ANALYSIS OF INCOME DIVERSIFICATION STRATEGIES AND FOOD SECURITY STATUS OF FARMERS IN OYO STATE OF NIGERIA

BY

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A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTERS OF SCIENCE DEGREE IN AGRICULTURAL ECONOMICS.

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DECLARATION

I hereby declare that this thesis titled **"Analysis of Income Diversification Strategies and Food Security Status of Farmers in Oyo State of Nigeria"** has been written by me and it is a record of my research work. No part of this work has been presented in any previous application for another degree or diploma at any institution. All borrowed ideas have been acknowledge in the text and a list of references provided.

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CERTIFICATION

This thesis titled **"Analysis of Income Diversification Strategies and Food Security Status of Farmers in Oyo State of Nigeria"** by Samuel Olusola OYEWOLE meets the regulation governing the award of the Degree of Master of Science of Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This thesis is dedicated to Almighty God, the giver of wisdom and knowledge

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TABLE OF CONTENTS

Title Page---------- i

Declaration---------- ii

Certification---------- iii

Dedication---------- iv

Acknowledgement---------- v

Table of Content---------- vi

List of Tables---------- x

List of Appendices---------- ------- xi

Abstract---------- xii

Chapter 1---------- 1

INTRODUCTION----------1

1.1 Background to the Study---------- 1

1.2 Statement of the Problem----------4

1.3 Objective of the Study---------- 5

1.4 Research Hypotheses----------6

1.5 Justification of the Study---------- 7

Chapter 2---------- 9

LITERATURE REVIEW---------- 9

2.1 Concept of Diversification---------- 9

2.2 The Determinants of Households' Diversification Behaviours---------- -------- 11

2.2.1 Pull and push factors---------- 12

2.2.2 Risk factor---------- 13

2.2.3 Gender ---------- 13

2.2.4 Education---------- 15

2.2.5 Age---------- ------- 16

2.2.6 Farm size---------- 16

2.2.7 Family-size---------- 17

2.2.8 Asset value---------- 17

2.3 Reasons for Household Income Diversification---------- 18

2.4 Measuring Household Income Diversification---------- 22

2.5 Empirical Studies of Diversification of Income Sources---------- 27

2.6 Concept of Food Security and Insecurity---------- 28

2.7 Approaches to the Measurement of Food Security---------- 36

2.7.1 Food economy approach---------- 38

2.7.2 Group ratings---------- 40

2.7.3 Dietary diversity---------- 40

1.7.4 Coping strategies index---------- 40

1.7.5 The food security module---------- 42

1.8 Determinants of Food Security among Farming Households---------- 43

Chapter 3---------- 47

METHODOLOGY---------- 47

3.1 Study Area---------- 47

3.2 Sampling Techniques and Sample Size---------- 48

3.3 Data Collection---------- 49

3.4 Analytical Techniques---------- 49

3.4.1 Descriptive statistics---------- 49

3.4.2 Diversity index---------- 49

3.4.3 Tobit regression model---------- 50

3.4.4 Food security line---------- 50

3.4.5 Logit regression model---------- 51

3.4.6 Simple regression analysis---------- 53

Chapter 4---------- 54

RESULTS AND DISCUSSION----------54

4.1 Socio-economic characteristics of the respondents in the study area--------- 54

4.1.1 Age distribution---------- 54

4.1.2 Gender of the respondents---------- 55

4.1.3 Marital status---------- 56

4.1.4 Household size---------- 57

4.1.5 Farming experience---------- 58

4.1.6 Educational level of the respondents---------- 59

4.1.7 Farm size---------- 60

4.1.8 Mode of land acquisition---------- 61

4.1.9 Number of extension visits---------- 62

4.1.10 Amount of credit obtained---------- 63

4.1.12 Years of membership of cooperatives---------- 63

4.2 Sources and Pattern of Diversity in Income Sources---------- -------- 64

4.2.1 Farmers' sources of income---------- 64

4.2.2 Farmers' degree of income diversification---------- 66

4.3 Determinants of Income Diversification among the Respondents in the study area.---------- 67

4.4 Food Security Status of the Respondents----------69

4.5 Determinants of Food Security among the Farmers in the Study Area------ 70

4.6 Effect of Income Diversification on Food Security Status of the Famers in the Study Area---------- 73

Chapter 5---------- 75

SUMMARY CONCLUSION AND RECOMMENDATIONS---------- 75

5.1 Summary----------75

5.2 Conclusion----------77

5.3 Recommendation---------- 78

References---------- 80

LISTS OF TABLES

Table 1: Distribution of Respondents in the Study Area---------- ------- 48

Table 2: Distribution of the respondents based on their age---------- ------- 55

Table 3: Distribution of the respondents based on gender---------- 56

Table 4: Distribution of the respondents based on their marital status----------56

Table 5: Distribution of the respondents based on their Household size---------- 58

Table 6: Distribution of the respondents based on their farming experience----- 59

Table 7: Distribution of the respondents based on their level of education------- 60

Table 8: Distribution of the respondents based on their farm size ---------- 61

Table 9: Distribution of the respondents based on land tenure system---------- 62

Table 10: Distribution of the respondents based on the number of extension visit--- ---------- 62

Table 11: Distribution of the respondents based on the amount of credit obtained---------- 63

Table 12: Distribution of the respondents based on years of membership of Cooperative---------- 64

Table 13: Distribution of the farmers according to their income sources---------- 65

Table 14: Distribution of the farmers by their degree of income diversification- 66

Table 15: Determinants of income diversification among the farmers---------- 69

Table 16: Distribution of the respondents by their food security status---------- 70

Table 17: Determinants of food security among the farmers in the study area--- 73

Table 18: Effect of income diversification on food security status of the farmers---74

LIST OF APPENDICES

Appendix 1: Farmers Research Questionnaire ---------- 90

Appendix 2: Calorie content of some commonly eaten food items in Nigeria------ 95

Appendix 3: Adult equivalent scale for adjusting the household size---------- 96

ABSTRACT

This study was conducted to examine the income diversification strategies and food security status of farmers in Oyo State. The specific objectives were to determine the socio-economic characteristics of the farmers, describe the pattern of diversity in income sources among the farmers, identify and describe the determinants of income diversification, determine the food security status of the farmers in the study area, identify and evaluate the determinants of food security among the farmers in the area and determine the effects of income diversification on food security status of the farmers in the study area. A multi-stage sampling technique was used to select 280 farmers for the study. Primary data were used and these were collected with aid of structured questionnaire. Descriptive statistics, diversity index, tobit regression model, food security line, logit model and simple regression analysis were employed to analyze the data. The results revealed that 33 percent of the farmers were within 41-50 years. Only 8 percent were below 30 years of age. The mean age of the farmers was 45 years. The average household size is 6 members and the average farming experience was 19 years. Only 25 percent do not have formal education. About 43 percent had farm size between 0.1-2.0 hectares and Average farm size was estimated to be 3.15 hectares. Majority of the farmers (78.21 percent) had no contact with extension agent. It was found that 52.14 percent had no access to credit. About 48.21 percent did not belong to any cooperative association. It was further found that 10 percent of the respondents had income diversity index of 1. The mean income diversity index was 2.02. The determinants of income diversification in the study area were education, household size, credit and extension contact. These variables were positively related to income diversification. Based on the recommended daily calorie intake of 2260 kilo calorie, it was found that 33.57 percent of the respondents were food secure and 66.43 percent were not food secure. The determinants of food security in the study area were education, household size, extension contact and per capita income of the respondents. Furthermore, income diversification has significant effect on food security. The estimated coefficient of income diversification (0.877) was positive and significant at 5 percent level of probability which implied that as income diversification increases, food security status of the respondents also increases. The study recommended that reduction in food insecurity should involve an integrated approach that promotes education among farm households. Also, agricultural activities should be promoted through the distribution of agricultural inputs such as improved seeds and fertilizers and better extension services delivery in order to boost agricultural production.

Chapter 1

INTRODUCTION

1.1 Background of the Study

Poverty reduction and food security have been the priority objectives since independence not only in Nigeria but also in other Sub-Saharan African (SSA) countries. However, these objectives have not been fully achieved due to a number of factors such as political and economic instability, inadequate infrastructural facilities, and inadequate credit facilities at both household and national levels (Chopra, 2004). In an effort to meet policy objectives, most governments in SSA promote crop output diversification. In response to diversification incentives such as credit facilities and availability of infrastructural facilities, farmers diversify income generation in order to increase per capita income and improved standard of living (Wanyama *et al.,* 2010).

Income diversification among rural households in developing countries is a topic that has received quite a bit of attention in the development literature (Damite and Negatu, 2004; Ellis, 2000). It refers to the allocation of productive resources among different income-generating activities, both on-farm and off-farm (Abdulai and Crolerees, 2001).

Over the past decades, there has been an outstanding trend of activity diversification in rural areas in developing countries. Available literature suggests that rural households adjust their activities either to exploit new opportunities created by market liberalization (Delgado and Siamwalla, 1997) or to cope with livelihood risks (Barrett *et al.,* 2001). These adjustments are found to have an important impact on income, income distribution and welfare across rural households (Block and Webb, 2001; Canagarajah

et al., 2001; de Janvry and Sadoulet, 2001; Ellis, 2000; Hoogeveen, 2001; Reardon *et al.,* 2000). The diversification of activities in rural areas is of great concern for rural development not only because of its expected impact on income and poverty reduction, but also because of its importance for the understanding of out-migration movements and rural exodus (Sylvie *et al*., 2009).

The changing socioeconomic, political, environmental and climatic atmosphere in Nigeria and other developing countries such as, increase incidence of poverty, political instability, climate change and variability has continued to aggravate the living conditions of most households especially those living in the rural areas. The accompanying increase in food insecurity levels has led residents of these economies to devise a number of strategies such as income diversification and community self-help to cushion the negative effects of these changes.

Whether household income diversification is a matter of necessity or choice is important for policy purpose. If rural households diversify out of necessity, policies which facilitate the movement of members of poor households out of high-risk and low-return agricultural activities into non-farm wage employment, and self-employment (in start-up businesses, for example) along with easier access to urban and semi-urban jobs, are of paramount importance. On the other hand, if income diversification is a matter of choice, mostly undertaken by richer households who have the necessary levels of income and assets to make the transition into non-farm activities where there are high entry costs, it may be necessary for an important policy to be put in place along with the

removal of impediments to engaging in high value agricultural activities such as production of cash crops for export markets. In this case, greater emphasis on fostering the growth of incomes in agriculture, especially among poorer households, so that they can generate the necessary capital to move out of agriculture at a later stage, may well be the desired policy objective (Sylvie *et al*., 2009).

Interest in food security has been very strong most especially since the world food crisis of 1972–74 (Ajibola, 2000). During the quarter–century following the Second World War, the faster growth of world food production than of both population and effective demand and the existence of large surplus stocks, kept the subject of global food security in the background. According to FAO (1988), the world food crisis of 1972–74 challenged the prevailing complacency as food suddenly appeared to be in short supply on world markets, cereal prices rose sharply, and food aid fell; those on whom the heaviest burden fell were the poor people in poor countries

At the World Food Summit in 1996, Nigeria along with 184 other countries made a commitment to reduce the number of chronically undernourished people by half by the year 2015 (FAO, 2002). Therefore, in order to formulate effective policies for reaching this goal, a thorough understanding of the causes of food insecurity is needed. Also, the process of identifying the food insecure as target groups and achieving a better understanding of the determinants of food security as policy instruments for development planners is crucial for designing effective food security programmes (Agboola *et al*., 2008).

1.2 Statement of the Problem

There is an emerging concern about the viability of small scale farm agriculture, particularly in the context of the on-going process of globalization. It is contended that viability of small farms can be improved through diversification of agriculture into higher-value crops and those whose consumer demand is high (Joshi *et al.,* 2006). In addition, the interaction of off-farm, crop and livestock income-generating activities are perceived to augments total incomes levels. Farmers adopt different farm enterprises to achieve better incomes and improved standards of living.

Diversification has been analysed as a rational response by households to lack of opportunities for specialization, and was initially considered not the most desirable option. However, recent studies indicate that rather than promoting specialization within existing portfolios, upgrading them to augmenting income could be more realistic and relevant for poverty reduction and food security (Ellis and Freeman, 2005). Several literatures on livelihood diversification across the developing world have pointed to the increasing role farm income diversification plays in reducing food insecurity.

Despite the growing importance of farm and off-farm activities, very little is known about the role they play in the income generation strategies of farm households in developing economies like Nigeria (Ibekwe *et al.,* 2010). The tendency for rural households to engage in multiple occupations is often noticeable, but few attempts have been made to link this behaviour in a systematic way to rural poverty reduction and food security policies. Also less emphasis has been given to household level choices and

especially to the explanation of differences of strategies among households in terms of income-source diversification. Based on the foregoing, the questions of interest in this research were as follows:

(i) What are the socio-economic characteristics of farmers in the study area?

