as proxies. These are often combined into a composite index allowing diverse variables to be integrated. The Livelihood Vulnerability Index is an approach used to design development programs at the community level and the proven useful to assess the ability of households to withstand shocks such as natural disasters, epidemics or civil conflicts. It uses multiple indicators to assess exposure to natural disasters and climate variability, social and economic characteristics of household that affect their adaptive capacity and current health, food and water resource characteristics that determine their sensitivity to climate change impacts (Hahn *et al.*, 2008).

Uses of the Livelihood Vulnerability Index

1. The LVI is designed to provide development organizations, policy makers and public health practitioners with a practical tool to understand demographic, social and health factors contributing to vulnerability at the district or community level.
2. It helps development planners to refine and focus their analysis to suit the needs of each geographic area.

Approaches to measure Livelihood Vulnerability Index

Hahn *et al.*, (2009) indicated three main approaches to measuring the Livelihood Vulnerability index and these include the composite approach, the aggregate approach and sector approach.

The Composite Approach- This expresses the Livelihood Vulnerability Index (LVI) as a composite index comprising seven major components namely Socio-demographic profile, Livelihood strategies, Social Network, Health Food, Water and Natural Disaster and Climate variability (respectively, denoted as SDP, LS, SN, H, F, W and NDCV). This approach uses the balanced weighted approach where each sub-components adds up to the total score. It uses the simple approach of applying equal weights to all major components.

The Aggregate Approach – This aggregate the seven major components as mentioned above into three defined co-ordinates to vulnerability by the Intergovernmental Panel on Climate Change (IPCC) which are exposure sensitivity and adaptive capacity.

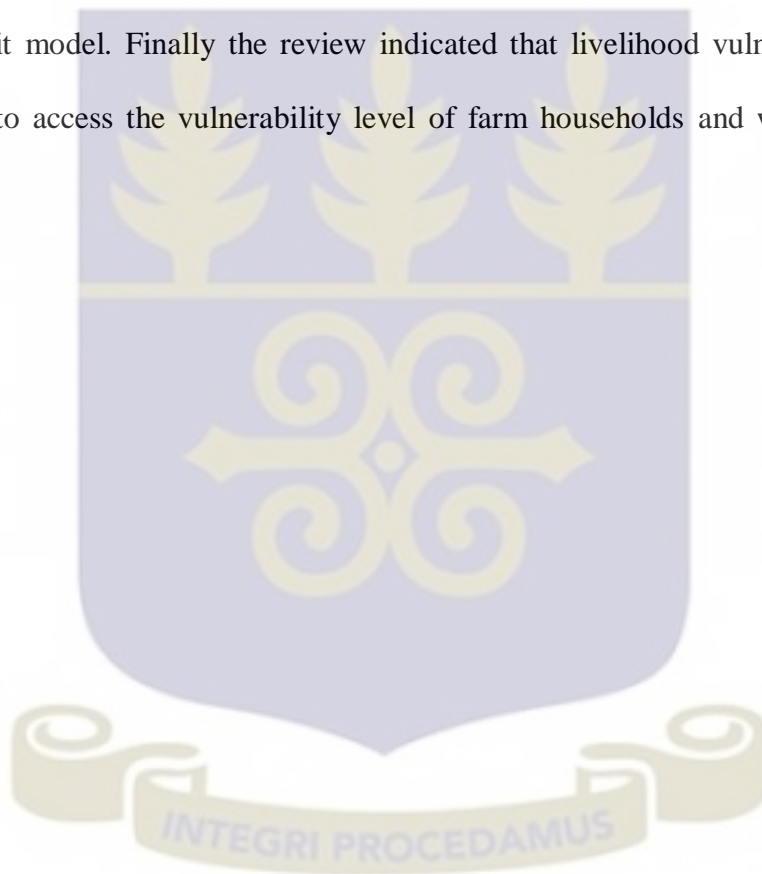
Sectorial Vulnerability Approach – This segregates the sectors of the economy to identify potential areas for intervention.

Hahn *et al.*, (2008) further indicated the approaches differ from previous methods in that,

1. It uses primary data from household surveys to construct the index. By using the primary data, the approach helps avoid the pitfalls associated with using secondary data.
2. It presents a framework for grouping and aggregating indicators on the district level, which can be critical for development and adaptation planning.
3. It also focuses on quantifying the strength of current livelihood and health system as well as the capacity of communities to alter these strategies in response to vulnerability shocks.
4. The weighting scheme especially with the composite approach gives room for adjustment by future users.

2.8 Conclusion

From the review of literature, the livelihood strategies that are mostly adopted by farm households are farming, non-farm, off-farm and on-farm activities. The determinants influencing the choice of alternative livelihood strategies by farm-households are several such as household age, total household size, gender, membership in a cooperative and access to credit among others. The review of literature has also provided basis for analyzing the determinants affecting the choice of alternative livelihood strategies by farmers using the multinomial logit model. Finally the review indicated that livelihood vulnerability index is a main tool used to access the vulnerability level of farm households and was adopted for the present study.



CHAPTER THREE

METHODOLOGY

3.1 Introduction

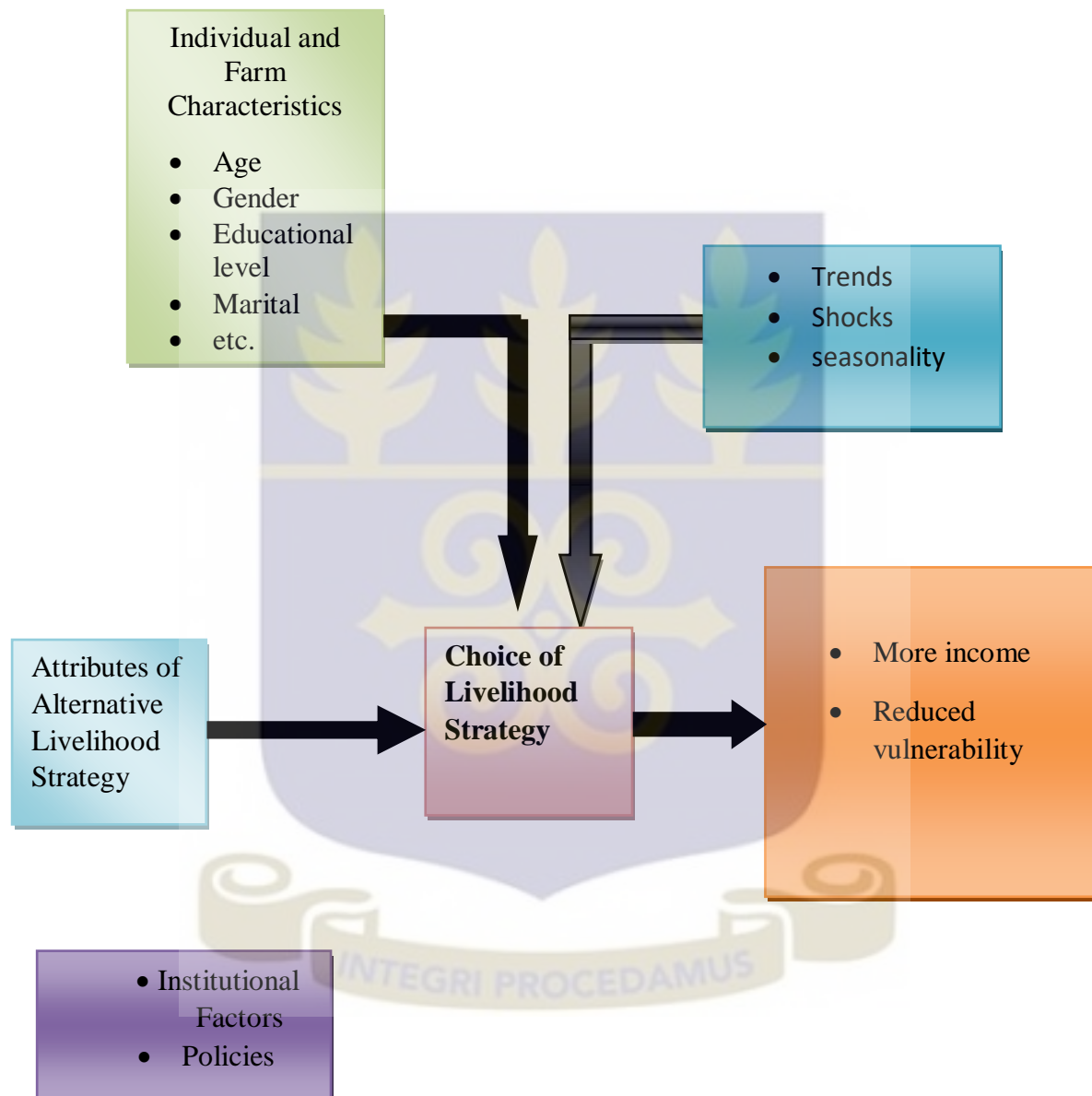
This chapter is divided into five sections. Section 3.2 explains the conceptual framework of the study. Section 3.3 describes the method of analysis. Section 3.4 provides the data collection and analysis whereas section 3.5 describes the study area.

3.2 Conceptual Framework

The conceptual framework for this study as shown in Figure 3.1, is adapted with critical emphasis on the livelihoods framework which was used by Alobo (2012). In the framework developed by Alobo (2012) as referred from IFAD (2009), assets activities, and their access, are altogether required for a means of living by an individual or a household to construct a livelihood.

The framework shows how, in different contexts, sustainable livelihoods are achieved through access to a range of livelihood assets which are combined in the pursuit of different livelihood strategies to achieve certain livelihood outcomes such as increased incomes (Alinovi *et al.*, 2010). Households can access a range of assets or resources (physical, natural, economic, human and social capital) which they can use to engage in farm or non-farm activities or both (Scoones, 1998). The decision of rural households to participate in non-farm activities is influenced by individual or household specific factors, as well as other social, economic and environmental factors (Barrett *et al.*, 2001; Barrett, Reardon and Webb, 2001; Escobal, 2001; Lay *et al.*, 2008; Idowu *et al.*, 2011). Various social relations, institutions, organizations, policies, as well as trends, shocks and seasonality modify access to and ability to convert livelihood assets into livelihood outcomes (Vedeld *et al.*, 2012).

Figure 3.1: Conceptual Framework for the Choice of Livelihood Strategy by Farm Households in Southern Benin



Source: Author's own construct

Figure 3.1 shows how, the combination of farm characteristics, the attributes of alternative Livelihood strategy, the trends , shocks , and institutional factors, can affect the choice of the

livelihood strategy to produce important and essential outcomes needed to in a rural communities like the southern region of Benin.

The livelihood framework provides a comprehensive but complex, approach to understand the way people especially the poor live by employing the various resource endowments at their disposal (IFAD, 2009). It also emphasizes understanding of the context within rural lives take place, the assets available, the various livelihood strategies chosen and respective intended or expected outcomes. The issue for attention then should be on what resources are available and accessible, what kind of activities are developed with these resources to produce a desired outcome. In any livelihood analysis, the major components defined in the framework include the vulnerability context, Assets, Policies-Institutions-livelihood Strategies and outcomes.

In comparison to other livelihood frameworks, the IFAD's brings in several changes making it less sequential and dependent, placing the poor at the core, emphasizing key processes, integrating personal assets and incorporating the 'Hub Model' for analyzing policies and institutions, unpacking processes(e.g. the markets, hospitals or clinic). It also highlights the relationship with the vulnerability context, introducing aspirations and opportunities, actions than strategies, emphasizing the feedback from strategies and outcomes to other livelihood elements and making the spiritual aspects of livelihoods more explicit.

The expected effect of this study is to encourage farm households to improve their income and also reduce their vulnerability level.

3.3 Method of Analysis

Identification of farm households' income sources in terms of livelihood strategies

A variety of methods can be used to identify the different households' income sources in terms of the livelihood strategies adopted. In a simpler method, descriptive statistics in the form percentage would be used to categorize the different livelihood strategy's contributing to overall household income for an annual season. Then under this circumstance four groups of farmers who have other livelihood strategies would be grouped in clusters of their livelihood choices i.e. L_A , L_B , L_C and L_D . Finally the annual households' income per capita for each of the four different groups would be calculated. As such for these four groups, the annual households' income per capita is given in equation

$$HHIC = \frac{\sum_{i=1}^k Y_{L_i}}{\sum_{i=1}^n T_{HHS_i}} \quad (3.1)$$

Where,

$HHIC$ is the annual households' income per capita

Y_{L_i} is the annual income received from the particular livelihood strategy

T_{HHS_i} is the total household sizes who uses a particular livelihood strategy

Then the difference between the two sample t-test between average annual incomes obtained from the various livelihood strategies would be estimated.

The t-statistic would then be used to test if there are significant differences among the percentage contributions to household incomes of the four different livelihood strategies.

