IMPACT OF PROMOTING SUSTAINABLE AGRICULTURE ON FOOD SECURITY, FARM INCOME AND RURAL LIVELIHOODS IN SOUTHERN BORNO STATE, NIGERIA

BY

Elias Andrew Gwanzuwang MANZA
(Ph.D/AGRIC/19016/2007-2008)

A Dissertation Submitted to the School of Postgraduate Studies, Ahmadu Bello University, Zaria, In Partial Fulfillment of the Requirements for the Award of the Degree of Doctor of Philosophy in Agricultural Economics.

DEPARTMENT OFAGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY, FACULTY OF AGRICULTURE,
AHMADU BELLO UNIVERSITY,
ZARIA, NIGERIA

MARCH, 2014

DECLARATION

I declare that this Dissertation titled "**Impact of Promoting Sustainable Agriculture on Food Security, Farm Income and Rural Livelihoods in Southern Borno State, 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 duly acknowledged in the text and a list of references provided

.

Elias A.G. Manza | Date

CERTIFICATION

This dissertation titled "**Impact of Promoting Sustainable Agriculture on Food Security, Farm Income and Rural Livelihoods in Southern Borno State, Nigeria"** by Elias A.G. Manza meets the regulations governing the award of the degree of Doctor of Philosophy of Ahmadu Bello University, Zaria and is approved for its contribution to scientific knowledge and literary presentation.

Professor Zakari Abdulsalam Chairman, Supervisory Committee	**Date**
Dr. Maiyaki A. Damisa Member, Supervisory Committee	**Date**
Professor Thomas K. Atala Member, Supervisory Committee	**Date**
Professor Zakari Abdulsalam Head of Department	**Date**
Professor A.A. Joshua Dean, School of Postgraduate Studies, Ahmadu Bello University, Zaria	**Date**

DEDICATION

This study is dedicated to my wife, Rhoda and to my late mother for their excellent support, love and understanding to whom I gratefully appreciate.

ACKNOWLEDGEMENTS

First of all, I would like to thank God Almighty for His love, mercies, faithfulness, and who by His power in me through the Holy Spirit and by His power at work in me through which I was able to do all that I have been able to do.

Professor Zakari Abdulsalam as my major supervisor was quite supportive and showed a lot of understanding and patience. I am equally grateful to Professor James O. Olukosi, who served as the initial second supervisor until he left the service of the University for landmark University at Omu Aran, Kwara State, Nigeria, Dr. Maiyaki A. Damisa and Professor Thomas K. Atala who served as members of my supervisory team. To each of them, I am grateful for painstakingly going through the work at different stages of it. To all of them, I deeply appreciate each one of them. Very useful ideas and suggestions were received from Professor Paul Amaza of the Department of Agricultural Economics and Extension, University of Maiduguri, Borno State who served as the Agricultural Economist of PROSAB, Dr. Zwaghu Bonat of the Centre of Population and Development, Kaduna and Mr. James Zira for reading one of the drafts(thesis) at one time or the other. I am grateful to each of them.

I cannot but thank friends and relatives who supported me in one way or the other without which I could not have made much progress. These include Mr. Simon Duniya of blessed memory and his dear wife Mrs. Hanatu Duniya, Senator Caleb Zagi and his lovely wife Linda Zagi, Mrs. Comfort Amwe, Mr. Peter Lekwot of blessed memory, Mr.& Mrs. Jonathan Achi, Sen. Nenadi E. Usman, Hon. Godfrey Gaiya,Mr. & Mrs. Ishaku Shekari and Mr. & Mrs. Silas Pompy Ayuba. Similarly, my senior friends namely, Mr. Bulus Dogara Emishe and Professor& Mrs. Aba were quite supportive too. To all of them, I feel indebted and deeply grateful.

The assistance and cooperation I received from Mr. Iliya Bwala who along with others collected the data for this study, Miss Faith Aminu and Miss Ladi John Gilla who did very well in providing secretarial assistance and later, Mr. I.A. Akaa, Mr. Gideon Kajang who assisted with the data entry and analysis. To all of them, I appreciate their effort. Some members of my family namely Dakaci Shinkut Manza and Gora Joseph Manza just to mention a few gave their support. Barrister John M. Adezaky and his wife Mrs. Rebecca Adezaky encouraged me to go on when I was getting discouraged to continue.. ECWA Goodnews Church, High Cost, Narayi leadership and members were supportive with computing facilities and office in which to sit and prayers.

How can I forget so soon the untiring efforts of my late mother to see me at school? As her last born child and only surviving male child, she exhibited so much foresight in letting me have the opportunity to go to school rather than remain at home to farm and ultimately get married. I will always remember her inspiring words, support, love, patience, encouragement, understanding and challenge to me to excel. I am indebted to my wife and kids – Kingsley, Kyantuk, Glory (Ta'a) and Joy (Sham) and sincerely thank them for their patience, love and understanding. But I probably owe them more apologies than thanks. I'm sorry for the hiccups and all the inconveniences she and the children must have gone through while I was always away to Zaria for lectures or working on my thesis.