(ii) What are the sources of income and pattern of diversity in income sources among the farmers in the study area?

(iii) What are the determinants of income diversification among the farmers in the study area?

(iv) What is the food security status of the farmers in the area?

(v) What are the determinants of food security among the farmers?

(vi) What is the effect of income diversification on food security status of the farmers in the study area?

1.3 Objectives of the Study

The broad objective of this study was to examine the income diversification strategies and food security status of the farmers in Oyo State. The specific objectives are to:

(i) describe the socio-economic characteristics of the farmers in the study area,

(ii) identify and describe the sources of income and pattern of diversity in income sources among the farmers in the study area

(iii) identify and evaluate the determinants of income diversification among the farmers in the study area

(iv) determine the food security status of the farmers in the study area

(v) identify and determine the determinants of food security among the farmers in the area

(vi) determine the effects of income diversification on food security status of the farmers in the study area.

1.4 Hypotheses

The hypotheses that were tested in this study include the following:

(i) There is no significant relationship between income diversification and socio-economic characteristics of farmers in the study area.

(ii) There is no significant relationship between the socio-economic characteristics of farmers and their food security status of farmers.

(iii) Income diversification has no effect on food security status of farmers in the study area.

1.5 Justification of the Study

One of the most established characteristics of rural communities in developing countries is that they obtain their incomes from many different sources (Reardon 1997, Davis *et al*., 2010). Household income diversification is the norm in rural societies, and specialization in a single activity is the exception. The failure of many food security interventions in Nigeria has been because they ignored the great diversity and heterogeneity in assets and income portfolios across the rural households and the range of activities in which they engage to generate income. It thus becomes important for policymakers to understand the nature and patterns of household income diversification, and distinguish the factors that drive households into diversification of their activities and income sources.

The goal of any food insecurity reduction strategy is to increase income and achieve improvements in other welfare indicators. Any policy whose aim is to increase income must first understand the composition and determinants of rural income so that target interventions can be applied appropriately. This research will examine the income portfolios of farm households in the study area which will provide an in-depth understanding of the different activities that rural households in Nigeria engage in to generate incomes and examine how the socio-economic characteristics of the households affect their income diversification and food security status. It is envisaged that the results of the study will contribute in the design of appropriate food security policies and programmes for rural Nigeria where the majority of the population reside.

The study will provide useful information for policy makers at local, state and federal levels. It will also provide information for researcher, NGOs both local and international for necessary interventions.

Chapter 2

LITERATURE REVIEW

2.1 Concept of Income Diversification

Income diversification refers to several distinct concepts. The patterns of diversification vary depending on the definitions used. One definitions of income diversification, perhaps closest to the original meaning of the term, refers to an increase in the number of sources of income or the balance among the different sources. Thus, a household with two sources of income would be more diversified than a household with just one source, and a household with two income sources, each contributing half of the total, would be more diversified than a household with two sources, one that accounts for 90 percent of the total (Joshi *et al*., 2003; Ersado, 2003).

A second definition of diversification concerns the switch from subsistence food production to commercial agriculture. For example, Delgado and Siamwalla (1997) argue that ‘‘farm diversification’ as an objective in African smallholder agriculture should refer primarily to the part of farm household output undertaken specifically for cash generation’’. A less ambiguous term for this type of diversification is agricultural commercialization. It does not necessarily involve an increase in the number or balance of income sources. For example, a farmer may move from producing various grains, tubers, and vegetables for own consumption to specializing in one or a few cash crops. Third, income diversification is often used to describe expansion in the importance of non-farm income. Non-farm income includes both off-farm wage labour and non-farm self-employment (Reardon, 1997; Escobal, 2001). Diversification into non-farm

activities usually implies more diversity in income sources, but this is not always the case. For example, if a household increases the share of income from non-farm sources, it implies diversification into non-farm activities but not income diversification in terms of the number of income sources. The share of income coming from non-farm activities often correlates with total income, both across households and across countries. This definition of income diversification is linked to the concept of structural transformation at the national level, defined as the long-term decline in the percentage contribution of the agricultural sector to gross domestic product (GDP) and employment in growing economies.

Fourthly, income diversification can be defined as the process of switching from low-value crop production to higher-value crops, livestock, and non-farm activities. "High value crops" are often defined in terms of the value per unit of weight, but it is probably more useful to define them as crops that generate high economic returns per unit of labour or land. This definition focuses on diversification as a source of income growth and a potential means for poverty reduction. Again, diversification from staple crop production into high-value activities often implies greater diversity in crops and income sources, but this is not always the case. For example, if a mixed grain-and-poultry farmer decides to specialize in poultry production, this would represent diversification into a high-value activity, but not diversification in the sense of multiple activities. Thus, many analyses of income diversification conceive of diversification in terms of strategies employed to earn cash income in addition to primary production activities from a variety of sources. It is often argued that this is a strategy primarily intended to

offset risk (Dercon and Krishnan, 1996). These analyses tend to be rooted in economics and quantitative analyses, focusing on the relative importance of the different sources of income of poor households.

However, the definition used by the United Kingdom's Department of Foreign and International Development (DFID) relates to livelihood diversification. 'A livelihood comprises the capabilities, assets (including both material and social resources), and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base' (Chambers and Gordon, 1992). Livelihood diversification therefore refers to attempts by individuals and households to find new ways to raise incomes and reduce environmental risk, which differ sharply by the degree of freedom of choice (to diversify or not), and the reversibility of the outcome. Livelihood diversification includes both on- and off-farm activities which are undertaken to generate income additional to that from the main household agricultural activities, via the production of other agricultural and non-agricultural goods and services, the sale of waged labour, or self-employment in small firms, and other strategies undertaken to spread risk (Carter, 1997; Stark and Levhari, 1982).

2.2 The Determinants of Households' Diversification Behaviours

Various explanations for diversification behaviours can be found in the economic literature to explain both incentives and disincentives for rural households to combine

traditional crops with new crops (Norman, 1974), agricultural crops with animal husbandry or forestry activities (Kurosaki, 1997), and/or agricultural activities with off-farm activities such as migration and tourism (Barrett *et al*., 2001; Murphy, 1999). On one hand, in a changing economic and institutional environment, agricultural households have incentives to find alternative income sources in order to secure their livelihood. But on the other hand, several factors such as risk aversion and barriers to entry can also hold them back from engaging in new activities. A rich literature on income diversification in rural areas has identified a wide range of explanatory factors for activity restructuring out of subsistence farming at the household level (Abdulai and CroleRees, 2001; Smith *et al*., 2001; Ellis, 1998). The motives are usually divided into two categories: "pull factors" and "push factors" (Barrett *et al*., 2001).

2.2.1 Pull and push factors

Pull factors include benefits from complementarities between activities (Norman, 1974), new income opportunities created by market development (Davis and Pearce, 2001), improvement of infrastructure (Jalan and Ravallion, 1998), and diversification for asset accumulation (Hart, 1994). Push factors include ex-ante risk management (Hoogeveen, 2001; Alderman and Paxson, 1992), ex-post risk coping (Carter, 1997), high transaction costs (Omamo, 1998), liquidity constraints and credit market failure (Reardon *et al.,* 1994), and the seasonality of agricultural activity (Sahn, 1989). Household livelihood strategies are jointly determined by these two sets of factors. Market development encourages households to reallocate their productive resources to higher-return activities (Xia and Simmons, 2004), while poor resource endowments, agricultural seasonality,

frequent climatic hazards, and poor access to credit may all push rural households to undertake a wider range of activities in order to secure their livelihood.

2.2.2 Risk factor

Risks play a key role in the activity diversification process. Since they strongly influence rural production, income and welfare, risks are major "push" factors that encourage households to turn to a more diversified portfolio of activities (Carter, 1997; Reardon *et al.,* 1992). Both on-farm and off-farm diversification can thus be seen as efficient mechanisms for households to reduce income risks (Ellis, 1998, 2000; Hoogeveen, 2001). However, in a rapidly changing and volatile environment, uncertainty may also make agricultural households more reluctant to engage in new activities. This is particularly the case for poor households who typically have a higher absolute risk aversion (Rosenzweig and Binswanger, 1993). In a poor area, agricultural households may prefer to stick to traditional crops for which risks are known, even though expected returns associated with alternative activities are higher and a more diversified portfolio of activities would certainly reduce the expected hazard of total income. Risk aversion combined with poverty traps, an ageing population and a massive migration of young people may strongly reduce incentives for poor agricultural households to allocate a higher portion of their land to non-food crops.

2.2.3 Gender

Gender relationships are important in shaping diversification process. Social organisation and culture can significantly influence the relative access of diverse gender (and age groups) to household's capital assets (Ellis, 2000; Gladwin *et al*., 2001; Dolan,

2002). This might result in a different degree of involvement in diversification activities and/or in an unequal distribution of their benefits between genders (Warren, 2001). In some activities, migratory wage labour or off-farm enterprises are basically men's business, which results in transferring to women the whole responsibilities of conventional subsistence and cash cropping (the so called "feminisation of agriculture"). However, in other cultures, women are often able to play an autonomous role on their own small-scale enterprises or migrate to towns or abroad.

Gender is an integral and inseparable part of rural livelihoods. Men and women have different assets, access to resources, and opportunities. Women rarely own land, may have lower education, and their access to productive resources as well as decision-making tend to occur through the mediation of men. Women typically confront a narrower range of labour markets than men, and lower wage rates. In general, therefore, diversification is more of an option for rural men than for women. In this sense, diversification can improve household livelihood security while at the same time trapping women in customary roles (Ellis, 1999). It is possible for diversification to improve the independent income–generating capabilities of women and in so doing, also improve the care and nutritional status of children, since a high proportion of cash income in the hands of women tends to be spent on family welfare. A diverse portfolio of activities contributes to the sustainability of a rural livelihood because it improves its long-run resilience in the face of adverse trends or sudden shocks. In this respect, individual and family livelihoods display similarities to larger social and economic groupings up to the level of the economy at large. In general, increased diversity

promotes greater flexibility because it allows more possibilities for substitution between opportunities that are in decline and those that are expanding.

2.2.4 Education

Education and training produce a labour force that is skilled. Unskilled agricultural wage labour is supplied by rural households. This has implication for poor wages and low income. The determinants of participation in and returns to rural non-farm activities include the households' assets endowment (quantity and quality) and its access to public goods and services as shown in various studies such as those of Reardon *et al*. (1998) and de Janvry and Sadoulet (2001). For particular activities, such as education, some households are "pushed" to diversify their activities off-farm only to cope with external shocks to their own farming (such as drought or a steep decline in farm-gate prices). Or, households may be "pulled" into non-farm activities because it often pays more than farming and generates cash. Oluwatayo (2009) in his work on poverty and income diversification among households in rural Nigeria noted that household heads with formal education, married, engaged in farming as primary occupation and those living far away from headquarters of state or local government are less diversified than those with no formal education, single/divorced/widowed, non-farming households and those living very close to the state or local government headquarters. The implication of this is that respondents with formal education (especially those educated up to tertiary level) are engaged in better and well-paid salaried jobs than those with no formal education hence they have lower likelihood of combining two or more jobs (multiple job holding).

This is because education enhances the potential of respondents and makes them access available opportunities with little or no stress.

2.2.5 Age

Lemi (2006) in his work on income diversification in Ethiopia noted that age has positive but declining effects on participation in off-farm diversification, which implies that farmers participate in off-farm activities at a decreasing rate as they advance in age. Ibekwe *et al*. (2010) in their work on determinants of farm and off –farm income among farm households in south east Nigeria noted that the age of household head was significant and negatively correlated with farm income. This may be due to the fact that the older the farmer the less productive the farmers will be. This equally has implication for farm productivity.

2.2.6 Farm size

Land is an important resource in agricultural production. Due to the fragmented nature of farm holdings in rural areas of a developing economy like Nigeria, farmers always diversify their livelihood activities. Also, an increase in farm size in form of land consolidations will increase farm income through better economies of scale (Ibekwe, 2001; Nwaru, 2004). The small size of farm holdings has been one of the factors that are driving people out of farm business and has been regarded by many authors as one of the push factors (Readon *et al*., 1998).

2.2.7 Family-size

Family size is an important factor for livelihood diversification. Reardon (1997) had observed that family size affects the ability of a household to supply labour to the farm. In a large family some members could remain engaged in traditional farming while others could opt for non-farm activities. It will also reduce the risk of livelihood failure. Ibekwe *et al*. (2010) reported that farm household size was significant and correlated with farm income diversification. This may be due to the fact that increase in farm household size means increase in family labour. This has implication for availability of labour during peak periods of farm activities.