Therefore following from Koutsoyiannis (1977): The null hypothesis tested is

$$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4 = 0 \quad (3.2)$$

The alternate hypothesis which is:

$$H_0: \mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4 \neq 0 \quad (3.3)$$

Where, μ_1, μ_2, μ_3 and μ_4 are the four percentage contributions of the livelihood strategies.

As such the t- statistic is written in equation 3.4

$$t^* = \frac{\sum \hat{y}^2 / (K-1)}{\sum e^2 / (N-K)} \quad (3.4)$$

Where t^* is the calculated t-statistic,

$\sum \hat{y}^2$ is the explained sum of squared deviations

$\sum e^2$ is the sum of residual deviations

K is the number of groups

N is the total summation of the three groups

This is then compared against the theoretical level of t (t- critical) which is chosen at a particular level of significance.

As such if $t^* > t$, the null hypothesis is rejected and this indicates that there is a significant difference in the percentage contribution of incomes by the four groups of livelihood strategies to total household income.

However if $t^* < t$, then the null hypothesis is accepted and this indicates that there is no significant difference in the percentage contribution of incomes by the four groups of livelihood strategies to total household income.

Estimation of the determinants in the choice of alternative livelihood strategies

Following Wanyama *et al.* (2010), the multinomial logit model is used to analyse the factors affecting the choice of a particular livelihood strategy and the model is specified as:

$$\text{Score}(X_i, L_i) = \beta_{L_i} \cdot X_i \quad (3.5)$$

Where X_i is the vector of explanatory variables describing observation i

β_{L_i} is the vector of weights corresponding to outcome,

X_i, L_i is the scored associated with assigning observation i to category L_i .

Based on the above theories and structural models, the empirical model leads to five different equations and these can be specified as follows;

$$\Pr(L_A = 0) = \frac{e^{\beta_0 \cdot X_i}}{1 + \sum_{k=1}^{k-1} e^{\beta_k \cdot X_i}} \quad (3.6)$$

$$\Pr(L_B = 1) = \frac{e^{\beta_1 \cdot X_i}}{1 + \sum_{k=1}^{k-1} e^{\beta_k \cdot X_i}} \quad (3.7)$$

$$\Pr(L_C = 2) = \frac{e^{\beta_2 \cdot X_i}}{1 + \sum_{k=1}^{k-1} e^{\beta_k \cdot X_i}} \quad (3.8)$$

$$\Pr(L_D = 3) = \frac{e^{\beta_3 \cdot X_i}}{1 + \sum_{k=1}^{k-1} e^{\beta_k \cdot X_i}} \quad (3.9)$$

$$\Pr(L_E = 4) = \frac{e^{\beta_4 \cdot X_i}}{1 + \sum_{k=1}^{k-1} e^{\beta_k \cdot X_i}} \quad (3.10)$$

Where,

L_A = those who adopted farm strategy only,

L_B = those who adopted farm strategy and off-farm activities

L_C = those who adopted farm strategy and non-farm activities

L_D = those who adopted off-farm activities + non-farm activities

L_E = those who adopted farm strategy + off-farm activities + non-farm activities)

Where L_A is the reference strategy because all the households sampled in the study area were having farming in common as a livelihood strategy.

The Multinomial logit can therefore be linearly transformed in equation 3.11

$$f(k, i) = \beta_{0,k} + \beta_{1,k}x_{1,i} + \beta_{2,k}x_{2,i} + \dots + \beta_{M,k}x_{M,i} \quad (3.11)$$

The dependent variable and their logit values are explained in the table 3.1

Table 3.1: Dependent Variables and their Respective Logit Values

Livelihood Strategies	Variable	Logit value
Farm strategy only	L_A	1 or 0 otherwise
Farm strategy + Off-farm activities	L_B	1 or 0 otherwise
Farm strategy + Non-farm activities	L_C	1 or 0 otherwise
Farm strategy + Off -farm activities + Non-farm activities	L_D	1 or 0 otherwise
Off-farm activities + Non-farm activities	L_E	1 or 0 otherwise

Table 3.1: Summary of A priori Expectation of Variables Used in the Regressions

Variables	Variable Description	Measurement	Aprior Expectation
Age	Age of household head	Year	+/-
Gender	Gender of household head	Male=1, Female=0	+/-
Thsize	Total household size	Count	+
Tfsize	Total farm size	Hectare	-
Lndowsh	Land ownership	Own land=1, Not Own land=0	-
Coop	Membership in cooperative	Yes=1, No=0	+
Leader	Membership in leadership	Yes=1, No=0	+
Tinmark	Time to the nearest market	Minute	-
Nexcont	Number of extension contact	Number	-
Credacc	Farmers access to credit	Yes=1, No=0	+
Imseed	Improved seed adoption	Yes=1, No=0	-
Educ	Education of household head	Educated=1, Not educated=0	+
Hhincom	Household annual income	CFA	+

A Priori expectation of variables

- Age of Household head (**Age**)

According to Lay and Schuler (2008) the choice of alternative livelihood strategies to increase with age of the household head, therefore there is a positive relationship between age and the choice of alternative livelihood strategies. On the other hand, as the individual advances in age a decline is expected in his choice into farming and non-farm activities (Canagarajah *et al.*, 2001). Therefore, either a positive or negative expectation is required from this study.

- Gender of household head (**Gender**)

Research reveal that male household heads tend to adopt more alternative livelihood alternative (Babatunde and Quaim (2009), as off-farm income component in male headed were found to be 13% higher than female headed households. However, female headed households tend to diversify less especially into agricultural wage activities but more into non-farm activities. They

are also receivers of remittances and transfers especially from spouses outside the community as Minot *et al.*, (2006), found a positive relationship between female. Therefore, a mixed result is expected between female headed households and the choice of alternative livelihood strategies from this study.

- Total Household size (**Thsize**)

Household size with more adults results in division of labour, leading to the choice of alternative livelihood strategies pursued by households. According to Ibrahim *et al.*, (2009) households with adults more than 60 years to be significant in relation to the choice of alternative livelihood strategies. The study also point the fact that, households with more working age adults means increased labour for income generating activities (Joshi *et al.*, 2003). Hence, the expectation of this study with regards to household size and the choice of alternative livelihood strategies is positive.

- Total Farm size (**Tfsize**)

Households with large farm size tend to adopt more agricultural activities than their counterparts with small sizes who tend adopt non-farm activities as alternative livelihood strategies. Therefore, a positive relationship is expected between farm size and the choice of alternative livelihood strategies (Abdulai and CroleRees, 2001; Idowu *et al.*, 2011)

- Type of land ownership (**Lndowsh**)

The type of land ownership is grouped into two main categories; freehold and short-term rented land. The freehold will include a long term lease hold of the land, the land being a bequest to the farmer or a family land which the farmer does not pay for. On the other hand the short term rented land takes into consideration the use of farmland by the farmer in which he has hired it for a short-term or pays for its usage on annual basis. It is expected that a farmer who owns the

farmland would tend to adopt other livelihood strategies. Therefore a positive relationship is expected between the type land ownership and the choice of an alternative livelihood strategies.

- Membership to a cooperative (**Coop**)

The number of farmer-based associations that a farmer joins helps to enlighten him on new technologies, innovations and services. It further helps him to know the advantages and associated negatives attached to each and every one of them. It is therefore the assertion in this work that the higher the number of farmer-based associations a farmer joins, the greater the probability of him knowing and learning about livelihood strategies that are suitable for them. This will subsequently improve his chances of participating in alternative livelihood strategies. In conclusion, there is a positive relationship between membership to a cooperative, participation in social network and the choice of alternative livelihood strategies.

- Time to the nearest market centre (**Tinmark**)

According to (Canajarajah *et al.*, 2001) remoteness or time from a market centre is not enough to discourage non-farm activities and that overall regional infrastructure is more important. However, the proximity to the market helps rural folks to engage in activities to sell in the market since less transaction cost (e.g. transport cost of passengers and goods) will be incurred in engaging such a venture. Hence a negative relationship is expected between time to the nearest market and the choice of alternative livelihood strategies.

- Number of Extension Contact (**Nexcont**)

Extension service is a public good and its distribution and nature of contact could have a bearing on the extent of the choice of alternative livelihood strategies. Extension agents engage in demonstrating new methods and technologies to farmers. Therefore a higher frequency may result in addition of more extra farming activities by farmers. In addition, extension services

could influence farmers to engage in service provision, and in non-farm activities. Therefore a positive relationship is expected between the choice of alternative livelihood strategies and number of extension visits. (Ibrahim *et al.*, 2009)

- Access to credit (**Credacc**)

Access both formal and informal credit is an important factor for farm expansion and entry into non-farm income generating activities. Credit access has been found by empirical studies to promote the choice of alternative livelihood strategies (Babatunde and Qaim, 2009), hence a positive relationship is expected between access to credit and the choice of alternative livelihood strategies in the southern Region.

- Educational status of household head (**Educ**)

The number of years spent in formal education helps household head gain access to new opportunities in the farm and non-farm sector and also facilitates shifts in activities (Gecho *et al.*, 2014). Engagement in local non-farm activities grows strongly for households whose head has primary or secondary education (Lay and Schuler, 2008). Therefore a positive relationship is expected between the choice of alternative livelihood strategies and education.

The hypothesis for the explanatory variables is stated as follows:

Educational status of household head

H₀: Educational level has no influence on the choice of the livelihood strategies.

H_A: Educational level has positive influence on the choice of the livelihood strategies.

This hypothesis is similar for all those variables that are supposed to have a positive effect on the choice of alternative livelihood strategies.

Time to the nearest market centre

H₀: Time to the nearest market has no influence on the choice of the livelihood strategies.

H_A: Time to the nearest market has positive influence on the choice of the livelihood

This hypothesis is similar for all those variables that are supposed to have a negative effect on the choice of alternative livelihood strategies.

Tests of Significance of Factors

The T-ratio test would be used to test for the significance of the various individual factors and it is represented as;

$$T_{cal} = \frac{\alpha_i}{SE(\alpha_i)} \sim t_{n-k} \quad (3.12)$$

Where, SE is the standard error of each explanatory variable, n is the sample size of farmers and k is the total number of parameters.

Estimation of the livelihood vulnerability index

The Livelihood Vulnerability index was employed to estimate the vulnerability levels of farm households. Vulnerability indexes provide reliably useful standards of monitoring vulnerability over time and space, identifying the processes that contribute to vulnerability, prioritizing strategies for reducing vulnerability, and evaluating the effectiveness of these strategies in different social and ecological settings (Adger *et al.*, 2009).

Hahn *et al.* (2009) developed a Livelihood Vulnerability Index (LVI) which employed household-level data to enlighten strategic community level planning. They integrated climate exposures and household adaptive practices in their approach; they tested the LVI in two

communities in Mozambique, where it was informative in capturing differentials in community-level climate vulnerability.

The Livelihood Vulnerability Index includes seven major components, Socio-demographic profile, Livelihood Strategies, Social Networks, Health, Food, Water and Natural Disaster and Climate Variability. Each and every one of these has several indicators or sub-components.

Following from Hahn *et al.*, (2009), it is essential to standardize each of the components since they are measured with different scales. Equation 3.13 was adapted from the Human development Index to find the index of the sub-components for a given major component.

$$index_{sa} = \frac{Sa - Smin}{Smax - Smin} \quad (3.13)$$

Sa = The score of a Sub-component in each of given major component

$Smin$ = Minimum score of a Sub-component in each of given major component

$Smax$ = Maximum score of a Sub-component in each of given major component

After getting the index of the sub-components for a given major component, the index for a major components j was given in equation 3.14

$$M_{aj} = \frac{\sum_{i=1}^n index_{sai}}{n} \quad (3.14)$$

M_{aj} = Index for a major components j

$index_{sai}$ = Index for sub-component

n = number of sub-components in the major component

Each of the seven major components were calculated, they were averaged using Eq. (3.15) to obtain the LVI:

$$LVI = \frac{\sum_{i=1}^7 W_{Ma} M_a}{\sum_{i=1}^7 W_{Ma}} \quad (3.15)$$

Where LVI is the Livelihood Vulnerability Index and the weights of each major component W_{Ma} , are determined by the number of sub-components that make up each major component. With reference to their study, the LVI is scaled from 0 (least vulnerable) to 0.5 (most vulnerable).

3.4 Data Collection and Analysis

A multi stage sampling technique was employed in this study. The multi-stage technique consists of four stages using purposive, cluster and simple random sampling methods at appropriate stages. The first stage involved the selection of the Southern Region. The Southern Region of Benin was chosen purposely for this study because of its noticeable agrarian and economic activities. The second stage involved the selection of Allada and Bonou district purposely. The third stage involved the selection of villages in the various districts. Finally, for the fourth stage, a total of 160 farm households were selected using a random sampling technique (74 farm households in Allada district and 86 farm households in Bonou district).