Definitely, there must be some names worthy of mention, too, that have escaped my memory. I owe all of them a debt of gratitude.

Elias Andrew Gwanzuwang MANZA
(2014)

TABLE OF CONTENTS

LIST OF TABLES

ABSTRACT

This study evaluated the impact of Promoting Sustainable Agriculture Project in southern Borno State, Nigeria (PROSAB) on food security, farm income and rural livelihoods of households. The major objective of the study was to evaluate the impact of PROSAB on food security, farm income and rural livelihoods. The specific objectives were to describe the socio-economic characteristics of households, their livelihoods and asset ownership, determine and compare the farm incomes and farm profitability of PROSAB and non-PROSAB households, compare food security status of households in the project area and non project area and compare food security status in the project area with that in 2004 and, identify constraints faced by farmers in the project area and assess the perception of women, men, and youth groups (farmers) on the impact of the project. Using a multistage sampling technique, three out of the four LGAs under the project were covered. The three LGAs were selected at random to include Biu, Hawul and Kwaya Kusar LGAs. Two communities from the list of the 39 communities in the project area were selected. In each of the selected communities, a random selection of 20 households was carried out giving a total of 180 households. Using similar procedures, 180 households were randomly selected from the non project area LGAs of Shani and Bayo to serve as counterfactuals. Secondary data was generated from publications and records of the PROSAB project. The study employed analytical tools such as descriptive statistics, budgetary analysis, food security index, logit regression analysis, double difference estimator and consumer price index (CPI). The socio-economic characteristic of household heads shows that the primary occupation among PROSAB households (84.4%) as well as non-PROSAB households (58.9%) was farming. Similarly, farming was found to be the major secondary occupation among PROSAB households (15%) as well as among non-PROSAB households (30%). Bicycles were ranked first among the household assets among PROSAB households (16.4%) as well among non-PROSAB households (14.3%). The gross margin for crop based enterprises was higher among PROSAB households (₦111,295.63) per ha compared to ₦88,006.96 per ha among non-PROSAB households and was found to be statistically significant at 5% level of probability. The food security status of PROSAB households was higher (57.2%) compared to non-PROSAB households (35.6%). The food security status in the project area increased from 42% in 2004 to 57.2% in 2010. Gender, age, use of modern farm inputs and membership of a cooperative society were found to be statistically significant at 1% level of probability while number of extension visits was statiscallys significant at 5% level of probability. Own production was the major source of food for PROSAB households (71.1%) and non-PROSAB households (61.3%). The major source of animal protein was purchase from the market for both PROSAB households (71%) and non-PROSAB households (71.1%). Inadequate storage facility was the major cause of food shortage among PROSAB households (23.3%) as well as among non-PROSAB households (26.1%). The Double Difference Estimator (DDE) was positive for maize (₦373,221), soybean (₦379,484), cowpea (₦204,458), sheep (₦773,208), and goats (₦401,709), cars/pick-ups (₦57) and new houses/renovated houses (₦62) signifying impact. The three major constraints faced by farmers in 2004 were low yield and production, inadequate market for farm produce/low prices and inadequate farm credit. However, in 2010, the three major constraints faced by the farmers were low extension visits, inadequate fertilizer and inadequate agrochemicals. This study concluded that PROSAB impacted positively on the beneficiaries as there was an increase in the number of households that were food

secure. It was recommended that more attention should be placed on the education of households, in the project area as well as in the non project area and that farmers in the project and non project areas should establish functional community based organizations as a way of assisting them to have access to credit.

INTRODUCTION

1.1 Background

Agriculture is still the most important sector of the Nigerian economy due to the fact that it plays very important role in its developmental process (Arifalo and Ayilaran, 2011). It is the dominant occupation of rural Nigerians and it is practiced under rain fed condition and under irrigation. It constitutes a significant sector of Nigeria's economy. This is explained by its contribution to growth rates of the Gross Domestic Product (GDP) at 1990 constant basic prices (percentage points) to be 2.4 in 2010 (CBN, 2011[a]). This can be understood when we realize that no activity sector contributed as much. The closest was services which was 2.1%. Similarly, its contribution to the GDP at current basic prices was ₦11,590, 120.18 million in 2011 (CBN, 2011[b]) and has contributed immensely to its economic development. It plays an important role in the economic development of Nigeria. It provides food for the growing population, employment for over 65% of the population, raw materials and foreign exchange earnings for the development of the industrial sector and generation of household incomes for farmers (Kwaghe, 2006; Amaza, 2000). However, the total food demand has never been met as the ability of Nigerian farmers to produce enough food for the growing population depends on their level of technical efficiency. The consequence of the decline in the performance of agriculture is the dwindling welfare condition of the rural people who are mostly farmers.