2.2.8 Asset value

Individuals' own asset base helps both directly and indirectly in livelihood diversification. Asset offers a store of wealth as well as provides an opportunity to invest in alternative enterprises. Several researchers have noted that the lack of asset base creates an entry level barrier for the resource-poor households in diversifying their livelihood options particularly towards high-end remunerative non-farm activities (Dilruba and Roy, 2012). Reardon *et al*. (1998) also showed that although the pattern of income diversification between farm and non-farm activities varies sharply across regions, it is clearly linked to the assets or endowments of rural households. It is obvious that non-farm earnings account for a considerable share of farm household income in rural Africa, typically more so than in other world regions.

2.3 Reasons for Household Income Diversification

Perhaps the most important characteristic of household incomes in rural areas of low-income developing countries is their extreme variability. Weather variation, the incidence of diseases, pests and fire, and random shifts in international crop prices cause farm incomes to fluctuate unpredictably in these countries. In the face of large shocks to their income, there are three ways in which poor rural households may attempt to smooth out their consumption. The first of these is the pooling of risk by which households within a village, kinship group or social network may share each other's risk through institutional arrangements which lead to the efficient allocation of risk. If such arrangements work well and if shocks or adverse effects are idiosyncratic, peculiar to the household, then for any particular household, its consumption would track the aggregate consumption of the village, kinship group or social network and not be affected by the household's income. In this case, there would be little incentive for the household to diversify risks by diversifying the sources of its income. While several empirical studies have documented the existence of risk-pooling mechanisms at the village level (such as Platteau and Abraham, 1987, and Townsend, 1994, for southern India, and Udry, 1994, for northern Nigeria), these studies also show that full risk-pooling is rarely observed, particularly among the poorer households. Thus, informal insurance mechanisms that exist among members of the village, kinship group or social network will not enable all households to insulate consumption from income fluctuations. This would particularly be true if fluctuations in household income are due more to aggregate village-level factors than to household-specific factors.

A second way in which rural households may attempt to insulate consumption from large unpredictable movements in their incomes is to smoothen consumption over time using saving and credit transactions. Households will save in the face of positive shocks to their income, which are expected to be transitory, and dis-save (or borrow) in the face of negative shocks to income. By doing so, they will attempt to keep consumption unchanged. While there is a good deal of evidence that households engage in a substantial degree of inter-temporal consumption smoothing using saving and credit transactions (Besley, 1995; Deaton, 1992), there are strong reasons to believe rural households in developing countries do not have access to credit markets that allow them to insulate consumption completely from income shocks. If credit markets are not perfect, some rural households will be constrained in their ability to borrow when faced with a large transitory fall in their incomes, leaving these households unable to cope with income variability.

Both risk-pooling and the use of saving and credit institutions may be seen as ex-post means of smoothening consumption. However, if these ex-post mechanisms fail (or more importantly, if households anticipate that these ex-post mechanisms will fail), then the preferred strategy for the household is to smoothen consumption ex-ante by reducing income fluctuations. Morduch (1995) refers to this as income smoothing. While households may smoothen income by favouring variability-reducing inputs and production techniques and shifting production into more conservative but less profitable modes (Rozenzweig and Binswanger, 1993), perhaps the most common method of income smoothing that they choose is to diversify the sources of their income. Thus,

income diversification may be seen as an outcome of risk-averse households' strategy to minimize the variance of their income by achieving an income portfolio with low covariate risk among its components (Alderman and Paxson, 1992; Reardon, 1992, Reardon *et al.,* 1997 and Ellis, 2000). Since poorer households tend to be more risk averse (given the widely held belief that risk aversion tends to decrease income and wealth), have fewer assets which can be sold to smoothen consumption, and have less access to credit facilities or formal and informal insurance mechanisms, the poor will be more likely to diversify ex-ante as a coping response to shocks (Dercon, 2002 and Barrett *et al.,* 2001). This theoretical implication of the incomplete markets approach to rural household behaviour underpins the diversification as survival perspective in the literature on household income diversification. Under this approach, income diversification is mostly undertaken by poor households as a mechanism to smoothen consumption in the face of high income volatility and out of sheer desperation.

Several studies find evidence to support the hypothesis that diversification is driven by income variability linked to survival concerns. Reardon *et al.* (1992) observed that harvest shortfalls and terms of trade movements drive diversification using four years of household data from Burkina Faso. Using household data for rural districts in Nepal, Menon (2009) reported that with the head of the household in agriculture, other members of the household are likely to choose agriculture in districts where rainfall is more uncertain. A similar finding is obtained for Mexico by Eakin (2005). Anderson and Deshingkar (2005) find that households with lower asset holdings have more diversified income portfolios using data from six villages in Andhra Pradesh, India

(though they also find greater diversification among households with asset holdings over a certain level, implying that there is U-shaped relationship between asset holdings and diversification).

An alternate explanation of household income diversification is based on the assumption of economies of scope in production, along with entry barriers to high return economic activities. Economies of scope exist when the same inputs generate greater per unit profits when spread across multiple outputs than when dedicated to any one output (Barrett *et al*., 2001). Unlike the presence of economies of scale, which tend to favour specialization in one activity, economies of scope tend to favour diversification as a means of profit maximization. While most empirical studies on Africa or Asia find little evidence of economies of scale beyond a very small farm size, it is likely that diversification across different types of crops (cash crops versus food crops, for example) or across different types of activities (farming in combination with livestock rearing or remittances derived from the migration of some members of the household to cities, for example) can lead to significant income enhancement for the household. However, entry into many activities both within and outside agriculture needs initial capital or access to land.

Both agricultural and non-agricultural thresholds are evident in most rural economies, where richer households are able to make investment outlays to meet fixed costs in the purchase of cattle and agricultural implements, the setting up of non-farm enterprise or the education of their children for the skilled labour market while poorer households are

unable to do so (Barrett and Swallow, 2005). Diversification in this case would be mostly driven by accumulation motives, and is mostly confined to richer households. There is strong evidence that income diversification has acted as a means of accumulation in Sub-Saharan Africa. Households with larger holdings of land or access to capital are more able to move into high-return activities such as livestock rearing or non-farm employment (Dercon, 1998, Block and Webb 2001, Abulai and CroleRees, 2001, Barrett *et al*., 2001, De Weerdt, 2010).

2.4 Measuring Household Income Diversification

Household income diversification has been measured in various ways in the empirical literature. Many studies of household income diversification consider diversification as a move away by rural households from growing crops (that is, being pure cultivators) to off-farm or nonfarm labour, rearing livestock or migration of some members of the household to cities. Diversification is measured using discrete indicator variables for different types of income portfolios that may exist among households (for example, an income portfolio with no diversification –pure cultivators - will get a value of one, a mixed income portfolio with both cultivation and livestock rearing will get a value of two, a mixed-income portfolio of both farming and nonfarming income will get a value of three, and so on). Other studies measured income diversification as the proportion of income derived from non-farm sources (Reardon *et al*., 1992, Davis *et al*., 2010).

While the move from farm activities to non-farm activities will be clearly beneficial to the household in most contexts, measuring diversification as a transition to more

rewarding sources of income or a move away from subsistence agriculture is problematic. Firstly, it becomes a tautological matter that diversification is associated with accumulation if the former is measured as a movement from less productive to more productive sources of income. Secondly, it is not obvious why a household that derives, say, 75 per cent of its income from one source of income should be seen as being more diversified than another household which may derive equal shares of income from different sources of income. For this reason, the use of indicator variables to denote the degree of diversification in different income portfolios is problematic– the construction of such indicator variables is sensitive to the assumptions made about the precise thresholds of income shares used to assign different households to different income portfolio categories.

There are quite a few methods which explain either concentration (that is, specialization) or diversification of commodities or activities in a given time and space by a single indicator, important ones include (i) index of maximum proportion (ii) Herfindal index (iii) Simpson index (iv) Ogive index (v) Entropy index (vi) modified Entropy index (Chand, 1996).

Index of maximum proportion is used to determine farm level diversification. The expression is given as:

Index of maximum proportion (M_d) = Max P_i

Where P_i is the proportion of i th activity in total income. With increase in

diversification, maximum proportion held by any activity i.e. M_d , decreases (Jha nd Jha,1995).

The Herfindahl index is a measure of the size of firms in relation to the industry and an indicator of the amount of competition among them. Named after economists Orris C. Herfindahl and Albert O. Hirschman, it is an economic concept widely applied in competition law, antitrust and also technology management. It is defined as the sum of the squares of the market shares of the 50 largest firms (or summed over all the firms if there are fewer than 50) within the industry, where the market shares are expressed as fractions. Increases in the Herfindahl index generally indicate a decrease in competition and an increase of market power, whereas decreases indicate the opposite (Catherine and Alan, 2004).

Herfindahl index is used to measure the degree of industry concentration. It can also be used to measure the degree of concentration of income from various sources at the individual household level. It is then calculated as the sums of squares of income shared from each income source. The Herfindahl index as such increasing concentration whereby households with perfect specialization (i.e. having only one source of income) have a value of one (Babatunde and Qaim, 2009).

The Simpson Index of Diversity (SID) is widely used to measure the biodiversity of an ecosystem and is expressed as follows;

$SID = 1 - \sum p_i^2$

Where p_i = proportion of organisms of classified in a species.

Σ = Summation sign

The Simpson Index of diversity can also be interpreted as the probability that two randomly selected organisms will be from the same species. Joshi *et al* (2003) adopted the Simpson Index to compare crop diversification in several South Asian Countries. In this study, it will be used to measure income and crop diversity, interpreting p_i as the proportion of income from source "i" and/ or crop "i". If there is just one crop or source of income, $p_i = 1$, so SID = 0, as the number of crops/income sources increases, the share "p_i" declines as does the sum of the squared share, so that SID approaches 1. If there are K sources of income then SID fall between zero and 1-1/K. The closer SID is to zero, the more specialization, and the further it is from zero, implies diversification (Ibrahim *et al*., 2009)

Ogive Index was First employed by Tress (1938) to study diversity in the field of economics, the Ogive Index has been implemented in the context of country specialization by Bahl *et al.* (1971), Hackbart and Anderson (1975), Wasylenko and Erickson (1978) or Attaran and Zwick (1987).

$$O = \sum_{i=1}^{I} I \ (b_i - \frac{1}{I})2$$

Specialization is analyzed using the equal distribution of employment across all sectors as an explicit benchmark for maximum dispersion. The index is a linear transformation

of the Herfindahl Index. Therefore, the country ranks of both indices are perfectly correlated if α = 2. The lower bound of the Ogive Index is zero; the upper bound is $I - \frac{1}{1}$

The Ogive Index puts relatively more weight on industries which deviate much from $\frac{1}{1}$ (i.e. both on industries that are heavily over- and under-represented in the country's economic structure) due to the fact that the numerator is squared. Therefore the Ogive measure can easily overestimate the degree of diversity between countries. To overcome this problem, one could use the modified Ogive Index of Jackson (1984), which employs absolute deviations instead of squared values. Using simple deviations only (instead of absolute values) as Siegel *et al*. (1995) is problematic, however, since over- and under-specialization could cancel out one another, leading to an underestimation of specialization.

The entropy index is a measure of "evenness" the extent to which groups are evenly distributed among organizational units (Massey and Denton, 1988). More specifically, Thiel and Anthony (1971) described entropy index as a measure of the average difference between a unit's group proportions and that of the system as a whole. It can also be interpreted as the difference between the diversity (entropy) of the system and the weighted average diversity of individual units, expressed as a fraction of the total diversity of the system (Reardon and Glan, 2002).

2.5 Empirical Studies of Diversification of Income Sources

Delgado and Siamwalla (1997) examined the broad pattern of income diversification in Asia and Africa. They noted that African farmers often have highly diversified crops mixed as a strategy to reduce risk associated with weather. In contrast, crop diversity in Asia is associated with farmers diversifying away from rice into higher value crops and activities such as horticulture, livestock, and aquaculture. In a study in Zimbabwe, Ersado (2003) examined the relationship between income diversification and household welfare. Using household survey carried out in 1990/1991 and 1995/1996, the study measured income diversification by the number of income sources, the share of non-farm income and the Simpson index of diversity. The study found that in rural areas, richer households had more diversified income sources while in urban areas the reverse was true. Ersado (2003) also found that households living in rural areas with highly variable rainfall were more likely to have large number of income sources which is consistent with the idea of income diversity as a risk management strategy.

Babatunde and Qaim (2009) noted in his study of pattern of income diversification in rural areas of Nigeria that income diversification is not only a risk management strategy in rural Nigeria, but a means to increase overall income which is consistent with previous studies from Sub-Saharan Africa. Babatunde and Qaim (2009) further argued that diversification has a significantly positive impact on total household income and households have unequal abilities to diversify their income sources. Education, asset endowment, access to credit and good infrastructure conditions increase the level of household diversification, as they improve the opportunities for households to start their

own businesses and find employment in the higher paying non-farm sector. In other words, resource-poor households in remote areas are constrained in diversifying their income sources.