A cross-sectional data was collected from household heads of the surveyed farm households in the southern Region, using a structured questionnaire. A first draft of the questionnaire was designed and pre-tested. The experiences of the pre-test helped to further improve the final questionnaire. A sample of questionnaire used is presented in Appendix 1. In the questionnaire administration, household heads were made to complete the questionnaire, themselves. In situations where the household head was not literate in the formal French language; interviews were used following strictly the questions on the questionnaire. The information collected from the head of households was demographics characteristic, socio-economic characteristics, household participation in farm, off-farm and non-farm activities and the associated cash (and

kind payments where applicable) incomes generated in the last farming year. Information on productive assets owned, household expenditure made and the constraints facing farm households were obtained.

The data collection spanned from January 20th, 2015 to 14th February, 2015. The STATA (12), and Microsoft Excel Tablesheet (2013) were used for data analysis.

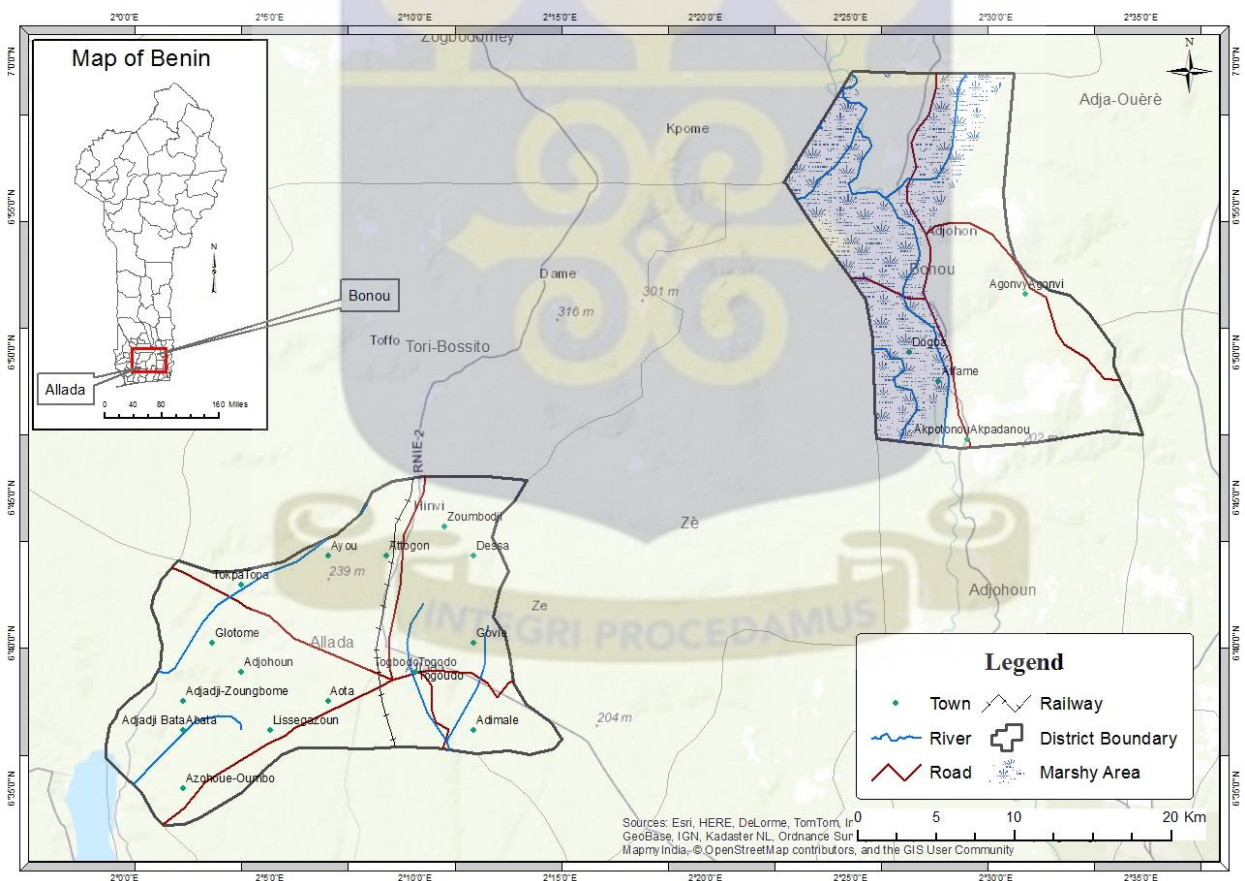
3.5 Study Area

A map of the study area is presented in Figure 3.2. Benin's latitude and longitude is 9° 30'N and 2° 15'E. (INSAE, 2011). Benin Republic is divided into 12 administrative departments. These 12 departments are also divided into 77 Districts. Departments in the Southern part of Benin include; Zou, Plateau, Oueme, Mono, Littoral, Atlantique, and Couffo. Oueme and Atlantique Departments have population percentages of 12.0% and 11.9%, and poverty rates of 51.6% and 57.3% respectively (INSAE 2011). The study area is the southern part of Benin, the study focuses on the Allada and Bonou Districts, which are located in the Atlantique and Oueme Administrative Departments of Benin.

Allada district covers 381 square kilometres of land area. Allada's latitude and longitude is 6.6500° N and 2.1500° E. It consists of twelve communities and 84 villages. The population of the city of Allada is estimated at 127, 493 inhabitants, 61,710 men and 65,783 women (RGPH4, 2013). Agricultural activity in the town of Allada is largely extensive. Crop production, animal rearing, fishery and trade are the main activities practiced in the district. The main crops are maize, cowpeas, groundnuts, cassava, pineapple, oil palm, coffee and various fruits. The climate is sub-equatorial with two rainy seasons (a major season from March to June and a minor season from September to November) and two dry seasons (July to September and from November to March). The annual rainfall ranges from 800 to 1,000 mm INSAE report (2011).

Bonou covers 275 square kilometres of land area. Bonou's latitude and longitude is 6.9000° N and 2.4500° E. It has a population of 44, 430 inhabitants composed of 21,462 men and 22,968 women living in twenty-eight villages (RGPH4, 2013). The fertile soils of the Bonou area favour the production of annual crops (maize, cassava, beans, sweet potatoes, peanuts) and perennial (oil palm, teak plantation, acacia). There are two rainy seasons from April to July and September to August, and two dry seasons from December to March and July to August. The annual average rainfall is about 1300 mm. Crop production, animal rearing; fishery and trade are the main activities practiced in the district INSAE report (2011).

Figure 3.2: A Map of Southern Benin Showing Sampled Districts



Source: Department of Geography, University of Ghana, Legon

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents the results and discussion of the study. Section 4.2 describes the socio-economic characteristics of the sampled households. Section 4.3 presents the results of the identification of farm households' income sources in terms of the adopted livelihood strategies. Section 4.4 proposes the results of the determinants of livelihood strategies. Finally section 4.5 presents the results of the vulnerability levels of farm households in southern Benin.

4.2 Socio-economic Characteristics of the Sampled Households

The socio-economic characteristics of the sampled households presented are age, gender, educational level, marital status of the household head, household size, farm size, the main farm activities and the different combinations of livelihood strategies of the household heads.

Age distribution of respondents

The results of the study showed that a relatively higher percentage (31.3%) of respondents from both Allada and Bonou district were in the age group 31-40. While a lower percentage (10.6%) were within the ages of 60 and above. The mean age was 43.11 years old with the minimum and maximum ages being 22 and 70 year old respectively. A standard deviation of 11.64 years was obtained (Table 4.1). This confirms the available data on the youthful nature of Benin's population (ILO, 2014).

Table 4.1 Demographic Characteristics of the Sampled Farm Households

Characteristics	Grouping	Allada district		Bonou district		Total	
		Freq	%	Freq	%	Freq	%
Age	21-30	18	23.7	6	7.1	24	15
	31-40	27	35.5	23	27.4	50	31.3
	41-50	18	23.7	27	32.1	45	28.1
	51-60	8	10.5	16	19.0	24	15
	60-above	5	6.6	12	14.3	17	10.6
Gender	Male	66	86.84	72	85.71	138	86.25
	Female	10	13.16	12	14.29	22	13.75
Marital status	Single	6	7.9	2	2.4	8	5
	Married	70	92.11	82	97.61	152	95
Household size	1-5	21	27.62	18	21.43	39	24.38
	6-10	44	57.89	35	41.67	79	49.37
	11-28	11	14.47	31	36.90	42	26.25

Source: survey data, 2015

Gender of respondents

Most of the respondents were male representing about 88.6 % of the total population. This reflects the fact that men are mostly the household decision makers in the region (Table 4.1). In cases where females are heads among married households, they did so due to the absence, incapacitation or migration of the spouse. However, as evidence from the Table 4.1, it could be said that women are not taking part in household decision making. This is consistent with data from INSAE report (2011) which shows that there is a higher proportion of households headed by males. Both in Allada and Bonou districts respondents, males were largely represented.

Marital Status of respondents

About 95% of the respondents in the study area were married and only 5% were single (Table 4.1). The mean and the standard deviation were respectively 0.95 and 0.219. However marital status is an indicator for the household's ability to pool resources together towards increasing the household's income.

Household size

Individuals (49.37%) in range of 6-10 were the most represented of the respondents in the study area (Table 4.1). The minimum and the maximum household size were respectively 1 and 28. A mean of 8.59 and a standard deviation of 4.369 were obtained as household size. The mean household size in the study area was higher than the recorded 5.1 for the the country in the INSAE report (2011).

Table 4.2 Socio economic Characteristics of Sampled Farm Households

Characteristics	Grouping	Allada district		Bonou district		Total	
		Freq	%	Freq	%	Freq	%
Level of education	None	42	55.26	29	34.52	71	44.36
	Basic	23	30.26	39	46.43	62	38.75
	Secondary	10	13.16	16	19.05	26	16.25
	Tertiary	1	1.32	0.0	0.0	1	0.63
Access to credit	Yes	42	55.3	22	26.2	64	40
	No	34	44.7	62	73.8	96	60
Farm size	Below 2 Ha	53	69.74	39	46.43	92	57.5
	2-4	20	26.32	27	32.14	47	29.38
	Above 4	3	3.95	18	21.43	21	13.13
Main farm activities	Food crops	27	35.53	67	79.76	94	58.75
	Cash crops	49	64.47	14	16.67	63	39.36
	Livestock	0.0	0.0	1	1.19	1	0.63
	Fishery	0.0	0.0	2	2.38	2	1.25
Livelihood strategies adopted	Farm only	20	26.3	12	14.3	32	20
	Farm and off-farm	33	43.4	22	26.2	55	34.4
	Farm and non-farm	10	13.2	14	16.7	24	15.0
	Off-farm and non-farm	0.0	0.0	0.0	0.0	0.0	0.0
	Farm, off-farm and non farm	13	17.1	36	42.9	49	30.6

Source: survey data, 2015

Educational Level of Respondents

Table 4.2 revealed that, in Allada district most of the respondents had no formal education (55.26%) while 44.43% of the Bonou respondents had basic education. The fact that most of Allada district respondents had no formal education is a critical situation, because education is a means of choosing alternative employment activities.

Access to credit during the last cropping season (2014)

The majority of respondent in study area did not have access to credit during the last cropping season (2014), this is because among this group are those who fall on money lenders and are charged exorbitant interest rates as high as 100%. Majority of Allada respondents had access to credit (55.3%) while 26.2% of Bonou respondents had no access to credit (Table 4.2).

Main Farm Activities from multiple responses

Most of the respondents (58.75%) during the 2013-2014 cropping season were engaged in food crop activities (Table 4.2). Also a significant number of them (39.36%) were also engaged in Cash crop activities such as pineapple and rice production. Only few of the respondents were involved in Livestock and Fishery activities (0.63% and 1.25%) respectively.

Percentages of livelihood strategies adopted by farm household

As depicted in Table 4.2, among the sampled respondents, about 20% of the respondents participated in “farm activities only”, 34.38% participated in “farm and off-farm activities”, 30.63% participated in the combination of “farm, off-farm and non-farm activities”, while none of the respondents were engaged in the combination of “off-farm and non-farm activities”.

Activities and incomes are categorized according to functions (self-employed and wage labour) and sectors (agricultural and non-agricultural). The off farm agricultural activities in the area included food processing, trade of agricultural product and processing of forest products. The

non-agricultural activities included street food preparation/vending, masonry, carpentry, trade-assemblers, wholesalers, retailers, other professional activities like teaching and administrative work.

4.3 Identification of Farm Households' Income Sources in Terms of the Adopted Livelihood Strategies

According to the results presented in table 4.3 which showed the means of the annual incomes per capital obtained from various livelihood strategies and table 4.4 which summarized the two sample t-test between average annual incomes obtained from the various livelihood strategies ;

The test of difference between the mean annual income per capita from “farm activities only” and the mean annual income per capita from “farm and off-farm activities” is not significant. The mean annual income per capita from “farm activities only” is equal to 175,946.5 FCFA while the mean annual income per capita from “farm and off-farm activities” is equal to 96,293 FCFA. This means that farm households that are engaged into agriculture generate more income than farm households that adopt farming and off-farm activities as alternative livelihood strategies.