According to Osinubi (2003), the fall in agricultural production made Nigeria, which was almost a food sufficient nation, to become a net importer of food. This can be observed from available statistics as compiled by Obiechina (2007) which shows that food imports which were ₦57.7 million against total imports of ₦756.4 million; thus translating to 7.63% in 1970 rose to ₦75,392 million against total imports of ₦562626 million, that is, 23.40% in 1997. Nigeria became dependent on oil as the main source of revenue. For example, in 2011, of the ₦9987,629.00 million as total Federally collected revenue, N8,848,615.00 which was 88.65% was the share of oil revenue in the country. Between 2003 to 2011, the least percentage contribution of oil revenue to the total federally collected revenue was in 2009 which was 65.9%. (CBN, 2011b) and when oil prices fell, the government increased borrowing abroad to sustain its pre-oil expenditure pattern. Foreign debt accumulated which led to shortfall in social sector expenditure and consequently fall in social services, making the welfare situation in the country to dwindle continuously over the years. For example, the country's debt which was ₦2,331.20 million in 1981 increased to ₦2,695,072.20 million in 2005. (CBN, 2011[b]). As at 2011, the external debt had risen to US$ 5.7 billion which had grown by 23.8% over the level as at December, 2010 (CBN, 2011[a]). The percentage total debt/revenue increased from 111.8 in 2007 to 183.5 in 2011 (CBN, 2011[a]).

The drastic decline in agricultural production became worrisome, as this led to the worsening of economic fortunes in terms of declining growth, increasing unemployment and galloping inflation that characterized the Nigerian economy. (Kwaghe, 2006). This can be explained through a sectoral analysis of Nigeria'seconomy which has shown that in terms of the nation's real GDP, agriculture's share in total GDP was lower than the 40.8% recorded in 2010 (CBN, 2011[a]). Consequently, government had to embark on various reform programmes with emphasis on expenditure switching policies, exchange rate policies, and ceiling on foreign exchange disbursement with a view to increase food production and processing both for home consumption and for export.

The reform programmes introduced include; the Green Revolution, Operation Feed the Nation, Directorate of Food, Roads and Rural Infrastructure (DFRRI),the River Basin Development Authorities (RBDA), the Nigerian Agricultural and Cooperative Bank Ltd (NACB), the Agricultural Credit Guarantee Scheme Fund (ACGSF), Agricultural Development Programmes (ADPs), Commercial Agriculture Programme, Special Programme on Food Security (SPFS), Inputs Supply Progamme, National Fadama Development Programme (NFDP), Nigerian Agriculture and Insurance Corporation (NAIC), Agricultural Research Institutes, National Accelerated Food Production Programme, National Fadama Project and several presidential initiatives on Cocoa, Cassava, Rice, Livestock, Fisheries, Vegetables, and Coffee which were aimed at addressing the dwindling welfare conditions of the people. It was hoped that these programmes would lead to the growth of the economy and thereby raise the standard of living of Nigerians and reduce poverty through a trickledown effect (Aigbokan, 2001, Osinubi, 2003, Panwal and Patrobas, 2011) and Sani, (2010).

Consequent on the foregoing situation in the country, the Federal Government of Nigeria prepared and adopted a new National Rural Development Strategy in 2001. The strategy aimed at improving livelihood and food security through a process of community based agriculture and rural development programmes. The strategy called for a community driven development approach that will ensure the active participation of beneficiaries and local governments at all levels of decision making. It was within this framework that the Canadian Government through the Canadian International Development Agency (CIDA) signified in September 2003 its intention to assist the agricultural and rural development sector of Nigeria by funding an agricultural project titled “Promoting Sustainable Agriculture in Southern Borno State (PROSAB)” from 2004 to 2009 (Amaza *et al*, 2009).

In spite of whatever considerable progress that would have been made as a result of the implementation of an agricultural project, the issue of sustainability of the benefits arising from the project is critical. These include such issues as technological support, the institutions required, and adequacy of experienced manpower like extension agents and cost implication of supporting the system (OECD,1988;UNDP,1989). Some of these factors would usually be recognized in the design of such project and would be identified as risks to the success of such project. In the case of PROSAB, leadership engagement in community based organizations (CBOs) and provision of overall project guidance amongst different community members was found lacking and therefore a risk. Unfinished business especially in community mentoring of the investment was seen as that which could hamper sustainability of the project especially at the organizational and management levels. During the midterm evaluation, maintenance of the momentum and interest in the project if further capacity building remained unaddressed was also observed as capable of hampering sustainability. Secondly, a demonstrated ability of farmers to engage in high value agriculture technologies into long-term sustainable actions and the need to enhance this engagement through building follow up project activities especially in the market improvement activities; and thirdly, the Community Action Plan (CAPs) process which was yet to commence as at the midterm evaluation in 2006 would raise community expectation and could undermine results achieved as at 2006 as only two years or so of project implementation were left. Other sustainable agriculture practices which were in place and required to continue were inorganic fertilizer application, provision of striga spp resistant cowpea varieties especially the brown varieties, linking the farmers with input dealers as well as output dealers and animal drug dealers and the need to develop fadama agriculture (PROSAB,2006).