Ibrahim and Onuk (2009) reported that household income and household farm size had negative and significant relationship with non-farm diversification. This implies that the lower the household income and household farm size, the higher the tendency to diversify into non-farm activities and vice-versa. Households with smaller farms are likely to combine farm and non-farm activities than those with larger ones. Ibrahim and Onuk (2009) also noted that dependency ratio and access to credit had positive and significant coefficients. A household with a very high ratio of dependants has a higher tendency to diversify into other non-agricultural activities in order to cope with the needs of the household. Access to credit plays a crucial role in the decision to diversify. Increase in access to credit by a given household will increase the level of non-farm diversification. The reason is that the increase in the capital base will enable household to start another business apart from the previous one because there is available capital (credit).

2.6 Concept of Food Security and Insecurity

In the past, the concept of food security was left undefined, perhaps by default, since the notion of food security, though not new, had defied solutions. More recently, however, the concept of food security is generally accepted as entailing not only food availability through domestic production, storage and or trade, but also, and perhaps more

importantly, food access through home production, purchase in the market, or food transfers (Abalu, 1991).

Food security refers to the condition in which all people, at all times, have physical, social, and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO, 1996). Food availability, stability of supplies and food access are related determinants of food security. At the household level, food security implies an adequate access to food over time. This is possible when there is adequate food availability to the household, and an adequate income capacity for the purchase of the available food. Stability of food implies that the food availability is not affected by any shocks or risks affecting food production at all times. Food access has three components: 1) physical access to food, 2) economic access to food, and 3) sustainable access to food. Physical access implies food availability or food supply to the household, as there might be food available at the national level which, however, may not trickle down to the household level (Oluwatayo, 2009). Food insecurity is the result of a confluence of factors. The raging conflicts in Africa and drought in parts of southern Africa alone need not cause food insecurity. Food security, by definition, is not simply about availability of food, it also entails accessibility, that is, the ability of individuals or a nation to acquire food on a sustainable basis. Food security is also about the reliability and distribution of food. The former relates to utilization and consumption of safe and nutritious food, while the latter relates to the equitable provision of food to points of demand at the right time and place (Richard, 2002).

Food security is a broad concept that is more than food production and food accessibility. In reality, it revolves around four pillars, namely: food availability, food accessibility, nutritional factors and stability of food supply (Babatunde *et al*., 2007). A nation is food secure when food is available and accessible in sufficient quantity and quality for a productive livelihood for every individual (Kidane *et al*., 2005). On the other hand, food insecurity represents the inability to fulfill such conditions; that is people have no access to sufficient, safe and nutritious food needed to maintain a healthy and active life. The most evident sign of food insecurity is the prevalence of hunger.

The committee on World Food Security has defined the three specific aims of Food Security (FAO, 1983) as:

- Ensuring adequate production of food;
- Maximizing the stability of food supplies; and
- Ensuring access to food particularly on the part of those in greatest needs.

Underlying this concept of food security are two assumptions, not in themselves new, but until recently, not given sufficient attention by policy makers in many African countries. These assumptions are that:

2. A distinction must be made between permanent and temporary food insecurity; and
3. Famine, hunger and malnutrition are, in most cases, as much a problem of poverty as of shortage of food supplies.

Temporary food insecurity is the result of short-term fluctuations in production brought about by fluctuations in household incomes, food consumption and in the availability of food at national and global levels. Temporary food insecurity is thus a manifestation of temporary lack of access to sufficient food and can therefore be eliminated or drastically reduced by corrective stocking policies. Because enough supplies of food to go around has traditionally been available at the global level, the problem of temporary food insecurity in the Nigerian context must be seen largely as one of ability to buy and the important variables here are the magnitude of instability in international prices and the average levels of real incomes prevailing in the economy. Permanent or structural food insecurity represents a state of continuous inadequate access to food and is due to a long-term structural deficit in production and chronic inadequacy or purchasing power.

There is no doubt that food security problem in Nigeria is first and foremost one of inadequate levels of locally produced food stuff. This is not to equate the concept of food security with that of food self–sufficiency. There is, however, no doubt that overall economic growth in Nigeria, hence national food security, will depend critically on enhanced productivity and expanded production of food crops. The country, like many other African countries, has a comparative advantage in food crops production and the attainment of an acceptable growth rate per capita food production will not only coincide with the attainment of national food security but also greater self-sufficiency in food supply (Abalu, 1991).

National food security in Nigeria, in either its permanent or temporary form, should be defined within the context of national food self-reliance because its attainment will depend on general increases in food production and not on imports or food aid. The definition of food security in Nigeria must therefore be seen as adequate access by most Nigerians to mostly domestically produced food at all times. Thus, a national food security system must be built on a sustainable access to food by all Nigerians, which access must not depend on more than marginally on food imports either along commercial lines or as food aid. If such a dependence was forced on the country, it will impact negatively on the country's scare foreign exchange and capital resources, since to pay for such imports the country would have to forego other more critically needed imports as well as cut back on investments, including those needed to eradicate chronic or permanent food supply deficits or to expand export earnings.

It is now generally accepted that the problem of food insecurity is not just about food alone but also about the general problem of poverty and unequal distribution of purchasing power among and within regions. Famine, for example, represents the most severe form of temporary food insecurity manifesting itself in a sudden collapse of food consumption and dramatic increase in the incidence of diseases and death. Because famine is caused by a variety of factors including crop failures, natural calamities such as floods and sometimes, high food prices, it often occurs without substantial reduction in food availability per head or even in the face of food exportation from the affected region (Abalu, 1991).

Temporary food insecurity can be perceived as either a problem of shorter variability in domestic food production trends which are usually weather–induced and can be quite substantial or as variability in world prices for food imports and/or decreases in the prices of exports used to cover the cost of food imports. In some cases, political and social conflicts may lead to the disruption of normal channels of delivery of food to an area causing scarcity of food supply. In such situations a resumption of the flow of food along these channels is what is required. This usually demands a political or engineering solution rather than an economic one. Domestic government policy- such as sudden changes in price policies, subsidy levels, support prices or other intervention policies- may contribute to changes in the levels of domestic food supply and consumption. Governments through pricing and other policies can secure a more favourable distribution of the available food supply and a larger share for the poor (Abalu, 1991).

Fluctuation in non-food production and prices also has considerable impact on food insecurity. For example, a cotton grower's consumption of rice may be as much affected by a sharp fall in cotton prices as by an increase in the price of rice. It is, therefore, more useful to classify the cases of food insecurity as production fluctuations, regardless of whether the fluctuations is in the food or the non-food sector and as price fluctuations, regardless of whether it is the price of food or of non food that is affected.

In some situations, severe imbalance in levels of income prevents the participation of some sectors of the population in the commercial grain markets. For example, food production and food supply in some countries are said to be very stable around trend and

the probability of a shortfall in trend output or in trend supply is negligible. Should such as a shortfall occur, it can easily be met through imports, placing little burden on foreign exchange earnings. Such countries do not have an aggregate food insecurity problem. Nevertheless, many of them are known to have a high percentage of the population suffering from light to severe malnutrition caused by inadequate purchasing power. For this segment of the population a relatively small shortfall in the supply of food that causes an increase in food prices will reduce their real income and could generate a decrease in food consumption and worsening of their already impaired nutritional status. The food insecurity here arises from the fact that the poor segment of the population spends a high proportion of their income on food. What this suggests is that stable food supplies in the aggregate for the nation as a whole is not necessarily synonymous with consumption stability for large segments of the population if the nation does not have the means to deliver the available food to the households that are exposed to food insecurity risks (Abalu, 1991).

Food insecurity also has an adverse impact on scarce foreign exchange and capital resources. In order to pay high food import bills, countries facing food insecurity must often forego other needed imports or cut back investments including those designed to reduce long–run food supply deficits or expand export earnings. The average ratio of the actual value of food imports to total export revenues (including services) can be used as an indicator of the pressure put on foreign exchange supplies to finance food imports. Even more important is the degree to which this ratio can reach significantly higher levels in unfavourable years (Abalu, 1991).

The concept of food insecurity includes not only the lack of availability, access, and utilization or use of food (for example, food preparation and intra-household food distribution), but also perceptions (for example, that food is insufficient, inadequate, unacceptable, uncertain, or unsustainable) (Wolfe and Frongillo, 2001). For example, food insecurity has been defined as the inability to acquire or consume an adequate quality of sufficient quantity of food in socially acceptable ways, or the uncertainty that one will be able to do so (Radimer *et al*., 1992). Food insecurity as experienced in other locations is likely to be somewhat different but will include similar components that go beyond availability and access.

Food insecurity affects dietary intake and ultimately, nutritional status and physical well-being. Although, measures of dietary intake of individuals can assess some aspects of food insecurity, such as caloric insufficiency and nutrient inadequacy, they do not assess the cognitive and affective components of uncertainty (expressed as anxiety), unacceptability, or un-sustainability. For example, current intake may be adequate, but food security may still be experienced because of concern over future intake. Alternatively, intake may be inadequate, but only temporarily to protect supplies and prevent future food insecurity (Wolfe and Frongillo, 2001). Furthermore, growth status is an indirect outcome, since it also depends on factors such as health and child care, in addition to access. Food insecurity is also related to available economic and social resources. Precursors such as income or total expenditure are correlated with caloric sufficiency, but they only capture this component of food insecurity and are quite indirect (Maxwell, 1992).

2.7 Approaches to the Measurement of Food Security

Food security measures are used to develop and validate quantitative measures of food security status of households. These measures are based largely on researches that involved quantitative, in-depth interviews with low-income, rural women with and without children who had experienced food insecurity (Radimer, 1990). Food insecurity is experienced differently at the household, adult and child levels; adults buffer the effects of food insecurity on children. Food insecurity has four components, two related directly to food (quantity and quality of food) and two are psychological and social in nature (certainty, which is related to worry about food, and acceptability, which is related to how food is acquired). (Wolfe and Frongillo, 2001)

A number of methods have been used to gain an understanding of food insecurity and to apply this understanding to the development of measures.

From the literatures, there are basically two approaches to the measurement of food security. These are the qualitative and quantitative approaches. The qualitative approach includes the Food and Agriculture Organization (FAO) method, Household Income and Expenditure Surveys (HIES) and the Food Surveys (FIS). The FAO method developed an Aggregate Household Food Security Index (AHFSI), which attempts to incorporate the availability and stability of food supplies and access to them. The factors and processes that are assumed to influence the status of household food security causally have been used to assess the validity and relevance of the index. The AHFSI uses FAO's estimates of the prevalence of under–nutrition in developing countries and regions as its primary building block. It combines these estimates with measures of the

extent of the food gap between undernourished people and national average requirements for dietary energy, the inequality in the distribution of food gaps and the instability in the annual availability of dietary energy (Adebayo, 2010). It is given by the formula.

$$AHFSI = 100 - [H(G + [1-G]I^P) + \tfrac{1}{2} d\{1-H(G + [1-G]I^P\}\ 100$$

Where:

H = Head count ratio that measures the proportion of undernourished people in the total population, expressing the extent of undernourishment.

G = Food gap that measures the proportion of shortfall in the average daily dietary energy intake of the undernourished from the national nutritional requirements, expressing the depth of undernourishment.

I^P = Measure of inequality in the distribution of the food gaps.

d = Coefficient of variation in dietary energy supplies, measuring the likelihood of facing temporary food insecurity.

Household Income Expenditure Survey (HEIS) and the Food Intake Surveys (FIS) estimate dietary intake and try to relate to energy and protein needs. The measurement is typically indirect and based on food balance sheets and national income distribution and consumer data linking hunger and nutrition. Another quantitative method (anthropometrics) measures physical effects on growth and thinness (FAO, 2002). On

the other hand, the qualitative measures of food security include amongst others the following:

2.7.1 Food economy approach

According to Devereux (2001), this approach divides a geographical area into food economy zones, each representing a common livelihood system. Next, communities are stratified into three to six wealth groups in terms of locally defined characteristics (asset ownership and months of self-provisioning) and households are allocated to these wealth groups, which can then be used to generate estimates of food insecure populations for targeting purposes.

The food economy approach is most powerful as a diagnostic tool rather than as a source of precise statistics. Food economy analysts prefer to present data in ranges rather than point estimates. Disadvantages of the methodology include (1) it is resource– and time– intensive (2) it generates relative proportions rather than absolute numbers, and (3) it has not yet been validated against conventional measures of poverty and food security (Adebayo, 2010).

The food-economy approach monitors household food security and early warning of food crises by quantifying household access to food in normal years and the effects of external shocks on this. By using in-depth interviews and various RRA techniques, a "baseline picture" describing how different families in a geographic-specific "food-economy zone" normally obtain food and nonfood income is developed, describing

sources and means of food and means of food and cash income and sometimes expenditure patterns. Potential changes in agricultural, economic, or security conditions that affect families' access to food are also quantified. A software program called Risk Map is then used to calculate the extent to which these changes affect different households' access to food and the amount this may be reduced by household-coping strategies. The results include an estimate of the shortfall in food income that people are likely to face, the costs of families and the likely effects of different levels and forms of assistance.