Also the test of difference between the mean annual income per capita from “farm activities only” and the mean annual income per capita from “farm and non-farm activities” is significant at 1%. The mean annual income per capita from “farm activities only” is equal to 175,946.5 FCFA while the mean annual income per capita from “farm and non-farm activities” is equal to 30,917.62 FCFA. This means that farm households that are engaged into agriculture generate more income than farm households that adopt farming and non-farm activities as alternative livelihood strategies.

From the results of the study, the test of difference between the mean annual income per capita from “farm activities only” and the mean annual income per capita from the combination of “farm, off-farm and non-farm activities” is significant at 1%. The mean annual income per capita from “farm activities only” is equal to 175,946.5 FCFA while the mean annual income per capita from the combination of “farm, off-farm and non-farm activities” is equal to 108,268.5 FCFA. This means that farm households that are engaged into agriculture generate more income than farm households that adopt the combination of “farm, off-farm and non-farm activities” as alternative livelihood strategies.

Moreover, the test of difference between the mean annual income per capita from “farming and off-farm activities” and the mean annual income per capita from the “farming and non-farm activities” is significant at 1%. The mean annual income per capita from “farming and off-farm activities” is equal to 96,293.43 FCFA while the mean annual income per capita from “farming and non-farm activities” is equal to 30,917.62 FCFA. This means that farm households that are engaged into farming and off-farm activities generate more income than farm households that adopt “farm, and non-farm activities” as alternative livelihood strategies.

The test of difference between the mean annual income per capita from “farm and off-farm activities” and the mean annual income per capita from the combination of “farm, off-farm and non-farm activities” is not significant. The mean annual income per capita from “farm and off-farm activities” is equal to 96,293.4 FCFA while the mean annual income per capita from the combination of “farm, off-farm and non-farm activities” is equal to 108,268.5 FCFA. This means that there is no much difference between farm households that are engaged into agriculture and off-farm activities as income sources than farm households that adopt the combination of “farm, off-farm and non-farm activities” as alternative livelihood strategies.

Finally, the test of difference between the mean annual income per capita from “farm and non-farm activities” and the mean annual income per capita from the combination of “farm, off-farm and non-farm activities” is not significant. The mean annual income per capita from “farm and non-activities” is equal to 30,917.62 FCFA while the mean annual income per capita from the combination of “farm, off-farm and non-farm activities” is equal to 108,268.5 FCFA. This means that farm households that are engaged into the combination of “farm, off-farm and non-farm activities” generate more income than farm households that adopt “farm, and non-farm activities” as alternative livelihood strategies.

From the results, the agriculture plays an important role on the households’ sources of income. In the study area, the effect of non-farm activities on the households’ income is not significant.

Also this results are in contrast with the findings of Babatunde and Qaim (2009), Reardon *et al.*, (1998) and De Janvry and Sadoulet (2001) that the combination of various livelihood strategies (non/off-farm) produce increasingly higher shares of household income.

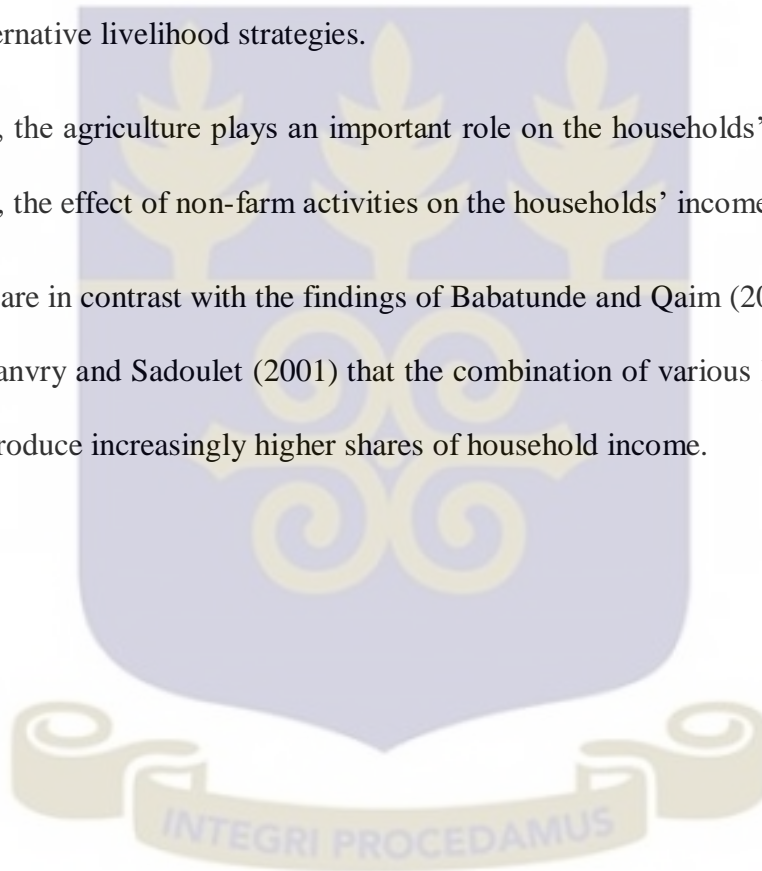


Table 4.3: Means of the Annual Incomes Per capita obtained from Various Livelihood Strategies Adopted by Farmers

Variable	Obs	Mean (CFA)	Stan.Err
Annual income per capita from “farm only”	32	175,946.5	48,546.65
Annual income per capita from “farm and off-farm”	55	96,293.43	19,557.48
Annual income per capita from “farm and non-farm”	24	30,917.62	6,949.66
Annual income per capita from “farm, off-farm and non-farm”	49	108,268.5	48,610.63
Total	160	411,426.05	123664.42

Source: Survey data, 2015

Table 4.4: Summary of the Two Sample T-test between Annual Incomes Per capita Obtained from the Various Livelihood Strategies.

	T- statistics	P- value
Annual income per capita from “farm only” Versus Annual income per capita from “farm and off-farm”	1.4658	0.1447
Annual income per capita from “farm only” Versus Annual income per capita from “farm and non-farm”	2.9769	0.0034
Annual income per capita from “farm only” Versus Annual income per capita from “farm, off-farm and non-farm”	7.2330	0.0000
Annual income per capita from “farm and off-farm” Versus Annual income per capita from “farm and non-farm”	3.048	0.0027
Annual income per capita from “farm and off-farm” Versus Annual income per capita from “farm, off-farm and non-farm”	-0.2233	0.8236
Annual income per capita from “farm and off-farm” Versus Annual income per capita from “farm, off-farm and non-farm”	-1.5616	0.1264

Source: survey data, 2015

4.4 Determinants of Livelihood Strategies

This section presents the results obtained from the multinomial logistic regression indicating the significant factors affecting the choice of alternative livelihood strategies by the sample farmers in the study area. Table 4.5 shows these results. Allison (2014) indicated that a low R square as that obtained in this regression's results does not necessarily signify the goodness of fit since this R square shows the predictive power of the model. It can also be realised that the overall model is significant at a probability of 0.000.

Table 4.5: Multinomial Logistic Results of the Factors Affecting the Choice of Livelihood

Variables	Farm + Off-farm		Farm + Non-farm		Farm + Off-farm + Non Farm	
	Magnitude	p. value	Magnitude	p. value	Magnitude	p. value
Age	.013615	0.601	.0302557	0.288	.0095822	0.734
Gender	-2.754756	0.014***	12.67354	0.000***	-3.140702	0.010*
Thhsize	-.072958	0.322	.0138555	0.843	-.0412425	0.548
Tfsize	.3516425	0.065*	.1711653	0.405	.1985413	0.316
Lndowsh	.3339445	0.606	.0625923	0.931	2.467161	0.009***
Coop	1.075308	0.067*	.2188408	0.728	.7003711	0.275
Leader	15.53259	0.000***	16.04189	0.000***	12.95536	0.000***
Tinmark	.0205628	0.096*	-.0141726	0.354	.0218114	0.202
Nexcont	-.0925538	0.185	-.0464545	0.362	.0052099	0.834
Credacc	.4356314	0.423	-.0207876	0.976	2.009169	0.001***
Imseed	-.3030879	0.574	-.2749777	0.642	1.390723	0.022**
Educ	-.064098	0.807	.4013532	0.195	.1871074	0.635
Hhincom	2.24e-07	0.302	-3.68e-08	0.876	1.69e-07	0.437
Dis	-.4518707	0.498	-.0211437	0.973	1.808747	0.009***
Constant	1.107304	0.482	-14.75118	0.000	-3.246728	0.063
Pseudo R ²	0.2459		Log Pseudolikelihood		-160.38655	
Wald Chi Squared	2933.56		Prob. > Chi ²		0.0000	
Number of Observations	160					

Source: survey data, 2015. *, **, and *** stand for significant at 1%, 5% and 10%.

The variables that have significant effect on the choice of livelihood strategies by farmers are gender, total farm size, membership in cooperative organization, participation in social

leadership, land ownership, access to credit, time to the nearest market and use of improved seed.

The effect of gender is significant at 1% and negative, this implies that the male farmers are less likely to use “farm and off-farm strategy” as alternative livelihood strategy than their female counterparts. Similarly, gender was also significant at 1% and 10% in determining the choice of both “farm and non-farm strategy”, and “farm, off-farm and non-farm strategy” respectively, as alternative livelihood strategies. In “farm and non-farm strategy”, it was observed a contrary relationship to that of “farm and off-farm strategy” that the male farmers are more likely to choose “farm and non-farm strategy” as alternative livelihood strategy than their female counterparts. The relationship between gender and “farm, off-farm and non-farm strategy” however yielded the same effect as that between gender and “farm and off-farm strategy” and in this it was explicitly shown that male farmers in the southern Benin from the sample are less likely to adopt livelihood “farm, off-farm and non-farm strategy” as alternative source of livelihood than their female counterparts. This result is in agreement with previous studies conducted by Adugna (2005) and Berhanu (2007). Gecho *et al.* (2014) found gender of farmer to be a significant variable in the selection of off-farm livelihood strategy as alternative livelihood strategy but did not identify it as an influential variable in the choice of non-farm strategy and both off and non-farm strategies combined.

It was also realised from the regression results that total farm size, time to the nearest market and membership in cooperative organisation, had a positive effect only on the addition of off-farm livelihood strategy by the farmers, all at 10%.

The effect of participation in social leadership is significant at 1% and positive, this means that farmers who have participated in social leadership are more likely to use “farm and off-farm strategy” as alternative livelihood strategy than those farmers who have no leadership role in

their community. Similarly, participation in social leadership was significant in determining the choice of “farm and non-farm strategy” and “farm, off-farm and non-farm strategy”, as alternative livelihood strategies at the same percentage level of significance of 1. Participation in social leadership “farm and non-farm strategy” and “farm, off-farm and non-farm strategy” had the same effect between participation in social leadership and “farm and off-farm strategy”. In this case farmers who have participated in social leadership are more likely to adopt “farm and non-farm strategy” and “farm, off-farm and non-farm strategy”, as alternative sources of livelihood than their counterparts who have no leadership role in their community.

The ownership of land by the farmer was positively significant at 1% in determining the choice of “farm, off-farm and non-farm strategy” but was not significant for the choice of “farm and off-farm strategy” and “farm and non-farm strategy” as alternative livelihood strategies.

Access to credit by the farmer was also found to be significant in determining the choice of “farm, off-farm and non-farm strategy” but was distinctively found to be insignificant for the choice of “farm and off-farm strategy” and “farm and non-farm strategy” as alternative livelihood strategies. The regression results showed that farmers who had access to credit were more likely to choose “farm, off-farm and non-farm strategy” than farmers who did not have access to credit and this was significantly determined at 99% level of confidence. The result is in line with that of Holden *et al.*, (2004); Brown *et al.*, (2006), and Berhanu (2007). This implies that the incentive for accessing credit accelerates agricultural production.

The effect of use of improved seed is significant at 5% and positive, this implies that farm households using improved seed are more likely to diversify into farm, off-farm and non-farm activities than those who did not use. Gecho *et al.* (2014) also found that use of improved seed negatively and significantly affected households’ livelihood diversification into off-farm activities at less than 10% but did not affect the choice of farm, off-farm and non-farm.

Even though some variables were expected to have an impact in the decision making of farmers in the model, they turned out to be non-significant. These variables were total household size, age, number of extension contacts, level of highest education attained, and annual income of farmers.

The mean and standard error of the explanatory variables is presented in Appendix 4.

4.5 Vulnerability Levels of Farm Households in Southern Benin

This objective estimates the vulnerability of the farm households by using the livelihood vulnerability index. The estimate is based on seven major components of the farmers, namely socio-demographic components, livelihood strategies component, social networks component, health component, food component, water component, and natural disasters and climate variability component. The estimate indexed sub-components, major components for Allada and Bonou and overall is presented in Appendix 5.