The mode of operation of a project places great demand on financial resources of the financiers of such project. During project implementation, cash flows may not be a serious challenge in most projects. However, at the termination of the project, cash flow becomes a serious challenge.

In order to enjoy food security, there must be on the one hand a provision of safe nutritious, and quantitatively as well as qualitatively adequate food and on the other hand, rich and poor, male and female, old and young must have access to it. The FAO report (2007) stated that food security has three dimensions: availability of, sufficient quantities of food of appropriate quality, supplied through domestic production or import; access by households and individuals to appropriate foods for a nutritious diet, and optimal uptake nourishment, clean water and adequate sanitation, together with health care.

Food security was formally considered essentially in terms of production. It was assumed that adequate food production will ensure adequate availability of food in the market and in the households. But lately, it has become clear that availability alone does not lead to food security. It is becoming evident that even if accessibility and availability are satisfactory, the utilization or biological absorption of the food in the body is relevant. Furthermore, even if there is access, availability and adequate utilization, it is necessary that the long term sustainability of the food security is guaranteed for the growth and development of our nation (Effiong and Etim, 2012).

According to Omonona and Agoi, (2007) in Effiong and Etim (2012), food access is determined by the ability of households to obtain food from their own production and stocks, from the market and from other sources. These factors are in turn determined by the resource endowment of the household, which define the set of productive activity they can pursue in meeting their income and food security objectives. Siamwalla and Valdes (1994) in Effiong and Etimi (2012) opined that the lack of purchasing power deprives a person from access to food even though food is available.

Omonona and Agoi (2007) in Effiong and Etim (2012) added that food sustainability entails access by all people to food. They added that the precondition for food sustainability is a stable economy offering suitable conditions for agriculture and animal farming. At the present, economic changes are the biggest challenges to securing food and growth since severe conditions such as prices and capital assets are escalating, especially in areas already tolling with poverty and low yields from agriculture. Finally, Diouf (1997) in Sani (2010) stressed that if the goal of food security for all must be then reached, there must be significant increase in food production and improved access to food.

Several measures are used to gauge income over a given period of time. For example, in the United States agricultural policy; farm income is divided into gross farm income which is the sum of all receipts from the sale of crops, livestock and farm related goods and services, as well as any direct payments from the government. Gross farm income is the same as gross cash income with addition of non-money income, such as the value of home consumption of self produced food. The net farm income is the gross cash income less all cash expenses, such as for feed, seed, fertilizer, property taxes, interest on debt, wagers, hired labour and rent on non operator landlords. Net farm income is the gross farm income less cash expenses and non-cash expenses, such as capital consumption and farm household expenses. (Wikipedia, 2014).

Robson (2010) stated that about 2.5 billion people worldwide live in farm based livelihood, most of these in developing countries. According to the World Bank report (1994), agriculture is the livelihood of the nation’s economy as well as the main option of livelihood for the rural people. About 80% of the population depends on agriculture and its allied fields. Rena (2002) noted that for most third world countries, agriculture is the only means of livelihood. He also added that cultivating subsistence crops is the main stay of the people as about 80% of the rural sector population are engaged in this practice therefore, it is the main base of livelihood. Growing food and farm crops, livestock and traditional fishing are parts of the rural way of life. Farming livelihood is the most important sector in terms of employment and livelihood.

The rural non-farming livelihood may be defined as comprising all those activities associated with waged work or self-employment in income generating activities that are not agricultural but which generate income in the rural areas (Valentine, 1993). In some context, rural non-farm livelihood activities are also important sources of local economic growth. The rural non-farm livelihood activities is of good importance to the rural economy for its productive and employment effects while the incomes it provides to the rural households represent a substantial and growing incomes (Daris, 2008).

According to Avery (2011) rural livelihoods system often develop a combination of strategies to maintain themselves while they may continue to farm at the minimal level.

Rural livelihood is the occupation and source of income in the rural areas. Rural livelihood or livelihood activities can be divided into farming livelihood and non-farming livelihood. Chambers (2008) in Effiong and Etim (2012) stated that it comprises of people, their capabilities, and their means of living, including food, income and assets. Daris (2008) in Effiong and Etim (2012) opined that rural people in Africa do not specialize in livestock, crop or fishing to the total exclusion of their income generating activities, rather, a majority of the rural producers have historically diversified their productive activities to encompass a range of other productive areas linked with wide range of possible activities and associated with both positive and negative outcomes. This recognition has led many researchers to represent rural livelihoods constructed from resources or activities (Ellis, 1996).

1.2 Statement of Problem

The baseline study in 2004 showed that food insecurity in the project area was 58% while the incidence of poverty was 67%. Other findings according to Amaza *et al.* (2009) were that:

(i) at the FAO recommended daily energy level (L) of 2250 Kcal, the food insecurity line Z (cost of the minimum energy requirement/adult equivalent/month) was N1975.01.