Households become food-insecure when the actual acquisition of food falls below what is required for all members to live "active and healthy" lives. Accordingly, for a household to be "food-secure," the following balance should hold:

$$Ac \geq R$$

Where $Ac = B + O + G + A + \Delta St$, and Ac is household units; R is the sum of individual nutrient requirements; B is food bought; O is household food production retained for consumption; G is food received as private gifts; A is food aid received as wages or gifts and ΔSt is the net change in household food stocks. This food balance equation highlights the fact that households use their entitlements to acquire food in a number of ways and that households may be both producers and consumers. It is important to be aware of this feature when assessing the impact of structural adjustment on household food security. For example, raising food prices might worsen food security by increasing the cost of food. However, it also increases household income which other things being equal should improve food security (Eele *et al.*, 1993).

2.7.2 Group ratings

This methodology evolved out of wealth ranking, so it shares a basic similarity with the Food Economy Approach. It has been tested recently for reliability by IFPRI in several countries including Honduras and Malawi. Essentially, single sex or mixed-sex groups assign members of their community to one of three categories – "food secure", "intermittently insecure" and "food insecure". The results from different groups are then compared. Unfortunately, the conclusion from Honduras was disappointing as the consistency of responses between sets of rates was alarmingly low (Bergeron *et al*., 1998).

2.7.3 Dietary diversity

This is an extremely simple method, again pioneered by IFPRI; this method generates a list of locally consumed foods (about 30 to 40 items) and then households are asked if they have consumed each item in the past week. The numbers of the different items consumed are simply added not even weighted, for instance, scoring meat higher than cereals, as most dietary assessments do and the higher the number, the more diverse the diet and the more food secure the household (Hoddinott and Johannes, 2001).

3.7.4 Coping strategies index

This was proposed by Maxwell (1995). He identified nine coping strategies by focus groups in urban Accra. Individual households were scored by frequency of adoption of these strategies and then composite indices were constructed to rank households by degree of food insecurity. The advantages of this method are that it is quick, cheap and

simple to administer, yet complex in terms of its conceptualization and the information it generates about household behaviour under stress. But coping strategies are locally–specific, as urban and rural "coping" options are different and scaling up to national level present formidable challenges. The method also shares a limitation with the group rating approach, that is, low consistency of responses between different groups (Maxwell *et al.,* 1999).

Devereux (2001) defines coping strategies as a response to adverse events or shocks. The definition by Snel and Staring (2001) captures the broad notion of coping strategies, namely, "all the strategically selected acts that individuals and households in a poor socio-economic position use to restrict their expense or earn some extra income to enable them to pay for the basic necessities (food, clothing, shelter) and not fall too far below their society's level of welfare". The latter definition implies that coping strategies involves a conscious assessment of alternative plans of action. This does not necessarily mean that their choice of strategies is always successful in achieving their intended objectives. In fact, the coping strategies often have unintended negative effects.

Ellis (2000) defines coping strategies as the methods used by households to survive when confronted with unanticipated livelihood failure. The strategies pursued by households differ in several aspects, that is, within the household and between households. Due to varying degrees of wealth among households, different coping behaviours are adopted by households at different poverty levels. However, some coping strategies are to all households although the extents to which such strategies

enable a household to remain afloat depend on the assets at their disposal (Devereux, 2001). Above all, the general tendency is that the lower the household asset status, the more likely the household would engage in erosive responses such as selling off productive assets such as farm implements.

Literature distinguishes between risk management (income–soothing) and risk coping strategies (consumption–soothing). The former attempts to reduce the ex-ante risk impact, for example through income diversification. Faced with an income or food shock, households may either protect their food consumption by purchasing or receiving food from other sources (Davies, 1993). Risk coping strategies deal with consequences (ex-post) of risk. Risk coping strategies involve self-insurance (through precautionary savings) and informal group-based risk-sharing (Davies, 1993). Households can insure themselves by building up assets in 'good' years and depleting these stocks in 'bad' years (Dercon, 2002). Households may modify their food consumption by reducing/modifying food intake or reduce the number of consumers (Corbett, 1988). Consumption soothing strategies generally increases as income–generating strategies come under strain.

3.7.5 The food security module

The core module questionnaire contained a total of eighteen questions for households with children and ten questions for households without children. All the questions in the module were converted into a food security scale using Rasch Measurement Model- a type of non-linear factor analysis that falls into the family of Item of Response Theory

(IRT) models (Hamilton *et al.,*1997). The food security scale is a continuous measure ranging from a score of zero to ten. The scaling model calculates a value on the scale for each household. The value is based on the number of questions answered affirmatively, adjusted for the number and severity of the questions answered. These data also allow the population studied to be divided into four distinct categories of food security based on the differing conditions, experiences and behaviour patterns that characterize each range of security. These four categories include: food secure– little or no evidence of food insecurity; food insecure without hunger–food insecurity is shown by households' non-adjustments to food management; food insecure with moderate hunger–food intake for an adult is reduced and adults are experiencing hunger owing to resource constraints; and food insecure with severe hunger–households with children reduce the children's food intake to an extent that implies that the children experience hunger as a result of inadequate resources within the household, while adults show evidence of more severe hunger (for example, going an entire day with no food).

3.8 Determinants of Food Security among Farming Households

The socio-economic characteristics and resources of individual households have been identified as basic factors influencing the food security status of households (Sanusi *et al*., 2006). In Nigeria, studies on the determinants of food security status of rural households will be better appreciated if the theoretical and empirical ramifications of these variables in relation to food security are highlighted. Lawal (2003) in a study n food security in Kwara State, identified household income, annual food stock from own production and the size of the household as the major determinants of food security. His

study further showed that expenditure on food by household has no impact on food security. Agboola (2004) in a study on food security in Osun State using Tobit regression model observed that household size and diversification extent had a negative effect on food security, while gender of household head, child dependency ratio, input usage, remittance, total expenditure, food allocation and crop output had a positive effect on food security. The study further revealed that age of household head, education level, farm size, commercialization, cooperative membership, fertilizer and chemical had no significant effect on food security. Kidane *et al* (2005) identified household size, education and farmland size and land quality as determinants of food security status of a household. Educational attainment by the household head could lead to awareness of the possible advantages of modernizing agriculture by means of technological inputs, engage them in diversification of household incomes which, in turn, would enhance households' food supply. Amaza *et al.* (2006) noted that the major determinants of food insecurity are: household size, gender, educational level, farm size and types of household farm enterprises. They concluded that policy measures towards the provision of better family planning should be given adequate attention and priority by the government in addition to improving access to education, credit facilities and agricultural extension services for rural households. Sanusi *et al.* (2006) reported in his study conducted in some selected Local Government Areas of Oyo and Lagos States that income status and the educational status of the household head influenced food security status of the household.

Babatunde *et al.* (2007) noted that household income, household size, education status of the household head and quantity of food obtained from own production determined the food security status of farming households in North Central Nigeria. They concluded that socio-economic variables of the households are important determinants of their food security or insecurity status.

Faleke *et al*. (2003) in his study on the determinants of food security in Southern Ethiopia using logit regression model, found that technology adoption, farming systems, farm size, land quality, household size, per capita aggregate production and access to market are the major factors that have significant impact in determining household food security. Bahiigwa (2002) in his study found that the probability that a household will be food secure is dependent upon the fertility of its land, good distribution and intensity of rainfall, planting improved seeds, having adequate labour, and having neighbors that are food secure. On the other hand, large numbers of non-productive dependents, inadequate rains and long distances to the market decrease the probability that a household will be food secure.

Scharr (2003) hypothesized that important determinants of food security are socio-economic developments such as population growth, increase in income and diets with respect to health and education. He further explained that population growth obviously increases the overall demand for food products while a higher income can increase the demand for livestock products (more meat and milk products), as human diets. Cohen *et al*. (1999) used logit regression model to estimate the marginal effects of household

characteristics on food security. The study indicated that household characteristics do not appear to influence the food security level substantially. Donald (1999) in a study on economic determinants and dietary consequences of food security in the United States identified only income as a major determinant of food security.

Chapter 3

METHODOLOGY

3.1 Description of the Study Area

The study was conducted in Oyo State. The State is an inland State in South-western Nigeria. It covers 27,107.93 square kilometres (Oyo State Government, 2010). The state lies between latitudes 7^0N and 9^0N of the equator and between longitudes 2.5^0E and 5^0E of the prime meridian (Oladejo *et al*., 2011). It is bounded in the south by Ogun State, in the north by Kwara State, in the west partly by Ogun State and partly by the Republic of Benin and in the east by Osun State (Meludu and Ajayi, 2005).

Oyo State has a projected population of 7,743,221, using a population growth rate of 3.2% from 2006 population census (NPC, 2006). The state covers an area ranging from swamp forests to western uplands. In-between are rain forests and deciduous forest/savanna. The rainfall pattern is bimodal with the peaks in June, early July and September, while November to February is characterized by harmattan brought about by the effect of the northeasterly trade winds from the Sahara desert. The agricultural sector forms the base of the overall development thrust of the state, with farming as the main occupation of the people in the area. Crops usually grown include maize, yam, cassava, cocoyam, melon, cowpea, and vegetables under mixed cropping practices. The livestock reared include poultry, sheep and goats.

3.2 Sampling Procedure and Sample Size

A multi-stage sampling technique was used for this study. In the first stage, three out of the four agricultural zones in Oyo State were purposively selected because these zones are purely agrarian communities. The zones that were selected were Ogbomoso, Oyo and Saki zones. In the second stage, two blocks were randomly selected from each of the three agricultural zones. In the third stage, two cells were randomly selected from each of the six blocks. Finally 10% of the farmers in each of the twelve cells were randomly selected because the farmers are homogenous and this percentage can represent the whole population. A total of 280 respondents were used for the study (Table 1).

Table 1: Distribution of respondents in the study area

Agricultural Zones	**Agricultural Blocks**	**Agricultural Cells**	**Sample Frame**	**Number of Farmers selected**
Ogbomoso	Suru-lere	Iresaadu	310	31
		Oko	270	27
	Ori-ire	Ikoyile	320	32
		Oolo	210	21
Oyo	Atiba	Aawe	205	20
		Akinmorin	220	22
	Afijo	Fiditi	305	29
		Ilora	260	26
Saki	Atisbo	Tede	203	20
		Irawo	150	15
	Kajola	Ilero	190	19
		Ayetoro	180	18
Total			**2800**	**280**

*Source: Oyo State Agricultural Development Programme (OYSADEP)

3.3 Data Collection

Primary data were used for this study. These were collected with the aid of structured questionnaire. Information were collected on: (a) households' socio-economic characteristics such as age, gender, educational level, farm size, farm income, non-farm income, extension contact, membership of association, household size, amount of credit received, number of income sources; (b) pattern and determinants of income diversification these such as age, education, household size, farm size, amount of credit received, membership of associations and extension contact; (c) household food expenditure and consumption; (d) households' food security status and determinants of food security such as age, education, household size, farming experience, amount of credit received, membership of cooperative, per-capita income and extension contact; and (e) effects of income diversification on households' food security status.

3.4 Analytical Techniques

3.4.1 Descriptive statistics

Descriptive statistics such as frequency counts, means and percentages were used to achieve objective i of the study.

3.4.2 Diversity index

The Diversity Index was used to achieve objective ii. The Diversity index is expressed as;

$$Diversity\ index = \frac{1}{\sum_{i=1}^{n}\left(\frac{ri}{\sum_{i=1}^{n}\mathrm{ri}}\right)^2} \quad \text{---------- (1)}$$

Where:

i = 1, 2, ------- n income sources

ri = the receipts from i^{th} income sources

n = number of respondents

If there is a lack of diversity, the index is unity. So the degree of diversification depends on the amount by which diversity index exceeds unity.

3.4.3 Tobit regression model

Tobit regression model was used to achieve objective iii of the study.

The model is specified as:

$Y_i = X_i\ b$ if $i^* = X_i b + u_i > T_i$ ---------- (2)

Where:

Y_i = Income diversification (1 if farmers did not diversify income and greater than 1 if farmers diversify income).

X_1 = Age of household head (years)

X_2 = Education (years of formal schooling)

X_3 = Household size (number of persons in the household)

X_4 = Farm size (hectares)

X_5 = Amount of credit received (Naira)

X_6 = Membership of cooperative (years)

X_7 = Extension contact (Number of contacts)

3.4.4 Food security line

Food security line was used to achieve objective iv. This was used to classify households into either food secure or food insecure, depending on which side of the line

they fall. The food security line was the FAO recommended minimum daily energy requirement per adult equivalent of 2260kcal adopted by Babatunde *et al.* (2007) and Okezie *et al.* (2011). A respondent whose daily per capita calorie intake is up to 2260 kilo calorie intake was regarded as food secure and those below 2260 kilo calorie were regarded as food insecure households.