The two districts' respondents reported smaller proportion of female household heads. The percent of female-headed households was higher for Bonou (12%) than Allada (10%). The percentage of household heads which have not had any formal education in Allada is greater (42%) compared to Bonou (29%). However, overall, Allada presented greater vulnerability on the Socio -Demographic Profile index than Bonou (SDP_{Allada} 0.32; SDP_{Bonou} 0.31). The average reported age of Allada female household head was 47 years versus 49 years in Bonou. The average number of family member available for farm activities is equal to (2), and it is, similar for both districts. The overall vulnerability on the Socio-Demographic Profile index is 0.33.

Bonou showed the same vulnerability on the Livelihood Strategies component (0.25) as Allada (0.25). A higher percentage of Allada households reported relying mainly on agriculture for income (agriculture dependency index: Allada 20%, Bonou 12%). Further, Allada households

reported a higher percentage of household depending on farm and off-farm strategies (33%) than (22%) reported by Bonou households.

These strategies include growing crops, associated activities like; charcoal/firewood selling, general trade in agricultural produce, gari processing, butcher etc. Bonou respondents reported also higher percentage of household dependency on farm and non-farm strategies (14%) versus (10%) for Allada. In this case the strategies included growing crops, and activities like: Artisan, General trade in non-agricultural produce, salaried employee, etc.

Moreover, the percentage of household in Bonou dependency on farm, off-farm and non-farm strategies was higher (36%) than Allada (13%). This might be explained by the fact that Bonou households have higher tendencies to be involved in the combination of farm, off-farm and non-farm activities, than any other type of livelihood strategies.

When the four sub-components were averaged the overall livelihood strategies vulnerability score was higher for Bonou than Allada. The overall livelihood vulnerability score is equal to 0.25.

The Social Network indicators were almost the same for the two districts. Over 72 % of Allada and 80% of Bonou households said they had not approached their local government for assistance in the past month. Bonou households reported borrowing money more frequently than Allada households (Average households which borrowed money from friends or relatives: 21% for Bonou versus 16% for Allada). Bonou respondents reported receiving more in-kind assistance from family and friends than Allada respondents (Average households which received help from friends or relatives: 28% for Bonou versus 21% for Allada). Furthermore, the number of times Bonou respondents lent money or provided assistance in the past month was greater than the number of times the Allada respondents had done it. 31% and 19% of the respondents respectively in Bonou and in Allada reported having borrowed money from

friends/relatives. 56% and 43% of the respondents respectively in Bonou and Allada gave help to friends and relatives. Overall, Bonou households were more vulnerable than Allada households on the Social Networks component (0.51 versus 0.40, respectively). The overall Social Networks score is 0.48.

Allada households reported traveling an average of 18.45 minutes to a health facility while Bonou households reported an average of 13.45 minutes. Chronic illness was reported by 29% of households in Allada compared to 39% in Bonou. 39% of Allada households said that a family member missed work due to illness in the past 2 weeks compared to 25% of Bonou households. Allada households also reported being more vulnerable to malaria than Bonou households (malaria prevention*exposure index: Allada 0.5, Bonou 0.43). The average number of mosquito nets in Allada households is less (03) than Bonou households (05). When the sub-components were combined, the overall Health vulnerability score for Allada (0.32) was similar to Bonou Health vulnerability score (0.33). The overall Health score is 0.35.

Allada and Bonou households reported struggling to find adequate food for their families 3 months per year on average. 5% of Allada households reported relying solely on their farm for food compared to 9 % for Bonou households. A higher proportion of Bonou than Allada households reported storing crops and saving seeds (store crops index: Allada (0), Bonou (0.06); save seeds index: Allada (0.02), Bonou (0.07)). The overall Food vulnerability score for Allada was lower (0.08) than that for Bonou (0.12). The overall Food score is 0.11.

Allada also had a lower vulnerability score (0.19) for the Water component than Bonou (0.22). In Allada, 15% of households reported using a natural water source while more than 89% of households in Bonou reported getting water from a community pump. Allada households reported storing 120.5 liters of water on average compared to 185.2 liters in Bonou. Also, 77% of households in Allada had had a consistent water supply while only 64% of Bonou households

have water every day. Similarly, Allada households reported traveling 8 minutes on average to get water compared to 6 minutes in Bonou. About 25% of Allada households reported hearing about conflicts over water in their communities compared to 36 % of Bonou households. The overall Water score is 0.26

Bonou and Allada had similar Natural Disaster vulnerability scores, related on the average reported number of flood, drought, and storm events the past 5 years, the percent of households who said they had received no warning, and the percent of households reporting a disaster-related injury or death.

The Natural Disaster vulnerability score for Bonou households is 0.34 and 0.33 for Allada households. The overall Natural Disaster vulnerability score is 0.34.

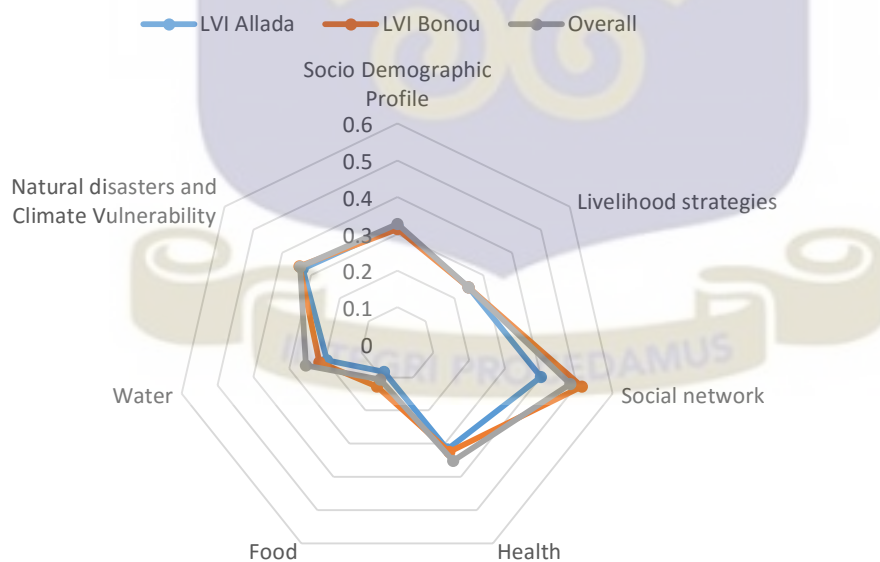
The Livelihood Vulnerability Index for each district and the overall population are described in Table 4.6. Overall, Bonou had a higher LVI than Allada (0.30 versus 0.27, respectively) and the livelihood Vulnerability Index for the overall population is 0.31. This means that Bonou households were more vulnerable than Allada households in terms of the choice of alternatives livelihood strategies, also the southern Region of Benin is less vulnerable following the scores defined by Sullivan *et al.*, (2002) which showed that the LVI is expected to fall between 0 and 0.5 for a less vulnerable community.

Table 4.6: Major Components and Weight Values Used to Estimate the LVI

Major components	Weight	Districts		Weight	Overall	Weight
		Allada	Bonou			
Socio-Demographic Profile	4	0.321	0.313	4	0.327	4
Livelihood strategies	4	0.249	0.249	4	0.249	4
Social network	5	0.400	0.514	5	0.483	5
Heath	5	0.316	0.325	5	0.352	5
Food	4	0.084	0.127	4	0.107	4
Water	5	0.195	0.217	5	0.255	5
Natural disasters and climate variability	3	0.329	0.340	3	0.338	3
Total	30			30		30
LVI		0.30	0.27		0.31	

Source: survey data, 2015

Figure 4.1: Vulnerability spider diagram of the major components of the Livelihood Vulnerability Index (LVI) for Allada, Bonou Districts and Overall.



Source: survey data, 2015

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary, main conclusions and policy recommendations of the study. Section 5.2 presents a summary of the study while the conclusions from the study are presented in section 5.3. Finally section 5.4 provides the recommendations from the study.

5.2 Summary of the Study

The study analyzed the livelihood strategies adopted by farm households in southern Benin. Specifically, the study identified the sources of farm household income in terms of their adopted livelihood strategies. Also, it determined the factors that influence the choice of their alternative livelihood strategies using a multinomial logit model. It further estimates the vulnerability level of farm households in southern Benin using the livelihood vulnerability index. Using a multi stage sampling technique, 160 farm households in the southern Benin were sampled and interviewed with the help of structured questionnaire. The study identified four main livelihood strategies adopted by farm households, namely farm strategy only; farm and off-farm strategy; farm and non-farm strategy; farm, off-farm and non-farm strategy.

The study also showed that farm strategy only was the main source of income adopted by farm households in the study area while farm and non-farm activities were the least source. The results indicated that eight out of 15 variables were found to be significant at various levels. These factors are age, sex, total farm size, membership in cooperative organization, participation in social leadership, landownership, access to credit, and use of improved seed. The findings also showed that the adoption of “farm and off-farm strategies” is influenced by household head age, total farm size and membership in cooperative organization. In addition, the decision by a farm household to adopt the combinations of “farm and off-farm-strategies;

farm and non-farm strategies; farm and off-farm and non-farm strategies” is significantly influenced by gender of household head and participation in social leadership. Furthermore, adopting “farm, off farm and non-farm” is influenced by access to credit, type of landownership, and the use of improved seed. Finally, participation in social leadership and gender are key determinants of the choice of alternative livelihood strategies by farm households.

From the Livelihood Vulnerability Index results, it was observed that the region was less vulnerable in terms of the different livelihood strategies among farm households.

5.3 Conclusion

It can be concluded that farming is the main source of households’ income in southern Benin. About 20% of farm households generally collect a majority of their incomes from the farm sector, with cash crop income alone contributing as high as 64.47% of the total household income. It can further be noted that agriculture plays important roles in rural livelihood. Therefore more attention should be given to the farm sector especially cash crop production, with particular reference to pineapple and rice farming.

The key determinants affecting the choice of alternative livelihood strategies by farm households in southern Benin are gender, and participation in social leadership. On one hand, it can be shown that male households head are less likely to choose “farm and off-farm activities” and “farm, off-farm and non-farm activities” than their female counterparts. On the other hand, male households head are more likely to choose “farm and non-farm activities” as alternative livelihood strategies than their female counterparts. In addition, participation in social leadership strongly affect the choice of farm households in adopting various livelihoods strategies.

Moreover even though the southern Benin was less vulnerable in terms of the livelihoods strategies adopted, the farmers were more vulnerable with respect to Social network components.

5.4 Recommendations

Based on the findings of the study, the following policy recommendations are made for enhancing livelihoods in rural areas:

- Stakeholders, should provide incentives to farmers to go into different shape of farming activities to ensure higher productivity and income in the farm sector.
- Priority should also be placed on the other livelihood strategies adopted by farmers so that policy makers would be able to devise more suitable ways of supporting these strategies. These policies may take the form of alternative livelihood support programmes that seeks to improve the alternative livelihoods sources of farmers.
- Also, stakeholders should encourage participation in social leadership to help ensure strong social cohesion to promote not only farmer education for increased production but also effective social communication which is known to enhance self-support. Implementation of social network policies should be well monitored to ensure that local government assistances get to the rural households and aids should as well be equitably distributed during critical period.
- Furthermore, the design in the implementation of farmer livelihood interventions should be gender sensitive. This has to do with equal representation of males and females in training, extension services and call up meetings. The development of technologies for farming should also not be gender bias.

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APPENDICES

Appendix 1 QUESTIONNAIRE

UNIVERSITY OF GHANA

DEPARTMENT OF AGRICULTURAL ECONOMICS & AGRIBUSINESS COLLEGE OF
AGRICULTURE AND CONSUMER SCIENCES

QUESTIONNAIRE

This questionnaire is to solicit your responses for academic purpose on the topic:

ANALYSIS OF THE LIVELIHOOD STRATEGIES OF FARM HOUSEHOLDS IN SOUTHERN BENIN

Please kindly provide your responses to the questionnaires as much as possible. Your responses will be treated with the highest level of confidentiality

General

Date of Interview.....