(ii) aggregate expenditure gap was 19.02

(iii) aggregate income gap was – 375.74

(iv) the major crops grown in the project area were found to be maize, sorghum, millet and cowpea.

(v) using the poverty line of 2446.67, 67% of the households were poor whereas 33% were not.

In view of this, it is pertinent to examine the project implementation from 2004 to 2009. Several questions beg for answers such as whether the outcomes were achieved, the appropriateness of the extension methods used, whether the appropriate crop technologies and management practices were used and what was the impact of the project on the farming households in the project area on food security, farm income and livelihoods. Considering these, an impact study of the project has become critically important because none had been conducted.This study, therefore, is taking the challenge of filling this research gap of conducting an impact study to empirically determine the achievements of the goal and objectives of the project.

Accordingly, the pertinent research questions raised were as follows:

(i) What are the socio-economic characteristics of households, in the project area and non-project area?

(ii) What are the profitability of participating farming households and non participating households?

(iii) Are households in the project area more food secure than those in the non project area compared to the project area in the year 2004?

(iv) Are the problems encountered by the farming households in the project area now different from those in the pre-project period?

(v) What is the perception of the beneficiaries (women, men and youth groups farmers) on the impact of the project?

1.3 Objectives of the Study

The main objective of the study is to evaluate the impact of PROSAB on food security, farm income and rural livelihoods of households in the project area.

The specific objectives are to:

(i) describe the socio-economic characteristics of households in the project and non project areas.

(ii) determine and compare the profitability of farm enterprises of PROSAB and non-PROSAB farmers.

(iii) compare the food security status of households in the project area with that of 2004.

(iv) identify the constraints faced by farmers in the project area.

(v) assess the perceptions of women, men and youth groups (farmers) in the project area on the impact of the project.

1.4 Hypothesis

The hypotheses of this study were:

HO.1 There is no difference in the profitability of farm enterprises between the project farmers and non project farmers.

HO.2 There is no difference in the food security status of households in the project area and non-project area.

1.5 Justification of the Study

A study of this kind is necessary for so many reasons. It is useful because so many scarce resources were invested in the course of the implementation of the project in southern Borno State. A substantial part of these resources were grants from the

Canadian Government. There is therefore the need to determine if these resources were used efficiently and effectively to produce any positive impact on the farming households in terms of improved food security, farm income and livelihoods. It must be noted that these resources had opportunity cost for being invested in agriculture or at another location. These resources could have been better used for some other project or at some other location in Borno State or even some other state of Nigeria.

According to Suchman (1967) in Manza (1988), “all social institutions or sub-systems, whether medical, educational, religious, economic or political are required to provide ‘proof’ of their legitimacy and effectiveness in order to justify society’s continued support. Furthermore, a better educated and more sophisticated public is less willing than ever to accept the need for community services on faith alone; increasingly, the public is demanding for scientific ‘proof’ of the effectiveness of various programmes.” The Federal Government of Nigeria, the Borno State Government and the Canadian Government require evidence in terms of impact that has been created in the lives of the farmers in the project area. The governments of Nigeria and Canada require accountability for the funds invested in the implementation of the project since funds usually have many competing investment alternatives in the portfolio of the development partners and the government; and development partners need stronger and clearer evidence of the net social, economic and environmental benefits of these investments.

It should be noted that development in itself is also becoming increasingly complex and requires a learning approach. Feedback is required on what works, what does not work and how programmes and strategies can be adjusted to become more effective in reaching beneficiaries.

The Canadian Government to a lesser extent, and the Nigerian government to a larger extent require the information on impact to provide feedback to the National Planning Commission, Federal Ministry of Agriculture and Rural Development and the Borno State Government. Impact studies such as this one can help adjust resource allocation across projects. Impact studies therefore are needed to measure benefits and compare such benefits with the cost of project implementation. The documentation of benefits of project implementation is also needed to ensure an appropriate level of public support for such huge investments in agriculture.The fact that the livelihoods of the poor are so diverse and need to be understood is an additional reason to undertake this study. For example, Hartman (2004) argued that child mortality rate in Sub-Saharan Africa (SSA) has not declined. He stated that it is infuriating also to see that 50% of all deaths of minors can be attributed to either poor nutrition or a lack of food. He concluded by saying that here is a critical entry point for any poverty reduction strategy.

It would be important to know the experience of farmers that participated in the project and benefited as well as those farmers who did not participate in the project and whether or not they benefited in some way as a result of the implementation of the project in the project area.

It should be noted that no previous study holistically looked at the impact of the project; hence the need for this study. Also, lessons learned from the project implementation would be useful for future project and policy formulation. Furthermore, the study has contributed to our knowledge of the application of the approach adopted by PROSAB management in the implementation of the project.

The study would be a source of information for policy makers. It would also be useful to research institutes in the country such as the Institute for Agricultural Research, Ahmadu Bello University, Zaria; other research institutes in Nigeria and research libraries.