The food security line was given as:

$$Z = Yi / R \text{ ---------- (3)}$$

Where:

Zi = food security status of ith households.

Yi = daily per capita calorie intake of ith household

R = recommended per capita daily calorie intake (2260Kilo calorie)

3.4.5 Logit regression model

Logit regression model was used to achieve objective v. The probability of a household being food secure is determined by an underlying response variable that captures the true economic status of a household. The underlying response variable y* in the case of binary choice is defined by the multivariate logit regression relation:

$y^* = (-\sum Xi\beta j) + \mu$

where: $\beta_j = \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8,$ and $X_i = X_{i1}, X_{i2}, X_{i3}, X_{i4}, X_{i5}, X_{i6}, X_{i7}, X_{i8}$

The relevant logistic expressions are given as:

$$Prob\,(y* = 1) = 1 - F * (\Sigma X_i\beta_j) = \frac{e^{\Sigma X_i\beta_j}}{1 + e^{\Sigma X_i\beta_j}}$$

$$Prob\,(y* = 0) = F * (\Sigma X_i\beta_j) = \frac{e^{\Sigma xi\beta j}}{1 + e^{\Sigma xi\beta j}}$$

Where: F = The cumulative distribution function for $\mu_{i,...}$

$$Prob\left(Y_i = \frac{0}{\beta j} X_i\right) = F\left(-\sum X_i\beta_j\right), \quad Prob\left(Y_i = \frac{1}{\beta_j} X_i\right) = 1 - F\left(-\sum X_i\beta_j\right)$$

The likelihood function is given by;

$L = \prod\{F(-\sum X_i\beta_j)\} \prod\{1 - F(-\sum X_i\beta_j)\}$

$y_i = 0 \qquad y_i = 1$

While the log likelihood function for the expression is:

$H(\beta) = \log L(\beta) = \sum_{i=0}^{n} log y_i$ ---------- (5)

$1 - F\left[\left(-\sum X_i{'}\beta_i\right) + (1-y)\log F\left(\left(-\sum X_i\beta_j\right)\right)\right]$

Where;

Y = Food security status (1= food secure, 0= not food secure)

μ_i = a logistic cumulative distribution in F

X_i = characteristics of households

X_1 = Gender (male= 1 , female = 0)

X_2 = Education (years of formal schooling)

X_3 = Household size (number of persons in the household)

X_4 = Farm size (hectares)

X_5 = Amount of credit received (Naira)

X_6 = Membership of cooperative (years)

X_7 = Household per capita income (Naira)

X_8 = Extension contact (Number of contacts)

β_i = The coefficients for the respective variables in the logit function

The probability of a household being poor and the corresponding change in probability due to unit change in a variable X_1 are given as:

prob ($y_i = 1/\beta X_i = \frac{e^{\Phi}}{1+e^{\Phi}}$) ---------- (6)

3.4.6 Simple regression analysis

This was used to achieve objective vi. Regression analysis is a statistical tool for the investigation of relationships between variables. It is used when two or more variables are thought to be systematically connected by a linear relationship. In the study, only two variables were involved. The model is specified below:

$y = \beta_0 + \beta_i X_i + \varepsilon$ ---------- (7)

Where:

y = Income diversification indices obtained for individual respondents

X_i= Food Security status of the farmers obtained from the estimation of daily calorie intake of the respondents

β = Regression coefficient

β_0 = Constant

ε = error term

Chapter 4

RESULTS AND DISCUSSION

4.1 Socio-economic Characteristics of the Respondents in the Study Area

This section described the results of socio-economic characteristics assessment for the farmers because of their perceived effect on income diversification and food security, these are; age, household size, farm size, years of farming experience, educational level, membership of cooperative, extension contact, access to credit and marital status.

4.1.1 Age distribution

The results presented in Table 2 represent the distribution of the respondents by their age. About 33 percent of the farmers were within 41-50 years, 28 percent were between 31-40 years while 17 percent were above 60 years. Only 8 percent were below 30 years of age. The mean age of the farmers was 45 years, implying that the farmers were in their active age group. This results were similar to the results obtained by Oluwatayo (2010) in his work on poverty and income diversification among households in rural Nigeria, he reported an average age of 45 years and noted that only a few of those surveyed are either too young or too hold to engage in one activity or the other in his study area. Age is very important in agricultural production and livelihood activities. Adubi (1992) argued that age, in correlation with farming experience, has a significant influence on the decision making process of farmers with respect to risk aversion, adoption of improved agricultural technologies, and other production-related decisions. Age has also been reported by Amaza *et al*. (2009) in their work on changes in household food security and poverty status in PROSAB area of Southern Borno State to determine how active and productive the farmer would be. It has also been found to affect the rate of household adoption of innovations, which in turn, affects household

productivity and livelihood improvement strategies (Dercon and Krishnan 1996). Age is associated with skills enhancement (experience), accumulation of resources and extensive social capital that ought to contribute positively to well-being (Bashaasha *et al*., 2006). Minot and Epprecht (2006) noted that age may be associated with accumulation of skills, more experience and accumulation of assets thereby allowing the household to diversify into more remunerative non-farm activities while maintaining food production for own consumption.

Table 2: Distribution of the respondents based on their age

Age (Years)	**Frequency**	**Percentage**
21-30	22	7.86
31-40	78	27.86
41-50	92	32.86
51-60	40	14.29
61-70	48	17.14
Total	**280**	**100.00**
Average age	45	

4.1.2 Gender of the respondents

The distribution of the respondents by their gender (Table 3) showed that 71.79 percent were male and 28.21 percent were female. This result was similar to result obtained by Oluwatayo (2009) in his study on poverty and income diversification among households in rural Nigeria, noted that majority of his respondents were males engaged in different

livelihood activities in his study area. He further argued that there are more male-headed households in rural Nigeria than female-headed households.

Table 3: Distribution of the respondents based on gender

Gender	Frequency	Percentage
Male	201	71.79
Female	79	28.21
Total	**280**	**100.00**

4.1.3 Marital status

The distribution of the respondents by their marital status is shown in Table 4. More than three quarters (87.14 percent) of the respondents were married, while 12.86 percent were single. The significance of marital status on agricultural production and livelihood activities can be explained in terms of the supply of agricultural family labour. It is expected that family labour would be more available where the household heads are married (Amaza *et al*., 2009). Marital status may influence the size of households as married farmers may have larger household sizes which may increase consumption expenditure thereby making them more prone to food insecurity.

Table 4: Distribution of the respondents based on their marital status

Marital status	Frequency	Percentage
Married	244	87.14
Single	36	12.86
Total	**280**	**100.00**

4.1.4 Household size

The distribution of the respondents by household size is shown in Table 5. From the table, 61.43 percent had 4-6 members. Those with 7-9 members constituted 18.21 percent. Only 15.71 percent had household size which ranged between 1-3 members. The average household size was 6 members. The significance of household size in agriculture hinges on the fact that the availability of labour for farm production, the total area cultivated to different crop enterprises, the amount of farm produce retained for domestic consumption, and the marketable surplus are all determined by the size of the farm household (Amaza *et al.,* 2009). Size of the household may enhance labour availability that can be used for different activities. However, the implication of household size for food security is that small-sized households are less prone to food insecurity than large-sized households because large household sizes have low per capita incomes which make them more prone to food insecurity than small-sized households (Mwabu, 2002; Oluwatayo, 2007). Ahmed (2011) argued that large household size is associated with increased household consumption expenditure which reduces the money that could be used for production purposes. The result obtained in this study is similar to the result obtained by Oluwatayo (2010) and Babatunde *et al.* (2007).

Table 5: Distribution of the respondents based on their Household size

Household size (number)	Frequency	Percentage
1-3	44	15.71
4-6	172	61.43
7-9	51	18.21
10-12	13	4.64
Total	**280**	**17.14**
Average household size	6	

4.1.5 Farming experience

Respondents' distribution by their farming experience (Table 6) showed that 30.71 percent had between 11-20 years of farming experience, 26.07 percent had 21-30 years and 29.29 percent had 1-10 years of farming experience. Only 1.43 percent had farming experience greater than 50 years. Average farming experience was 19 years. Farming experience is expected to influence income diversification because the accumulation of skills over time by older farmers can make them combine different income-generating activities which in turn improve their income level and food security status. Farming experience is an important factor determining both the productivity and the production level in farming activities. But the effect of farming experience on productivity and production may be positive or negative. Generally, it would appear that up to a certain number of years, farming experience would have a positive effect; after that, the effect may become negative. The negative effect may be derived from aging or reluctance to change from old and familiar farm practices and techniques to those that are modern and improved (Amaza *et al.,* 2006).

Table 6: Distribution of the respondents based on their farming experience

Farming experience (Years)	Frequency	Percentage
1-10	82	29.29
11-20	86	30.71
21-30	73	26.07
31-40	35	12.50
41-50	4	1.43
Total	**280**	**100.00**
Average farming experience	19.40	

4.1.6 Educational level of the respondents

Distribution of the respondents by educational level (Table 7) indicates that 25.36 percent had no formal education, 22.5 percent had primary education, 37.14 percent had secondary education and 15 percent had tertiary education. This result showed that majority of the respondents (74.74 percent) in the study area had one form of formal education or the other. Najafi (2003) noted that educational attainment is very important because it could lead to awareness of the possible advantages of modern farming techniques and diversification of households' incomes which in turn would enhance household food security.

Table 7: Distribution of the respondents based on their level of education

Level of education	Frequency	Percentage
No formal education	71	25.36
Primary education	63	22.50
Secondary education	104	37.14
Tertiary education	42	15.00
Total	**280**	**100**

4.1.7 Farm size

The distribution of the respondents by their farm size is shown in Table 8. The results revealed that 42.5 percent had farm size of between 0.1-2.0 hectares, 36.07 percent had between 2.1 and 4.0 hectare and 15.71 percent had between 4.1-6.0 hectares. Only 5.69 percent had farm size greater than 6 hectares. Average farm size is 3.15 hectares. From the results, majority of the farmers in the study area had small farm sizes and could be classified as subsistence farmers. Small farm size may affect the size of food production which in turn will affect the food security status of the farmers. According to Najafi (2003) food production can be increased extensively through expansion of area under cultivation. Therefore under subsistence agriculture, farm size is expected to play a significant role in influencing a farm household's food security because size of the land under cultivation will determine the size of food production. Also, limited farm size may encourage the farmers to diversify into non-farm activities.

Table 8: Distribution of the respondents based on their farm size

Farm size (ha)	Frequency	Percentage
0.1-2.0	119	42.50
2.1-4.0	101	36.07
4.1-6.0	44	15.71
6.1-8.0	12	4.29
8.1-10.0	4	1.40
Total	**280**	**100.00**
Average farm size	3.15	

4.1.8 Mode of land acquisition

The result of mode of land acquisition in Table 9 showed that more than one third (47.86 percent) of the respondents in the study area obtained their farm land through inheritance, 14.64 percent rented their farm land, 4.64 percent obtained their land through purchase and 9.64 percent through gift. Mode of land acquisition determines farmer accessibility to farm land and limited access to farm land may encourage farmers to diversify into non-farm activities. Access to land may determine the scale of food production thereby enhance the food security status of the farmers.

Table 9: Distribution of the respondents based on land tenure system

Mode of land acquisition	Frequency	Percentage
Inheritance	134	47.86
Purchased	13	4.64
Gifted	27	9.64
Rented	41	14.64
Borrowed	65	23.21
Total	**280**	**100.00**

4.1.9 Number of extension visits

As shown in Table 10, majority of the farmers (78.21 percent) in the study area had no contact with extension agent while 10 percent had between 1-2 contacts 10.36 percent had between 3-4 contacts and 1.43 percent had more than 4 contacts. Limited extension contact may reduce farmers' accessibility to information on improved farm technologies which in turn can make farmers to diversify into non-farm activities. Contact with the extension can lead to improvement in food production as a result of information on improved agricultural technologies which will enhance food security status of the farmers.

Table 10: Distribution of the respondents based on the number of extension visits

Number of extension visit	Frequency	Percentage
No contact	219	78.21
1-2	28	10.00
3-4	29	10.36
5-6	4	1.43
Total	**280**	**100.00**

4.1.10 Amount of credit obtained

The results presented in Table 11 show the distribution of the respondents by the amount of credit received. The results reveal that 52.14 percent had no access to credit, 19.29 percent received between10001-20000 and 6 percent received between 20001-30000. Only 2.84 percent received above 50000. Access to credit can increase farmers' liquidity which may encourage them to invest in more rewarding non-farm activities. Also, accessibility of farmers to credit facilities may increase their access to agricultural inputs which may increase food production thereby increasing their income and food security status.