1. Questionnaire No.

4. Enumerator Name/No.....

2. District:

3. Village:

5. Country /Region of Origin.....

6. Sex of farmer respondent:

7. Name of Respondent.....

1. Male

0. Female

8. Age of respondentyears

9. Marital Status of respondent:.....

Code: 1= Married 2 = Widowed 3 = Single
4= Separated 5 = Divorced

10. Is respondent Head of the Household?

1. Yes

0. No

12. Religion of respondent:

1= Traditional religion

2 = Christian

3 = Muslim

4 = Other

13. What is your educational status? Tick as appropriate

1. Primary

3. Secondary/SSS

5. None

7. Other (specify)

2. Middle/JSS

4. Higher than Secondary/JSS

6. Muslim education

14. What is the size of your household and how many are available for farmwork regularly?

Category of household member	Number of Size	Number Available for farm Work	
		≤ 2 days/Wk	> 2 days/Wk
Male adults (eighteen years and above)			
Female adults (eighteen years and above)			
Children between 6 years and 18 years			
Children under 6 years			

14. What is the educational status of members of farmers' household?

Category of household member	Number with primary/JSS/Middle School education	Number with more than primary / JSS / Middle education	Number with no formal education	Other(Arabic, etc) Specify
Male adults (eighteen years and above)				
Female adults (eighteen years and above)				

15. What type(s) of agricultural production unit(s) farming are engaged in? Tick and Rank by importance where 1 equals most important

	A) Tick	B) Rank
Foodcrop		
Cashcrop		
Livestock		
Fish rearing/ Farming		
Other (specify)		

16. Indicate the major works / activities you do in addition to farming. See codes below (Multiple response)

- | | | |
|--|--|---------------------------|
| 1. Pito /Akpeteshi Brewing | 9. Mason, construction work, etc | 17. Palm Oil Processing |
| 2. Sheabutter/groundnut oil extraction | 10. Mining (quarrying, gold winning, etc) | 18. Corn Dough processing |
| 3. Charcoal/firewood selling | 11. Artisan (blacksmith, carpentry, tailoring) | 19. Salaried employee |
| 4. Basket weaving | 12. General trade in agricultural produce | |
| 5. Smock weaving | 13. General trade in non-agricultural produce | |
| 6. Sell cutlasses, hoe, fertilizer, etc. | 14. Farm Hand | |
| 7. Hire out equipment (tractor, bullock, donkey, etc.) | 15. Pottery | |
| 8. Butcher | 16. Gari Processing | |
| 20Other _____ | | |

17. What proportion of your time do you spend on farming, non-farm and off-farm activities?

	Wet Season (%)	Dry Season (%)
Proportion of time spent on farm		
Proportion of time spent on non-farm		
Proportion of time spent off-farm		

18. Which months of the year do you engage in non-farm activity? Tick months.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec

19. Which months of the year do you engage in off-farm activity? Tick months.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec

20. How did you acquire the land you farm on now?

- | | | |
|----------------------------------|------------------|-------------------------|
| 1. Purchase | 4. Sharecropping | 7. Gift |
| 2. Allocated by village chief | 5. Rent | |
| 3. Part of family land/inherited | 6. Leasing | 8. Other (specify)..... |

21. Indicate the Number of plots cropped in year 2014

22. CROPS INFORMATION

Plot #	Plot size (acre)	Main crop	Seed type(See codes below)	Source of seed(See codes below)	Quantity of seed (Kg)	Price (unit of measure) (CFA/Kg)	Type of fertilizer (See codes below)	Quantity (number of 50 kg)	Price (CFA/50 Kg)	Type of agro-chemical (See codes below)	Quantity (Kg)	Unit Price
Plot 1												
Plot 2												
Plot 3												

- | | | | |
|---------------|-----------------------------|--------------|-----------------------|
| 1.Traditional | 1. Own seed | 1. Organic | 1.Field pesticide |
| 2. Improved | 2. Market | 2. inorganic | 2. Weedicides |
| | 3. NGO//Development Project | 3. None | 3. Storage pesticides |
| | 4. Ministry of Agric | | 4. None |

23. How many bags/sacks/calabashes, etc. of major crops produce did you harvest last year (2014), and at what price did you sell a unit.

Output for major crops

Plot #	Quantity Harvested	Quantity Sold	Month most crop sold	Unit price (Kg/CFA)
Plot 1				
Plot 2				
Plot 3				

24. How many bags/sacks/calabashes, etc of minor Crop produce did you harvest last year (2014) and at what price did you sell a unit?

Minor Crops	Minor on which plot	Quantity Harvested	Quantity Sold	Month most crop sold	Unit price
1. Maize					
2. Sorghum/millet					
3. Rice					
4. Other cereal (name)					
5. Groundnuts					
6. Cowpea					
7. Soybean					
8. Bambara					
9. Pigeon pea					
10. Other legume (Specify name)					
11. Yam					
12. Cassava					
13. Sweet Potato					
14. Tomato					
15. Okro					
16. Leafy Vegetables					
17. Pepper					
18. Garden Eggs					
19. Other Vegetables (specify)					
20. Cotton					
21. Tobacco					
22. Cashew					

24. Please indicate your Livestock size (numbers) as at the last season (2014). Which of the livestock did farmer start rearing in last 10 years?

Livestock	Number	Started rearing in last 10 years? 1 = YES 2 = NO
Cattle < 2year		
> 2 year		
Sheep < 1 year		
> 1 year		
Goat < 1 year		
> 1 year		
Donkey < 1year		
> 1 year		
Pigs < 1 year		
> 1 year		
Other(specify)		

25. Please indicate the size of your Poultry enterprise as well as those that the farmer started rearing in last 10 years.

Poultry	A) Number	B) Started rearing in last 10 years? 1 = Yes 2 = No
Chicken		
Duck		
Turkey		
Guinea Fowl		
Pigeon		
Other(specify)		

27. Do you do fish farming? 1. YES 0. NO (If NO go to 40)

28. If YES, how much did you earn from fish farming in year 2014?

1. less than 50 thousand CFA
2. 50-100 thousand CFA
3. 101-200 thousand CFA
4. 201-299 thousand CFA
5. 300 thousand CFA and above

29. Please provide information on the ownership of livestock in your household

Livestock type	Number owned by MALE household members	Number owned by FEMALE household members
Cattle		
Sheep		
Goats		
Guinea Fowl		
Chicken		
Pig		
Turkey		
Ducks		
Donkeys		
Other (specify)		

30. How many animals (Livestock) did you sell and purchase at the last season (2014)?

Livestock	Units sold	Selling price	Units purchased	Purchased price
1. Cattle				
2. Sheep				
3. Goats				
4. Guinea Fowls				
5. Chicken				
6. Pigs				
7. Turkey				
8. Ducks				
9. Donkeys				
10. Other (specify)				

31. For each plot of land you cultivated, please indicate the number (quantity) and whether hired or family labour as well as contract hire labour or daily wage hire labour is used in undertaking the following farm activity:

Plot 1

Farm activity (where applicable)	Family labour				Hired labour									
	Male		Female		Male					Female				
	Qty	# of days	Qty	# of days	Type of Hired labour	Qty	# of days	If daily hired labour, state daily wage(CFA)	If contract hired labour, state cost for contract (CFA)	Type of Hired labour	Qty	# of days	If daily hired labour, state daily wage(CFA)	If contract hired labour, state cost for contract (CFA)
Land clearing/ stumping														
Nursery														
Ploughing														
Harrowing														
Planting/sowing/ seeding														
1 st Herbicide /weedicide application														
1 st weeding: Manual														
2 nd Herbicide /weedicide application														
2 nd weeding: Manual														
Fertilizer application														
Insecticides/Fungicides application														
Birds control														
Harvesting														

Plot 2

Farm activity (where applicable)	Family labour				Hired labour									
	Male		Female		Male					Female				
	Qty	# of days	Qty	# of days	Type of Hired labour	Qty	# of days	If daily hired labour, state daily wage(CFA)	If contract hired labour, state cost for contract (CFA)	Type of Hired labour	Qty	# of days	If daily hired labour, state daily wage(CFA)	If contract hired labour, state cost for contract (CFA)
Land clearing/ stumping														
Nursery														
Ploughing														
Harrowing														
Planting/sowing/ seeding														
1 st Herbicide /weedicide application														
1 st weeding: Manual														
2 nd Herbicide /weedicide application														
2 nd weeding: Manual														
Fertilizer application														
Insecticides/Fungicides application														
Birds control														
Harvesting														

Plot 3

Farm activity (where applicable)	Family labour				Hired labour									
	Male		Female		Male					Female				
	Qty	# of days	Qty	# of days	Type of Hired labour	Qty	# of days	If daily hired labour, state daily wage(CFA)	If contract hired labour, state cost for contract (CFA)	Type of Hired labour	Qty	# of days	If daily hired labour, state daily wage(CFA)	If contract hired labour, state cost for contract (CFA)
Land clearing/stumping														
Nursery														
Ploughing														
Harrowing														
Planting/sowing/seeding														
1 st Herbicide /weedicide application														
1 st weeding: Manual														
2 nd Herbicide /weedicide application														
2 nd weeding: Manual														
Fertilizer application														
Insecticides/Fungicides application														
Birds control														
Harvesting														

32. How many members of your household have left to other places outside the district in the last 5 years?

	Number
Male	
Female	

33. If ANY, is this migration seasonal or permanent? (1) Seasonal (0) Permanent

34. Why do you think they left the village for other places? Tick reasons given.

- (1) To be with parent
- (2) To be near school / get better education
- (3) Sent to relative/friend
- (4) To live with spouse/marriage reason
- (5) To take up job
- (6) Because of drought / famine
- (7) Conflicts /War
- (8) To farm
- (9) Other (specify)

35. When they leave, where (location) do they most often go?

- (1) Big Cities in Parakou / Porto-Novo / Cotonou
- (2) Farming areas in Karimama / Save / Ouidah
- (3) Ketou
- (4) Ouidah
- (5) Nearby countries (Togo /Burkina Faso / Cote d'Ivoire)
- (6) Other places (Specify).....

36. What was the relationship of the person who left (migrant) to you? Indicate approximate age at migration against choice. Indicate if you receive money from them, also the amount received in 2014

Migrating Relative	Age	Received remittances or not 1. Yes 2.No	Amount received (CFA)
1 = Son			
2 = Daughter			
3 = Father			
4 = Mother			
5 = Sister			
6 = Brother			
7 = Wife			
8= Husband			
9 = In-Law			
10= Friend			

37. Do you remit money /kind to the migrant? (1) Yes (0) No

38. If Yes, how much in total did you remit in a year 2014? If in kind indicate approximate value.

39. Have you had contact with any extension officer in the last farming season (year 2014)?

1= YES 0= NO

40. If Yes , what was the number of contact?

41. Did you borrow money for farming in 2014 (from any source)? (1) YES (0) NO

42. If YES, from which source? 1. Formal 0. Informal

43. Have you ever applied for a bank loan for your farm activities? 1= YES 0= NO

44. If NO, why?

- (1) Don't have access to a Bank—Bank too far
- (2) From experience, the Bank will not give me a loan
- (3) Don't know that Banks give loans to farmers
- (4) Don't need money from the Banks
- (5) Relatives/Friends, etc always help me financially
- (6) Afraid to get loan from bank
- (7) Never made any attempt
- (8) Don't know how to access loan from Banks
- (9) No savings at bank to access loans
- (10) Others (specify)

45. If YES, was your application successful? 1= YES 0= NO

46. If YES, did you get the whole amount applied for? 1= YES 0= NO

47. How was the borrowed money used? 1=Agricultural purposes 0=Non-agricultural purposes
3=Both

48. If NO what was the reason for not getting the Bank loan?
1= no collateral 2= had outstanding loan 3=Don't know 4=Other, specify_____

49. Did your household request for in kind credit during the 2014 crop year? 1=Yes 0=No

50. If Yes, did you receive the credit in kind that you tried to obtain? 1=Yes 0=No

51. Is your household participate in social leadership ? (1) YES (0) NO

52. In what form was the credit in kind received? 1=Agricultural inputs 2=Household consumption 3=Both

53. If you tried to get credit in kind but did not get, what was the reason for not getting
1=Had outstanding loan 2=Don't Know 3=Other, specify_____

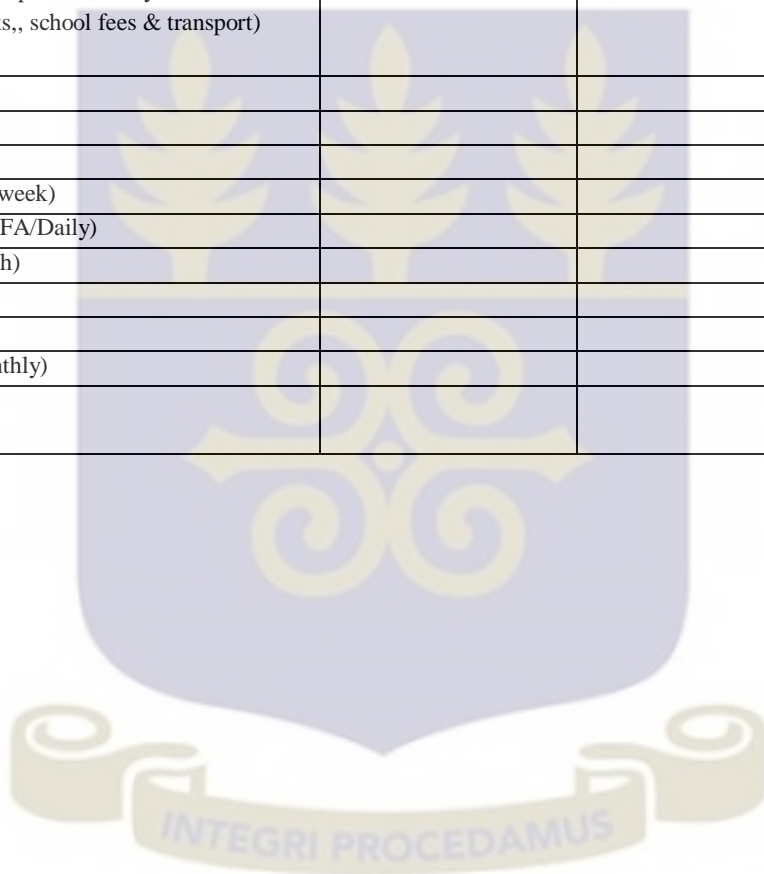
54. If credit was used for non-agricultural purposes give details