1.6 Limitations of the Study

There were a few basic limitations to this study. Data collection commenced soon after the post election crisis in 2011. As a result, even the enumerators who were from southern Borno State did not feel free to move around as they were used to in the past. As a result of the crisis, the researcher could not stay beyond two weeks in the field for data collection. Financial resources at the disposal of the researcher were limited and therefore sample size was limited.

Chapter 2

LITERATURE REVIEW

2.1 Conceptual Framework

The project, Promoting Sustainable Agriculture in Southern Borno State (PROSAB) was launched by the International Institute for Tropical Agriculture (IITA) in collaboration with Borno State Agricultural Development Project (BOSADP), University of Maiduguri (UNIMAID) and other partners in February 2004, with funding provided by the Canadian International Development Agency (CIDA) from 2004-2009. The goal of the project was to improve the livelihoods of rural communities in Borno State while the purpose was to improve sustainable agricultural production in the south and central Borno State through the transfer of improved agricultural technologies and management practices, improved market access, a more enabling policy environment, and enhanced capacity of agricultural stakeholders. The project operated in three agro-ecological zones, i.e. Sudan Savanna (SS), Northern Guinea Savanna (NGS) and Southern Guinea Savanna (SGS) (PROSAB, 2005; Amaza *et al*., 2009).

The project was divided into four expected outcomes with each of the outcomes subdivided into outputs as follows:

Outcome 1: Increase in sustainable agricultural productivity

Outputs:

a. Enhanced awareness of male and female farmers in the project area about livelihood constraints and opportunities for improvement.

b. Improved land, crop and livestock management practices are developed, selected and made available to male and female farmers.

c. Increased capacity of male and female farmers in the project area to acquire and share agricultural knowledge in order to utilize improved land, crop and livestock management practices.

Outcome 2: Improved access to agricultural input and output markets

Outputs:

a. Appropriate input and output marketing strategies identified for both men and women farmers.

b. Ensure improved linkages between male and female farmers and private sector.

c. Increased access to market information by male and female farmers in the project area.

d. Increased access to and understanding of credit and insurance markets.

Outcome 3: Contribution made to an improved policy environment.

Outputs:

a. Identification of gender sensitive sustainable agricultural policy options.

b. Enhanced awareness of policy makers at community, Local Government and State Government of appropriate policy options.

c. Participatory community Action Plans that are gender sensitive and reflect local needs are developed in collaboration with Local Governments.

Outcome 4: Strengthen project partners for the implementation of project activities

Outputs:

a. Enhanced capacity of project partners to plan, manage and implement agricultural development activities; monitor and evaluate agricultural development activities; and mobilize resources to promote agricultural development.

b. Enhanced capacity of male and female project partners to train others in the planning, management, implementation, monitoring and evaluation of and incorporation of gender into agricultural development and marketing activities. (PROSAB, 2005; Amaza *et al*., 2009).

2.1.1 The concept of impact evaluation

Enhanced emphasis on monitoring and evaluation of programmes constitutes a key aspect of results based management approaches to development assistance. This is a multifaceted challenge involving a range of activities: from monitoring and assessing progress in the implementation of programmes, to measuring changes in outcomes and evaluating the impact of specific interventions on those outcomes. Within the toolkit of evaluation approaches, impact evaluations play an important role. The goal is to assess the specific outcomes attributed to a particular intervention. They do so by using a counterfactual that represents the hypothetical state the beneficiaries would have experienced without the intervention. In view of this, impact evaluation provides a powerful instrument to determine 'what works and what does not work' and, thus, constitute a fundamental means to learn about effective development interventions.

Casley and Lury (1985) in an attempt to explain what impact evaluation is stated that the immediate objective in a project is to provide inputs that are necessary to achieve agriculture and/or rural development. It is expected that the use of these inputs will result in outputs by the project beneficiaries. The outputs will, in turn, generate effects amongst the target population. The effects will have an impact on the social and economic life of the community. The archetypal formulation of an evaluation problem aims to estimate the average impact on those to which a specific program is assigned (the participants) by attempting to infer the counterfactual from those to which it is not assigned (non-participants).

An impact evaluation should strive to identify not just if but also how a project delivers its result. Identifying where a chain of causation breaks down in the case of unexpected results is important in determining if the model does not accurately reflect reality, or if implementation deviated from the model. Making these determinations can help improve the model upon which the intervention is based, by providing specific points to consider in designing, modifying, and implementing the intervention in the future. In more rigorous evaluation, it added that it is necessary to have data from at least two points in time, before and after project implementation on the same group of observations. This allows the comparison of progress over time between programme participants and non participants. Repeated observations over time can allow the estimation of trends before, during and after project execution.