Table 11: Distribution of the respondents based on the amount of credit obtained

Amount of credit obtained (₦)	Frequency	Percentage
0	146	52.14
1-10000	24	8.57
10001-20000	54	19.29
20001-30000	17	6.07
30001-40000	4	1.43
40001-50000	27	9.64
50001-60000	4	1.42
60001-70000	4	1.42
Total	**280**	**100.00**

4.1.12 Years of membership of cooperatives

The results in Table 12 show the distribution of the respondents by their years of membership of cooperatives. It was found that 48.21 percent did not belong to any cooperatives, 18.21 percent had between 1-5 years of cooperative membership, 20.36

percent had between 6-10 years of membership and 4.64 percent had more than 15 years of membership. Membership of cooperative can enhance the accessibility of farmers to credit facility and serve as a medium for exchange of ideas that can improve their farm and non-farm activities.

Table 12: Distribution of the respondents based on years of membership of cooperative

Years of membership (Years)	Frequency	Percentage
0	135	48.21
1-5	51	18.21
6-10	57	20.36
11-15	24	8.57
16-20	13	4.64
Total	**280**	**100.00**

4.2 Sources and Pattern of Diversity in Income Sources

4.2.1 Farmers' sources of income

The results in Table 13 show the distribution of farmers based on their different income sources. It was found that 22.18 percent derived their income from arable crop farming, 13.02 percent from tree crop farming and 11.09 percent from livestock production. Only 3.81 percent obtained income from non-agricultural wage employment, 8.75 percent from agricultural wage employment, 19 percent from non-farm self-employment and 3.93 percent from remittances. Non-agricultural wage employment includes formal and informal jobs in education, construction, commerce, health and administration. Self-employment includes handicrafts, shoe cobbling, barber's work, tailoring, bricklaying, carpentry as well as trading. Remittance income includes money sent by children and

relatives living elsewhere. These results showed that agriculture remains the major source of rural income for the farmers. Babatunde and Qaim (2009) in their study on patterns of income diversification in rural Nigeria found arable crop production, which is mainly subsistence in nature, to be the most important single source of income providing about 45% of total income. They also found that more than half of their respondents derived income from livestock enterprises, though this accounted for less than 5% of total income. Idowu *et al*. (2011) in their study on non-farm income diversification and poverty among rural farm households in Southwest Nigeria found that majority (94.89%) of the rural farm households were involved in arable cropping, followed by tree cropping (61.56%) Involvement in natural resource collection was the least (12.41%) among the households.

Table 13: Distribution of the farmers according to their income sources

Source of income	Number of farmers	Percentage of farmers	Average income(₦)	Income share in total income (%)
Farm Income				
Arable cropping	276	22.18	93531.82	28.93
Tree cropping	162	13.02	39509.32	12.22
Livestock sales	138	11.09	29913.67	9.25
Non-farm income				
Non-agricultural wage employment	34	3.81	48559.06	15.02
Agricultural wage employment	78	8.75	27913.67	8.64
Non-farm employment	168	18.86	65894.12	20.38
Remittance income	35	3.93	17914.25	5.54
Total	**891**	**100.00**	**323235.9**	**100.00**

* Multiple responses were allowed, hence total frequency exceeded sample size

4.2. 2 Farmers' degree of income diversification

The results in Table 14 show the degree of income diversification among the farmers in the study area. Respondents with the most diversified income sources had the largest index and those with the least sources had the smallest index. Ten percent had a diversity index of 1. This implies that these farmers did not diversify their income sources. About 8 percent had diversity index between 1.1 and 1.5, 1.79 percent had between 3.1-3.5 and about 2.86 percent had diversity index between 3.6 and 4.0. The mean income diversification index is 2.02. This implies that an average respondent in the study area had its members involved in almost in all the types of income–generating activities simultaneously. These activities were distributed between the two sectors, that is the farm and non-farm sectors due to long list of activities identified in the area. On average, a respondent was involved in at least one farming activity and one non-farm activity. The result obtained is consistent with Idowu *et al.'s* (2011) who reported an average income diversification index of 2.83.

Table 14 Distribution of the farmers by their degree of income diversification

Diversity indexes	**Frequency**	**Percentage**
1	28	10.00
1.1 - 1.5	22	7.85
1.6 - 2.0	98	35.00
2.1 – 2.5	73	26.07
2.6 – 3.0	46	16.43
3.1 – 3.5	5	1.79
3.6 – 4.0	8	2.86
Total	**280**	**100.00**
Mean	2.02	

4.3 Determinants of Income Diversification among the Respondents in the Study Area.

The factors that determine income diversification are presented in Table 15. The results showed that the coefficient obtained for education was positive and significant at 1 percent level of probability. This result implies that each additional year of schooling increases income diversification by 0.6294. Education enhances the potential of respondents and makes them assessed available opportunities with little or no stress. The positive coefficient of education agrees with results of studies earlier reported by Minot *et al.* (2006) that education gives individuals access to a number of different economic activities, either as a formal requirement for wage earning jobs or because it helps them in setting up and managing their own small businesses.

The coefficient obtained for household size was positive and significant at 10 percent. This implies that increase in household size would increase income diversification. Increase in household size may increase labour availability which will make it easier for the household to let some members engage in off-farm and other income generating activities.

Amount of credit received was positive and significant at 5 percent level of probability. This means that amount of credit received would increase income diversification by 0.0004. This result is similar to that reported by Babatunde (2009) who noted that credit can reduce liquidity constraints and increase the capacity of households to start off-farm business. Ibrahim (2009) also noted that access to credit without any means of

increasing farm size will cause the households to invest in non-farm activities in order to increase the rate of return to capital investment.

The coefficient obtained for extension contact was positive and significant at 5 percent level. The implication of this is that increase in the number of extension contact would increase income diversification. Contact with extension can provide information to the respondents on better and modern techniques of farming as well as income-generating activities.

The coefficients obtained for age, farming experience and membership of cooperatives were not significantly related to income diversification. However, age was negative and this implies that an increase in age would decrease income diversification. This is because the older the farmers the less their willingness to take risks (Philips and Stenthal, 1977; Fabyan, 1999). The result on age is similar to the result obtained by Lemi (2006) who found that farmers' participation in income diversification decreased as their age increases. The non–significance of membership of cooperatives may be attributed to the fact that about half of the respondents did not belong to cooperative associations.

Based on the findings of this study, the hypothesis which states that there is no significant relationship between income diversification and socio-economic characteristics of farmers is rejected while the alternative hypothesis which states that

there is significant relationship between income diversification and socio-economic characteristics of farmers is accepted.

Table 15 Determinants of income diversification among the farmers in the study area

Variable	Coefficient	Standard Error	b/St.Er.
Age(X_1)	-0.1955	0.4096	-0.477^{NS}
Education(X_2)	0.6294	0.1451	4.337***
Household size (X_3)	3.4885	2.0127	1.733*
Farming exp. (X_4)	0.1414	0.5289	0.267^{NS}
Credit (X_5)	0.0004	0.0002	1.913**
Cooperative (X_6)	0.2364	0.7736	0.306^{NS}
Extension cont. (X_7)	5.5081	2.6326	2.092**
Sigma	27.5119	3.6585	7.520***

*** = P < 0.01 ** = P < 0.05
* = P < 0.10 NS = Not significant

4.4 Food Security Status of the Respondents

The result of the food security status of the respondents is presented in Table 16. Based on the recommended daily calorie intake of 2260 kilo calories, it was observed that 33.57 percent of the respondents were food secure and 66.43 percent were food insecure. From the results of the analysis, about two-thirds of the respondents were not food secure with an average daily per capita calorie consumption of 1547.66 calories which is about 31.51 percent less than the recommended minimum daily calorie requirement. Only one-third of the respondents were food secure with average daily

calorie intake of 4816.69, which is 53.07 percent greater than the recommended daily calorie intake requirement. This is similar to results obtained by Babatunde (2007) in his study on the socio-economic characteristics and food security status of farming households in Kwara State. He reported that based on the recommended daily calorie intake of 2260 Kcal, it was observed that 37.2% of the households were food secure and 62.8% were food insecure. Ibrahim *et al.* (2009) reported in their studies on food security and resource allocation among farming households in north central Nigeria that more than half (58.9 percent) were substantially consuming less than the recommended daily per capita calorie requirement.

Table 16: Distribution of the respondents by their food security status

Statistical Estimates	**Food secure**	**Food insecure**
Frequency	94 (33.57)*	186 (66.43)*
Average daily calorie intake	4816.69	1547.66
Maximum daily calorie intake	5758.36	15211.50
Minimum daily calorie intake	2262.00	386.78
Standard deviation	1644.27	1912

*Figures in parentheses are percentages

4.5 Determinants of Food Security among the Farmers in the Study Area

Results presented in Table 17 show the factors that determine the food security status of the respondents in the study area. It was revealed that four out of the nine variables included in the model were significant. These variables were education, household size, extension contact and per capita income of the respondents. The coefficient obtained for

education is positive and significant at 5 percent level. This implies that the higher the educational level, the more food secure the farmers and vice versa, This is because education enhances the productivity of the respondents and the respondents tend to be better informed and have better food management techniques that will ensure equitable and all-round supply of food. This result is similar to the findings of Babatunde (2007) who found education to be positively related with food security, which implies that households with more education are more food secure.

The estimated parameter for household size was negative and significant at 1 percent level of probability, suggesting that the higher the household size the more food insecure the respondent. This implies that respondents with large household sizes are more prone to food insecurity than those with small household sizes. Large household size translates into more consumption expenditure. Poor rural households with large household sizes and limited finance and few assets are therefore more food insecure. This result is similar to that obtained by Ojogbo (2010) in his study on determinants of food insecurity among arable farmers in Edo State of Nigeria. He found household size to be positively related to the probability of a household being food insecure. Babatunde (2007) found in his study of socio-economic characteristics and food security status of farming households in Kwara State of Nigeria that household size had a negative coefficient that was significant at 5% level, implying that as the household size gets larger, the food security decreases.

The coefficient obtained for extension contact was positive and significant at 1 percent. The implication of this is that increase in extension contact will increase the food security status of the respondents in the study area. This is similar to the findings of Amaza *et al*. (2006). They reported that households that had access to extension agents have higher probability of being food secure than those who do not have access to extension agents and vice versa. This is because access to extension agents enhances the chances of households having access to better crop production techniques, improved inputs as well as other production incentives and these go to increase their output, and hence raise their food security status.

The per capita income of the respondents was found to exert significant and positive influence on food security status of the respondents. This indicates that the higher the respondents per capita income, the higher the probability that the household would be food secure. This is because increased income would increase access to food.

The coefficients obtained for amount of credit received and membership of cooperative was not significant. These implied that these variables exert no influence on the food security status of the farmers which could be attributed to limited access to credit facilities and less participation in cooperative association among the respondents in the study area. It was revealed that more than half of the respondents do not have access to credit.

Based on the findings of this study, the hypothesis which states that there is no significant relationship between the socio-economic characteristics of farmers and their food security status is rejected while the alternative hypothesis which states that there is significant relationship between the socio-economic characteristics of farmers and their food security status is accepted.

Table 17: Determinants of food security among the farmers in the study area

Variable	Coefficient	Standard Error	b/St.Er.
Age (X_1)	0.0067	0.0092	0.724^{NS}
Education (X_2)	0.0282	0.01289	2.194**
Household size (X_3)	-0.4166	0.0971	-4.291***
Farming exp. (X_4)	0.1589	0.1176	1.351^{NS}
Credit (X_5)	0.1065	0.9450	0.113^{NS}
Cooperative (X_6)	-0.0172	0.0402	-0.428^{NS}
Per capita income(X_7)	0.1923	0.0520	3.695***
Extension contact.(X_8)	0.5048	0.1367	3.693***

*** = P < 0.01
** = P < 0.05
* = P < 0.10
NS = Not Significant

4.6 Effect of Income Diversification on Food Security Status of the Farmers in the Study Area

The results presented in Table 18 revealed that there is significant relationship between income diversification and food security status of the farmers. The R^2 value was 0.45, and implied that 45 percent of the variation that occurred in food security status of the farmers could be explained by the diversification of income sources among the

respondents. The coefficient obtained for the diversification index (0.87) was positive and significant at 5 percent level of probability. This implied that as income diversification increases, food security status of the respondents also increases. Income diversification has been reported to cause a significant increase in total household income, which would, in turn, increase household food security status. This result is similar to that of Agboola *et al.* (2008) who found that food security among farming households was influenced by income diversification strategies. This is because 61% of individuals that derived their livelihood from a combination of crop production and off-farm activities were food secure. They found that the food security status of households that diversified their income exceeded the recommended calorie requirement by 29 percent.

Based on the findings of this study, the hypothesis which states that income diversification has no effect on food security status of the farmers is rejected while the hypothesis which states that income diversification has effect on food security status of the farmers is accepted .