Main use of the credit Code: 1=school fees 2=medical 3=business 4=household consumption 5=other, specify_____	Type of credit received Code: 1=Cash 2=In Kind 3=Both	What was the source of credit Code: 1=neighbor 2=farmer group 3=commercial bank, specify__ 4=relative/friend 5=NGO/MFI, specify_____ 6=group (ROSCA) 7=Rural bank 8=shopkeeper 19=other, specify_____	Value of credit (CFA)	How is/was the credit repaid? Code: 1=crop revenue 2=livestock revenue 3=off farm income 4=both livestock and crop revenue 5=other, specify_____
(Multiple response: enter as many as applicable)				

Household Consumption Expenditure

55. Indicate your household expenditure for the year 2014, if any on the following items

Item	Expenditure (CFA)	Main source of financing 1. Salary 2. Remittance 3. Sales animal 4. Sales of crops in storage 5. Sales of crops just harvested
Food purchase (CFA/daily)		
Imputed food expenditure (CFA/daily)		
Water (CFA/daily)		
Public toilet, (CFA/daily)		
Sanitation – waste disposal (CFA/daily)		
Education for children up to second cycle institutions (mainly uniform, books,, school fees & transport) (CFA/term)		
Health (CFA/month)		
Rent (CFA/month)		
Travels (CFA/week)		
Funerals/social (CFA/week)		
Firewood/Charcoal (CFA/Daily)		
Electricity (CFA/month)		
Gas (CFA/month)		
Kerosene (CFA/week)		
Remittance (CFA/monthly)		
Others (specify)		



VULNERABILITY LEVEL

HEALTH (H)

- 56. How long (in minutes) does it take your household to get to the nearest health facility?
- 57. Is anybody in your family get ill very often? 1= YES 0= NO
- 58. Has anyone in your family been no sick in the past 2 weeks that they had to miss work or school?
1= YES 0= NO
- 59. Which months of the year is malaria particularly bad?.....
- 60. How many mosquito nets do you have in your household?.....

SOCIAL NETWORKS (SN)

- 61. What are the types of help received from other relatives and friends for the past month?
- 62. What are the types of help given to other relatives and friends for the past month?.....
- 63. Did you borrow any money from relatives or friends in the past month? 1= YES 0= NO
- 64. Did you lend any money to relatives or friends in the past month? 1= YES 0= NO
- 65. In the past 12 months, have you or any member of household gone to the local government for help?
1= YES 0= NO

FOOD (F)

- 66. Where does your household get most of its food?
0= Own farm 1= purchased 2= Both
- 67. How many months in the year do your household struggle to get enough food?.....
- 68. Does your household save some of the crops you harvest to eat during a different time of the year?
1= YES 0= NO
- 69. Does your household save seeds to grow for the following year? 1= YES 0= NO

WATER (W)

- 70. In the past year, have you heard about any conflicts over water in your community?
(1) YES (0) NO
- 71. What is your primary source of water?.....
- 72. How long (in minutes) does it take your household to get to your main water source?.....
- 73. Is this water available every day? 1= YES 0= NO
- 74. In what containers do you usually store the water?.....
- 75. How many litres are they?.....

NATURAL DISASTER AND CLIMATE VARIABILITY (NDCV)

- 76. How many times has this area been affected by flood or drought or any other natural disaster for the past 5 years?
- 77. Did you receive any warning about the afore-mentioned disasters before it happened? 1= YES 0= NO
- 78. Was anyone in your household injured, during those events? 1= YES 0= NO
- 79. Did any member in your household die during those events? 1= YES 0= NO

Thank you for your cherished responses

We reiterate the confidentiality of all your responses

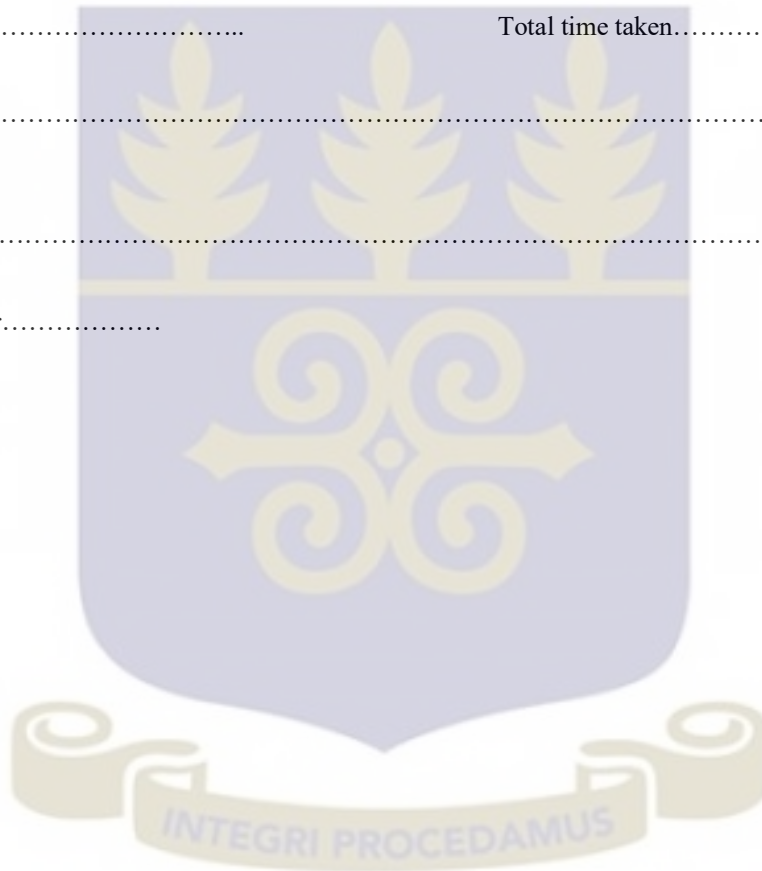
End of the discussion

Closing Time Total time taken.....

Signature of Enumerator.....
.....

Name of verifier.....
.....

Signature of verifier.....



Appendix 2 Two-Sample T-test

```

_____ (R)
/___ / ___/ / ___/
___/ / ___/ / ___/ 12.0 Copyright 1985-2011 StataCorp LP
Statistics/Data Analysis StataCorp
4905 Lakeway Drive
Special Edition College Station, Texas 77845 USA
800-STATA-PC http://www.stata.com
979-696-4600 stata@stata.com
979-696-4601 (fax)

```

Single-user Stata network perpetual license:

```

Serial number: 93611859953
Licensed to: ULYSSE AZANNAI
UNIVERSITY OF GHANA, LEGON

```

Notes:

1. (/v# option or -set maxvar-) 5000 maximum variables
- ```

. *(4 variables, 160 observations pasted into data editor)
. ttest hhicpa=hhicpb

```

Paired t test

| Variable | Obs | Mean     | Std. Err. | Std. Dev. | [95% Conf. Interval] |          |
|----------|-----|----------|-----------|-----------|----------------------|----------|
| hhicpa   | 160 | 175946.5 | 48546.65  | 614072    | 80067.09             | 271826   |
| hhicpb   | 160 | 96293.43 | 19567.46  | 247510.9  | 57647.78             | 134939.1 |
| diff     | 160 | 79653.11 | 54339.45  | 687345.7  | -27667.1             | 186973.3 |

mean (diff) = mean (hhicpa - hhicpb) t = 1.4658

Ho: mean(diff) = 0 degrees of freedom = 159

Ha: mean(diff) < 0 Ha: mean(diff) != 0 Ha: mean(diff) > 0

Pr(T < t) = 0.9277                      Pr(|T| > |t|) = 0.1447                      Pr(T > t) = 0.0723

. ttest hhicpa=hhicpc

Paired t test

| Variable | Obs | Mean     | Std. Err. | Std. Dev. | [95% Conf. Interval] |          |
|----------|-----|----------|-----------|-----------|----------------------|----------|
| hhicpa   | 160 | 175946.5 | 48546.65  | 614072    | 80067.09             | 271826   |
| hhicpc   | 160 | 30917.62 | 6949.696  | 87907.47  | 17192                | 44643.25 |
| diff     | 160 | 145028.9 | 48718.06  | 616240.1  | 48810.93             | 241246.9 |

mean(diff) = mean(hhicpa - hhicpc)                      t = 2.9769  
 Ho: mean(diff) = 0                      degrees of freedom = 159  
 Ha: mean (diff) < 0                      Ha: mean (diff) != 0                      Ha: mean (diff) > 0  
 Pr(T < t) = 0.9983                      Pr(|T| > |t|) = 0.0034                      Pr(T > t) = 0.0017

. ttest hhicpa=hhicpd

Paired t test

| Variable | Obs | Mean     | Std. Err. | Std. Dev. | [95% Conf. Interval] |          |
|----------|-----|----------|-----------|-----------|----------------------|----------|
| hhicpa   | 160 | 175946.5 | 48546.65  | 614072    | 80067.09             | 271826   |
| hhicpd   | 160 | 108268.5 | 48610.63  | 614881.3  | 12262.73             | 204274.4 |
| diff     | 160 | 67678    | 9356.863  | 118356    | 49198.23             | 86157.76 |

mean(diff) = mean(hhicpa - hhicpd)                      t = 7.2330  
 Ho: mean(diff) = 0                      degrees of freedom = 159  
 Ha: mean(diff) < 0                      Ha: mean(diff) != 0                      Ha: mean (diff) > 0  
 Pr(T < t) = 1.0000                      Pr(|T| > |t|) = 0.0000                      Pr(T > t) = 0.0000





### Appendix 3 Multinomial Logistic Regression Results

```

_____ (R)
/___ / ___/ / ___/
___/ / /___/ / /___/ 12.0 Copyright 1985-2011 StataCorp LP
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```

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```

Notes:

1. (/v# option or -set maxvar-) 5000 maximum variables

. \*(18 variables, 160 observations pasted into data editor)

```

. mlogit livstrat age sex thsize tfasize lndowsh nexcont credacc educ hhincom tinmark imseed
leader coop dis, base (0) rob

```

```

Iteration 0: log pseudolikelihood = -212.67459
Iteration 1: log pseudolikelihood = -166.67771
Iteration 2: log pseudolikelihood = -161.2388
Iteration 3: log pseudolikelihood = -160.52528
Iteration 4: log pseudolikelihood = -160.41816
Iteration 5: log pseudolikelihood = -160.39392
Iteration 6: log pseudolikelihood = -160.38812
Iteration 7: log pseudolikelihood = -160.38688
Iteration 8: log pseudolikelihood = -160.38662
Iteration 9: log pseudolikelihood = -160.38657
Iteration 10: log pseudolikelihood = -160.38655

```

```

Multinomial logistic regression Number of obs = 159
 Wald chi2(42) = 2933.56

```

Log pseudolikelihood = -160.38655      Prob > chi2 = 0.0000  
Pseudo R2 = 0.2459