Impact is defined more broadly than goal attainment. It is a long term influence on the state of the environment surrounding an organization. The impact of a programme can be seen in relation to what the programme actually does to the people who participated in them. According to Folorunso (2009), it is the actual programme outcome in relation to the desired outcomes (goals). Folorunso (2009) added that in determining the impact of social intervention, the goals or objectives of the organization rendering the services should be established. Furthermore, Folorunso (2009) suggested that the programme should be assessed considering the desirability of the goals or outcomes sought preferably by the beneficiaries and the extent to which the goals are furthered by the demonstrable effects.

The goal of an impact evaluation is to attribute impacts to a project and to that project alone. To do this, a comparison group is needed to measure what would have happened to the project beneficiaries had the project not taken place. A good impact evaluation provides the basis for sound policy making. It helps researchers and beneficiaries to understand whether or not the project has had an impact, how large the impact is, and who has benefited (or not). Impact evaluation allows us to learn which projects work in which contexts, and use these lessons to inform the next generation of policies not only in the country of concern, but also across countries. The exercise of carrying out an impact evaluation helps to build and sustain national capacities for evidence based policy making.

Furthermore, the World Bank (2006) stated that a quality impact evaluation must:

(i) develop a set of indicators that can meaningfully and realizably define and measure project inputs, implementation process, outputs, intended outcomes and impacts.

(ii) develop a logically sound counterfactual presenting a plausible argument that observed changes in outcome indicators after the project intervention are in fact due to and not to other unrelated factors, such as improvements in the local economy or programs organized by other agencies; and

(iii) determine, in accordance with accepted statistical procedures, whether a project has contributed to the intended impacts and benefited a significant proportion of the target population.

The World Bank (2006) added that when resources are not a constraint, the conventional evaluation approach is to use a pre-and post-intervention project and control group.

Ravallion (2003) wrote that an indicator by which a programme is to be assessed is taken as given, as appropriate to the type of programme. For example, for direct anti-poverty programmes the concern is about the impact on incomes of the participants and possibly also effects on other indicators such as school attendance. Ravallion (2003) further stated that the two methods commonly used in impact evaluation are Propensity Score Matching method (PCM) and Double Difference method. However, to use any of the two methods, data would be required on an appropriate outcome indicator for the participants. This will not be sufficient, however, since to assess impact we will need some way of inferring the counterfactual of what we expect would have been the value of the outcome indicator in the absence of the programme. This calls for data for non participants.

But even with good data on outcome measures for both participants and non participants, retrieving a reliable estimate of the programme's impact is far from easy. The main reason is that public programmes are generally not assigned randomly across the population units. So we cannot attribute to the programme the observed differences in measured outcome indicators between units who received the programme and those who did not. The measured differences we see in data could just be due to the fact that the programme participants were purposively selected.

2.1.2 The need for impact assessments

According to Simonyan (2009), the broad goals of impact assessment are a way to account for past funding; a basis for attracting new funding, create awareness on the importance of agricultural research, a means of securing political support for agricultural projects and lastly, it provides feedback for assessing agricultural growth and development objectives. Impact evaluations improve targeting of development projects and help adjust resource allocation across projects. That is, impact studies are required to measure benefits. These are required because resources are scarce, and there is the need to justify every investment as the findings can be used to enlist support for more and sustained funding. With careful evaluation of impact, scientists can target their work to achieve the greatest possible pay offs.

Impact assessment helps to document and account for past funding, build a tract record to attract new funding, and also guide the research agenda to achieve national priorities. The methods of measuring impact assessment include: Econometric method, programming method, economic surplus method and lastly, the double-difference (with/without or before/after method) (Simonyan, 2009).

2.1.3 Impact assessment methods

According to Haggblade and Hazel (1989) in Simonyan (2009) and Khandker *et al*. (2010), impact assessment methods are classified into three broad methods namely, first, quantitative methods which include (a) social experiments (b) cross sectional and longitudinal comparison (c) econometrics (d) propensity score matching, and (e) double difference estimator; secondly, qualitative method, and; thirdly, a combination of quantitative and qualitative methods.

2.1.3.1 Quantitative methods

(a) Social Experiments Method

Social experiments involve the use of experimental designs also known as randomization. In this method, an intervention programme is randomly allocated among eligible participants such that the assignment processes will create comparable treatment and control groups that are statistically equivalent to one another given appropriate sample size. Theoretically, the control groups generated through random assignment serve as a perfect counterfactual, free from the troublesome selection bias issues that exist in all evaluations. The main benefit of this method is said to be the simplicity in interpreting results, because the programme impact on the outcome being evaluated can be measured by the difference between the means of the treatment group and the control group (Simonyan, 2009). However, while experimental designs of the social experiment method are considered the optimum approach to estimating project impact, in practice there are several problems. These problems include the fact that randomization may be unethical owing to the denial of benefits or services to otherwise eligible members of the population for the purposes of the study. Secondly, it can be politically difficult to provide an intervention to one group and not another. Thirdly, the scope of the programme may mean that there are no non-treatment groups such as with a project or policy change that is broad in scope. Fourthly, individuals in a control group may change certain identifying characteristics or contaminate the results. Fifthly, it may be difficult to ensure that the assignment is truly random. Finally, experimental designs can be expensive and time consuming in certain situations, particularly in the collection of new data.