Table 18 Effect of income diversification on food security status of the farmers in the study area

Variable	**Coefficient**	**Standard Error**	**b/St.Er.**
Constant	0.854	0.705	1.20
Diversity Index	0.877	0.331	2.64**

** P< 0.05
F – Value 6.98**
R –Square 0.45

Chapter 5

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The broad objective of this study is to examine the income diversification strategies and food security status of the farmers in Oyo State. The specific objectives were to determine the socio-economic characteristics of the farmers in the study area describe the pattern of diversity in income sources among the farmers, identify and describe the determinants of income diversification, determine the food security status of the farmers in the study area, identify and evaluate the determinants of food security among the farmers in the area and determine the effects of income diversification on food security status of the farmers in the study area.

Primary data were used for this study and these were collected with aid of structured questionnaire. The respondents were purposively drawn from three out four agricultural zones in Oyo State. These were Ogbomoso, Oyo and Saki zone. From each of the zones, two agricultural blocks were selected. In the third stage of the sampling procedure, two agricultural cells were also selected and 10 percent of the respondents were selected from each of the agricultural cells, giving a total of 280 respondents for the study. Descriptive statistics, diversity index, tobit regression model, food security line, logit model and simple regression model were employed to analyze the data.

The results revealed that 33 percent of the farmers were within 41-50 years. Only 8 percent were below 30 years of age. The mean age of the farmers was 45 years. About

71 percent were male and 28.21 percent female. Only 12.86 percent were single while 87.14 were married. About 61.43 percent had 4-6 members in their household and the average household size is 6 members. About 30.71 percent had between 11-20 years of farming experience while only 1.43 percent had farming experience greater than 50 years. Average farming experience was 19 years. Only 25 percent do not have formal education. About 43 percent had farm size between 0.1-2.0 hectares Average farm size was estimated to be 3.15 hectares. Majority of the farmers (78.21 percent) had no contact with extension agent while 10 percent had between 1-2 contacts. It was found that 52.14 percent had no access to credit. About 19.29 obtained credit between ₦10001-20000, while 6 percent received between ₦20001-30000. About 48.21 percent did not belong to any cooperative association while 18.21 percent had between 1-5 years of cooperative membership.

Also, it was found that 22.18 percent derived their income from arable cropping, 13.02 percent from tree cropping and 11.09 percent from livestock sales. About 9% had agricultural wage employment as their source of income and 19 percent obtained their income from self-employment. It was further found that 10 percent of the respondents had income diversity index of 1. About 7.85 had diversity index between 1.1 and 1.5 and 35 percent had between 1.6 – 2.0. The mean income diversity index was 2.02.

The determinants of income diversification in the study area were education, household size, credit and extension contact. These variables were positively related to income diversification.

Based on the recommended daily calorie intake of 2260 kilo calorie, it was found that 33.57 percent of the respondents were food secure and 66.43 percent were not food secure.

The determinants of food security in the study area were education, household size, extension contact and per capita income of the respondents.

Income diversification was also found to be significantly related with the food security status of the respondents in the study area. The estimated coefficient (0.87) obtained for the diversification index was positive and significant at 5 percent level of probability. This implied that as income diversification increases, food security status of the respondents also increases.

5.2 Conclusion

Empirically, income diversification in Oyo State was high. Only 10 percent of the farmers had income diversity index of 1, meaning the respondents adopted multiple income generating-activities. However, crop farming remained the dominant income source for the respondents. Socio-economic characteristics such as education, household size, credit and extension contacts were the main determinants of income diversification, meaning that adequate attention should be given to these variables. About two-thirds of the respondents were not food secure, with an average daily per capita calorie consumption of 1547.66 calorie, which was about 31.51 percent less than the recommended minimum daily calorie requirement of 2260 kilo calories. The

determinants of food security were education, household size, extension contact and per capita income of the respondents. The income diversification and food security status of the respondents were positively and significantly related, meaning that as income diversification increases, food security status of the respondents also increases.

5.3 Recommendations

Based on the findings of this study, the following recommendations are made:

1. Farm income was found as the major income source. It implies that food insecurity can be reduced through agricultural growth, thus agricultural activities should be promoted through the distribution of agricultural inputs such as improved seeds and fertilizers and better extension services delivery in order to boost agricultural production.

2. Access to credit was significantly and positively related to income diversification in the study area, hence farmers should form themselves into groups and pull their resources together in order to increase their capital base.

3. Education was positively and significantly related to food security status of the farmers, thus reduction in food insecurity should involve an integrated approach that promotes education among farm households.

4. In view of the negative impact of large household size on food security, participatory family planning programmes should be introduced so as to assist farm households to have moderate household sizes.

5. There is a need for the government to pay more attention to agricultural extension programmes, through the recruitment and training of adequate extension workers to meet the needs of farmers in the study area. Also, farmers in the study area through cooperative arrangements should source for extension information.

6. Income diversification has a significantly positive impact on food security status of the farmers in the study area, thus there is need for the provision of rural infrastructure such as rural electricity, roads, markets, water supply, health and telecommunication as well as improvement in financial markets so as to enhance farmers' capacity to generate income from more sources.

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APPENDIX 1

DEPARTMENT OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY,

AHMADU BELLO UNIVERSITY, ZAIRA.

FARMERS RESEARCH QUESTIONNAIRE

TOPIC: ANALYSIS OF INCOME DIVERSIFICATION STRATEGIES AND FOOD SECURITY STATUS OF FARMERS IN OYO STATE OF NIGERIA

Dear Respondent,

This questionnaire will be used by a student in the above- named department. Please, provide the necessary information required in the questionnaire.

All information will be treated with utmost confidentiality and will strictly be used for accademic purposes.

Thanks for your cooperation.

(A) Background information on the questionnaire

(i) Name.....
(ii) Village.....
(iii) Date of interview.....

(B) Socio-economic characteristics

(1) Age of the respondents ..... (years)

(2) Gender (i) Male ( ) (ii) Female ( )

(3a) Marital status (i) Married ( ) (ii) Single ( )

(3b) If single, tick the one that best describes your condition (i) Widow ( ) (ii) Widower ( ) (iii) Divorced ( )

(4) Educational qualification

(i) No formal education ( )

(ii) Primary ( ) .....(years)

(iii) Secondary ( ).....(years)

(iv) Tertiary ( ) .....(years)

(v) Others specify .....

(5) How long have you been involved in farming ..... (years)

(6) Did extension staff visit you last growing season Yes ( ) No ( )

(7) If yes, how many times did extension staff visit you last cropping season.....

(8) Do you belong to farmers' association or cooperative society (a) Yes ( ) (b) No ( )

(9) If yes how long have you been in the association or cooperative ..... (years)

(10) How many of your household members fall in the following age group

Age group (in years)	Number of males	Number of female
0-10		
11-20		
21-30		
31-40		
41-50		
51-60		
60 and above		

(11) Do you have access to credit (a) Yes ( ) (b) No

(12) If yes indicate from which source and the amount given

(i) Agricultural bank (NACRDB) ₦.....

(ii) Commercial bank ₦.....

(iii) Cooperative ₦. CBFVGFGR.....

(iv) Friend/Relatives ₦.....

(v) Others specify ..... ₦.....

(13) Kindly indicate the ownership type of the land you cultivate

(a) Borrowed ( ) (b) Purchased ( ) (c) Gifted ( ) (d) Rented ( ) (e) Inherited ( ) (e) Others specify .....

(14) Kindly give a rough estimate of the total size of land cultivated .....(ha)

(C) Pattern of diversity in income sources of the respondents

(15) Tick the enterprises you are into

(i) Food crop ( ) (ii) Livestock ( ) (iii) Cash crops ( ) (iv) Tree crops ( ) (v) Others, specify .....

(16) Do you work off-farm? (i) Yes ( ) (ii) No ( )

(17) If yes what type of activities do you engage in during the off-farm time?

(i) ..... (ii) .....

(iii) ..... (iv) .....

(18) How much does your household earn from the following sources of income?

SN	Income Source	Amount in Naira
1	Arable cropping	
2	Tree cropping	
3	Livestock production income	
4	Non-farm self employment(trading, tailoring, carpentry, crafts, bricklaying, blacksmithing, barber's work, shoe cobbling, repairing motorcycles etc.	
5	Non-Agricultural wage employment	
6	Agricultural wage employment	
7	Remitance income(money sent by children and relative	
9 Others specify		

(D) Respondents' calorie intake

(19) Kindly provide information on the following crops

	Item purchased last season for household		Amount produced last cropping season (Quantity/units)	Amount consumed from food purchased (quantity/units)	Amount consumed from production (quantity/ units)	Value of Foods eaten outside the household last one week (~~₦~~)
	Quantity or units	Price paid/unit				
Maize						
Grain						
Flour						
Sorghum						
Grain						
Flour						
Rice						
Imported						
Local						
Cassava						
Tubers						
Gari						
Cassava chips						
Yam						
Tubers						
Yam flour						

Cocoyam						
Corms						
Groundnut						
Shelled						
Unshelled						
Soybean						
Grain						
Flour						
Cowpea						
Okra						
Tomato						
Onion						
Pepper						
Egg plant						
Carrot						
Pumpkin						
Green leaves						
Guava						
Citrus						
Mango						
Others specify:						
1						
2						
3						

Units refers to local measures (e.g., Mudu, Tiya, baskets, etc) and Kilogramme (kg)

(20) Indicate the amount purchased of the following items for household consumption

Item	**Quantity purchased**	**Purchased value (₦)**	**Quantity consumed**
Salt/Potash/Maggi			
Groundnut oil			
Palm oil			
Other oils, specify:			
1.			
2.			
3.			
Fish (Fresh/dried/smoked)			
Meat (beef/mutton etc)			
Sugar			
Bread			
Drinks, specify:			
1.			
2.			
3.			

(21) Kindly indicate how many livestock you own and also provide other related information.

	Number of livestock presently owned	How many did you have last year?	How many have you sold this year?	How many have you consumed this year?	Amount of animal product consumed (qty/units)	Amount of animal products sold (qty/unit)
Cattle						
Sheep						
Goats						
Pigs						
Chickens						
Ducks						
Guinea fowls						
Others specify:						
1.						
2.						

APPENDIX 2

Calorie content of some commonly eaten food items in Nigeria

Food items	Kcal/kg	Food items	Kcal/kg
Staple foods		Mango	590
Cassava Tuber	1500	Pawpaw	300
Cassava flour	3870	Pineapple	320
Cassava chips	3000	Apple	570
Garri	3840	Coconut	580
Yam Tuber	1100	Guava	730
Yam flour	3810	Sugar cane	360
Yam chips	3000	**Meat and animal products**	
Sweet potato Tuber	1100	Cow meat	2370
Sweet potato chips	900	Goat meat	2370
Irish potato	1200	Sheep meat	2370
Cocoyam Tuber	3830	Pork	2370
Maize green	3100	Bush meat	2370
Maize grain	4120	Chicken	2380
Maize flour	4120	Turkey	2380
Sorghum grain	3500	Fish	2230
Sorghum Flour	3500	Snail	2245
Millet grain	3500	Shrimps	2230
Millet flour	3500	Crayfish	2200
Rice	1230	Crabs	2200
Wheat grain	3400	Eggs (pieces)	1400
Wheat flour	3300	**Dairy products**	
Cowpea (beans)	5920	Milk	4900
Ground nut	5950	Cheese	4000
Soybeans	4050	Yoghurt	4100
Soybean flour	2600	Ice cream	4100
Melon (shelled)	5670	Beverages	
Plantain	770	Cocoa	1200
Banana	960	Tea (leaves)	1200
Vegetables		Tea (liquid)	1200
Okra	4550	Coffee (powder)	1340
Tomato	880	Coffee (liquid)	1340
Pepper	3930	**Drinks**	
Onion	440	Soft drinks 620	
Carrot	400	Orange juice	400
Egg plant	440	Apple juice	550
Cucumber	270	Pineapple juice	560
Cochorus/ewedu	500	Local beer	740
Spinach	220	Bottled beer	460
Bitter leaf	220	Wine	330
Water leaf	180	**Condiments and spices**	
Cabbage	230	Maggi	220
Pumpkin	440	Salt	180

Source: Babatunde (2007)

APPENDIX 3

Adult equivalent scale for adjusting the household size

Age category (year)	Male	Female
0 – 1	0.33	0.33
1 – 2	0.46	0.46
2 – 3	0.54	0.54
3 – 5	0.62	0.62
5 – 7	0.74	0.70
7 – 10	0.84	0.72
10 – 12	0.88	0.78
12 – 14	0.96	0.84
14 – 16	1.06	0.86
16 – 18	1.14	0.86
18 – 30	1.04	0.80
30 – 60	1.00	0.82
> 60	0.84	0.74

Source: Stefan and Pramila, (1998)