```
-----+-----
```

|             |                | Robust    |           |       |       |                      |
|-------------|----------------|-----------|-----------|-------|-------|----------------------|
|             | livstrat       | Coef.     | Std. Err. | z     | P> z  | [95% Conf. Interval] |
| -----+----- |                |           |           |       |       |                      |
| 0           | (base outcome) |           |           |       |       |                      |
| -----+----- |                |           |           |       |       |                      |
| 1           |                |           |           |       |       |                      |
|             | age            | .013615   | .0260455  | 0.52  | 0.601 | -.0374333 .0646633   |
|             | gender         | -2.754756 | 1.121877  | -2.46 | 0.014 | -4.953593 -.5559179  |
|             | thhsize        | -.072958  | .0737024  | -0.99 | 0.322 | -.217412 .0714961    |
|             | tfasize        | .3516425  | .1902971  | 1.85  | 0.065 | -.021333 .724618     |
|             | lndowsh        | .3339445  | .6483221  | 0.52  | 0.606 | -.9367434 1.604632   |
|             | nexcont        | -.0925538 | .0697606  | -1.33 | 0.185 | -.229282 .0441744    |
|             | credacc        | .4356314  | .543254   | 0.80  | 0.423 | -.6291269 1.50039    |
|             | educ           | -.064098  | .2619193  | -0.24 | 0.807 | -.5774503 .4492543   |
|             | hhincom        | 2.24e-07  | 2.17e-07  | 1.03  | 0.302 | -2.02e-07 6.50e-07   |
|             | tinmark        | .0205628  | .0123514  | 1.66  | 0.096 | -.0036456 .0447711   |
|             | imseed         | -.3030879 | .5390724  | -0.56 | 0.574 | -1.35965 .7534747    |
|             | leader         | 15.53259  | .7712193  | 20.14 | 0.000 | 14.02103 17.04415    |
|             | coop           | 1.075308  | .5861481  | 1.83  | 0.067 | -.0735207 2.224138   |
|             | dis            | -.4518707 | .6669188  | -0.68 | 0.498 | -1.759007 .8552661   |
|             | _cons          | 1.107304  | 1.574172  | 0.70  | 0.482 | -1.978016 4.192625   |
| -----+----- |                |           |           |       |       |                      |
| 2           |                |           |           |       |       |                      |
|             | age            | .0302557  | .0284758  | 1.06  | 0.288 | -.0255559 .0860672   |
|             | gender         | 12.67354  | 1.09253   | 11.60 | 0.000 | 10.53222 14.81486    |
|             | thhsize        | .0138555  | .0700448  | 0.20  | 0.843 | -.1234297 .1511407   |
|             | tfasize        | .1711653  | .2056247  | 0.83  | 0.405 | -.2318517 .5741822   |
|             | lndowsh        | .0625923  | .7189303  | 0.09  | 0.931 | -1.346485 1.47167    |
|             | nexcont        | -.0464545 | .0509901  | -0.91 | 0.362 | -.1463931 .0534842   |
|             | credacc        | -.0207876 | .6969306  | -0.03 | 0.976 | -1.386746 1.345171   |
|             | educ           | .4013532  | .3099806  | 1.29  | 0.195 | -.2061976 1.008904   |
|             | hhincom        | -3.68e-08 | 2.37e-07  | -0.16 | 0.876 | -5.01e-07 4.27e-07   |
|             | tinmark        | -.0141726 | .0152908  | -0.93 | 0.354 | -.044142 .0157967    |
|             | imseed         | -.2749777 | .5911823  | -0.47 | 0.642 | -1.433674 .8837183   |
|             | leader         | 16.04189  | .7911714  | 20.28 | 0.000 | 14.49122 17.59256    |

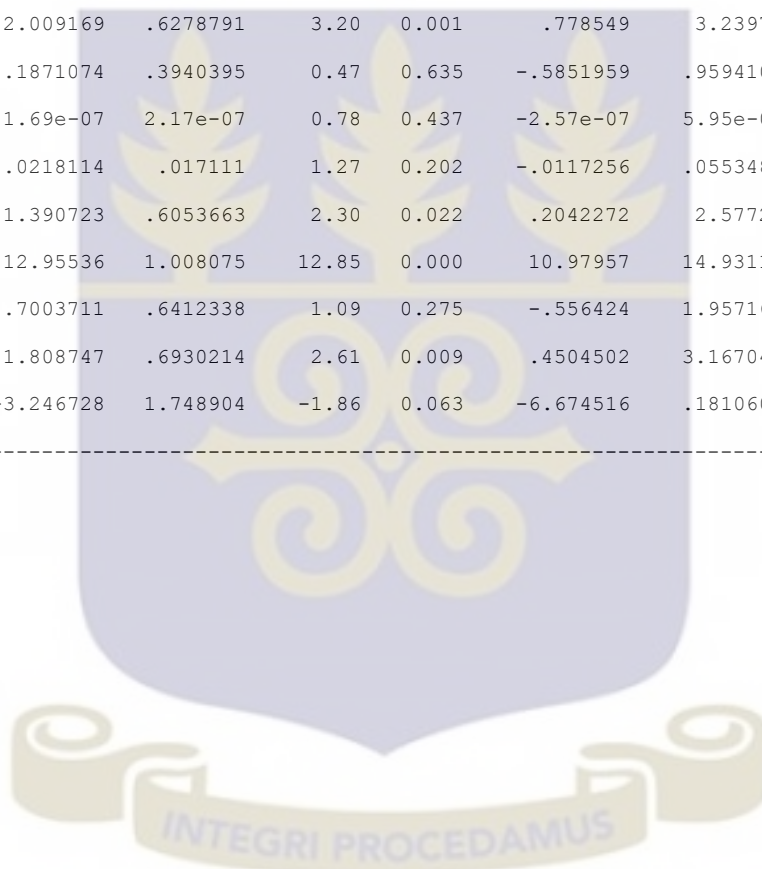
|       |  |           |          |       |       |           |           |
|-------|--|-----------|----------|-------|-------|-----------|-----------|
| coop  |  | .2188408  | .6286959 | 0.35  | 0.728 | -1.013381 | 1.451062  |
| dis   |  | -.0211437 | .6270705 | -0.03 | 0.973 | -1.250179 | 1.207892  |
| _cons |  | -14.75118 | 1.906688 | -7.74 | 0.000 | -18.48822 | -11.01414 |

---

3

|         |  |           |          |       |       |           |           |
|---------|--|-----------|----------|-------|-------|-----------|-----------|
| age     |  | .0095822  | .0282067 | 0.34  | 0.734 | -.045702  | .0648664  |
| gender  |  | -3.140702 | 1.225202 | -2.56 | 0.010 | -5.542053 | -.7393512 |
| thhsize |  | -.0412425 | .0686904 | -0.60 | 0.548 | -.1758732 | .0933881  |
| tfasize |  | .1985413  | .1981365 | 1.00  | 0.316 | -.189799  | .5868817  |
| lndowsh |  | 2.467161  | .9458127 | 2.61  | 0.009 | .6134024  | 4.32092   |
| nexcont |  | .0052099  | .0249163 | 0.21  | 0.834 | -.0436252 | .054045   |
| credacc |  | 2.009169  | .6278791 | 3.20  | 0.001 | .778549   | 3.23979   |
| educ    |  | .1871074  | .3940395 | 0.47  | 0.635 | -.5851959 | .9594107  |
| hhincom |  | 1.69e-07  | 2.17e-07 | 0.78  | 0.437 | -2.57e-07 | 5.95e-07  |
| tinmark |  | .0218114  | .0171111 | 1.27  | 0.202 | -.0117256 | .0553484  |
| imseed  |  | 1.390723  | .6053663 | 2.30  | 0.022 | .2042272  | 2.57722   |
| leader  |  | 12.95536  | 1.008075 | 12.85 | 0.000 | 10.97957  | 14.93115  |
| coop    |  | .7003711  | .6412338 | 1.09  | 0.275 | -.556424  | 1.957166  |
| dis     |  | 1.808747  | .6930214 | 2.61  | 0.009 | .4504502  | 3.167044  |
| _cons   |  | -3.246728 | 1.748904 | -1.86 | 0.063 | -6.674516 | .1810605  |

---



**Appendix 4 Means and Standard errors of the Explanatory Variables**

| <b>Variables</b>                | <b>Measures</b> | <b>Means</b> | <b>Sta.Dev</b> |
|---------------------------------|-----------------|--------------|----------------|
| <b>Age</b>                      | Year            | 43.11        | 11.640         |
| <b>Total farm size</b>          | Hectare         | 2.757        | 3.271          |
| <b>Household size</b>           | Count           | 8.59         | 4.369          |
| <b>Time to market</b>           | Minute          | 25.12        | 20.004         |
| <b>Households annual income</b> | CFA             | 1933701.88   | 3760502.889    |
| <b>Access to credit</b>         | Access          | 0.40         | 0.491          |
|                                 | No Access       | 0.59         | 0.493          |
| <b>Educational level</b>        | No education    | 0.18         | 0.386          |
|                                 | Basic education | 0.27         | 0.445          |
|                                 | Secondary       | 0.07         | 0.254          |
|                                 | Tertiary        | 0.01         | 0.079          |
| <b>Gender</b>                   | Male            | 0.86         | 0.345          |
|                                 | Female          | 0.14         | 0.345          |
| <b>Cooperative</b>              | Not member      | 0.40         | 0.491          |
|                                 | Member          | 0.60         | 0.491          |
| <b>Leadership</b>               | Not participate | 0.6          | 0.231          |
|                                 | Participate     | 0.94         | 0.231          |
| <b>Land ownership</b>           | Not owned       | 0.81         | 0.392          |
|                                 | Owned           | 0.19         | 0.392          |
| <b>Extension contact</b>        | Number          | 0.369        | 7.557          |

Source : Survey data, 2015

Exchange rate during the period of study : 1 GHS = 185 CFA

## Appendix 5 Indexed Sub-components, Major components and Overall for Allada and Bonou

| Major component                           | Sub-component                                                                           | Units   | Allada | Bonou<br>All   | Max.<br>value<br>in<br>districts | Min.<br>value<br>in<br>districts |
|-------------------------------------------|-----------------------------------------------------------------------------------------|---------|--------|----------------|----------------------------------|----------------------------------|
| Demo.<br>Profile                          | % of female-headed HHs                                                                  | %       | 13.15  | 14.3<br>13.75  | 100                              | 0                                |
|                                           | Inverse of Ave. age of female head of HH                                                | 1/Yrs   | 0.023  | 0.021<br>0.022 | 0.035                            | 0.014                            |
|                                           | % of females with no formal education                                                   | %       | 55.3   | 34.5<br>44     | 100                              | 0                                |
|                                           | Ratio of adults available for farm work                                                 | Ratio   | 1.98   | 2.24<br>4.22   | 12                               | 0                                |
| Livelihood strategies                     | % of HH depending only on farm                                                          | %       | 26.32  | 14.29<br>20    | 100                              | 0                                |
|                                           | % of HH depending on farm and off-farm strategies                                       | %       | 43.42  | 26.19<br>34.38 | 100                              | 0                                |
|                                           | % of HH depending on farm and non-farm strategies                                       | %       | 13.16  | 16.67<br>15    | 100                              | 0                                |
|                                           | % of HH depending on farm, off-farm and non-farm strategies                             | %       | 17.11  | 42.9<br>30.63  | 100                              | 0                                |
| Social networks                           | Ave. HH who received help from friends/relatives                                        | %       | 27.6   | 33.3<br>30.63  | 100                              | 0                                |
|                                           | Ave. HH who helped friends/relatives                                                    | %       | 56.6   | 66.7<br>61.86  | 100                              | 0                                |
|                                           | Ave. HH who borrowed money from friends/relatives                                       | %       | 21.1   | 2523.13        | 100                              | 0                                |
|                                           | Ave. HH who lent money to friends/relatives                                             | %       | 25     | 37<br>31.25    | 100                              | 0                                |
|                                           | % of HHs that have not gone to their local gov't for assistance in the past 12 months   | %       | 94.7   | 95.2<br>95     | 100                              | 0                                |
| Health                                    | Ave. time to Health facility                                                            | Minute  | 18.45  | 13.45<br>15.83 | 60                               | 2                                |
|                                           | % of HHs with family member with chronic illness                                        | %       | 39.1   | 46.4<br>42.2   | 100                              | 0                                |
|                                           | % of HHs where a family member missed work or school in the last 2 weeks due to illness | %       | 51.3   | 29.8<br>40     | 100                              | 0                                |
|                                           | Ave. malaria exposure*prevention index                                                  | Mnths   | 6      | 56             | 12                               | 0                                |
|                                           | Ave. no. of mosquito nets in the HH                                                     | No.     | 3      | 5<br>4         | 20                               | 0                                |
| Food                                      | % of HHs dependent solely on family farm for food                                       | %       | 6.6    | 10.7<br>8.75   | 100                              | 0                                |
|                                           | Average number of months HHs struggle to find food                                      | Mnths   | 3      | 3<br>3         | 12                               | 0                                |
|                                           | % of HHs that do not save seeds                                                         | %       | 0      | 7.1<br>3.75    | 100                              | 0                                |
|                                           | % of HHs that do not save crops                                                         | %       | 2.6    | 8.3<br>5.62    | 100                              | 0                                |
| Water                                     | % of HHs reporting water conflicts                                                      | %       | 32.9   | 42.9<br>38.12  | 100                              | 0                                |
|                                           | % of HHs that utilize a natural water source                                            | %       | 19.7   | 13.1<br>16.2   | 100                              | 0                                |
|                                           | Average time to water source                                                            | Minute  | 8.2    | 6.4<br>14.6    | 90                               | 1                                |
|                                           | % of HHs that do not have a consistent water supply                                     | %       | 30.3   | 42.9<br>37     | 100                              | 0                                |
|                                           | Inverse of the average number of liters of water stored per HH                          | 1/Litrs | 0.014  | 0.014<br>0.02  | 1                                | 0                                |
| Natural disasters and climate variability | % of HHs that did not receive a warning about the pending natural disasters             | %       | 98.7   | 100<br>99.4    | 100                              | 0                                |
|                                           | % of HHs with an injury or death as a result of recent natural disasters                | %       | 0      | 1.2<br>1.2     | 100                              | 0                                |
|                                           | Average number of disaster                                                              | Count   | 0      | 1<br>1         | 100                              | 0                                |