(b) Cross Sectional & Longitudinal Comparison Method

A cross-sectional design is used for research that collects data on relevant variables one time only from a variety of people, subjects, or phenomena. The data are collected all at the same time or within a short time frame. It provides a snapshot of the variables included in the study, at one particular point in time. It may reveal how those variables are represented in a cross section of a population. Cross-sectional designs generally use survey techniques to gather data.

Longitudinal design collects data over a long period of time. Measurements are taken on each variable over two or more distinct time periods. This allows the researcher to measure change in variables over time. There are two different types of longitudinal designs: time series and panel. A time series design collects data on the same variable at regular intervals (weekly, monthly or yearly) in a form of aggregate measures of a population. Panel designs collect repeated measurements from the same people or subjects over time. Panel studies reveal changes at the individual level, for example, when a particular person was employed or unemployed. (Wikipedia, 2014).

Haggblade and Hazel (1989) in Simonyan (2009) and Khanker *et al.* (2010), have said that these techniques are used to evaluate the impact of a project when it is not possible to construct treatment and comparison groups through experimental design. Cross-sectional comparisons compare households in the programme to those not in the programme and as such the expected income of those in the programme is subtracted from the expected income of those not in the programme. They however, argued that non-participants may differ from participants and that cross-sectional differences may not only be due to the intervention programme.

According to Baker (2000) in Simonyan (2009) longitudinal comparison which is otherwise called reflexive is an impact assessment method in which a baseline survey of participants is done before the programme and a follow-up survey is done after. The baseline provides the comparison group, and impact is measured by the change in outcome indicators before and after the programme

Barres and Hirakata (2003) found that Cox or poison regression with variance and log-binomial regression provide correct estimates and were found to be better alternatives for the analysis of cross-sectional studies with binary outcomes, than logistic regression, since the prevalence ratio was more interpretable and easier to communicate to non-specialists than the odds ratio. However, they concluded that precautions were needed to avoid estimation problems in specific situations. The cox model regression formulation is given as $h(t) = h_o(t) \exp(\beta_1 Z_1 + \ldots.. + \beta_k Z_k)$ ---------------------------------(1)

Where,

$h_o(t)$is the base hazard function of time, the $Z_{is}$are the covariates and the β_{is} are the coefficients for the covariates. The model treats $h_o(t)$ as a nuisance function and actually does not estimate it. Although this model can produce correct point estimators, the underlying distribution of the response is poison. Also, poison regression is commonly used to analyze longitudinal studies where for example, the outcome is a count of episodes of an illness occurring over time.

The model formation is Log $-$ $\beta_o + \beta_1 X_1 + \ldots \beta_k X_k$--------------------------------------(2)

Where n is the count of events for a given individual, t the time it was followed up, and X_i the covariates. The model parameter (β_i) are log relative risks.

(c) Econometrics Method

This method according to Nkonya *et al.* (2008) in Simonyan (2009) was developed to address selection biases. Econometrics is said to account for effects of differences in observable characteristics across individuals or over time and it has controls for many variables simultaneously. On the other hand, the econometrics method of impact evaluation can be viewed as an approach that employs a production function, cost function, or total factor productivity analysis to estimate the change in productivity due to investment in the programme. Using the same data base, the econometric method is adopted to research impacts within the framework of a production that incorporates conventional inputs (land, labour, fertilizer etc), non-conventional inputs (education, infrastructures, etc), and the stock of technical knowledge (investment in research and extension). However, the problems associated with the use of the econometrics method are the fact that parametric approaches often used depend on valid parametric assumption. Secondly, there is the problem of validity of heterogeneity and exclusion assumptions about instrumental variables. Thirdly, there is the need to address endogeneity of participation in projects. Fourthly, biases are often introduced by comparing non-comparable observations.

The basic tool for econometrics is the linear regression model. In modern econometrics, other statistical tools are frequently used, but linear regression is still the most frequently used starting point for an analysis. Econometric theory uses statistical theory to evaluate and develop econometric methods. Econometricians try to find estimators that have desirable statistical properties including unbiasedness, efficiency, and consistency. An estimator is unbiased if its expected value is the true value of the parameter, it is consistent if it converges to the true value as sample size gets larger, and it is efficient if the estimator has lower standard errors than other unbiased estimators for a given sample size. Ordinary least squares (OLS) is often used for estimation since it provides the BLUE or “best linear unbiased estimator” (where “best” means most efficient, unbiased estimator) given the Gaus-Markov assumptions. When these assumptions are violated or other statistical properties are desired, other estimation techniques such as maximum likelihood estimation, generalized least squares are used. Estimators that incorporate prior beliefs are advocated by those who favor Bayesian statistics over traditional, classical or “frequentist” approaches.

Econometrics method may use standard statistical models to study economic problems, but most often they are with observational data, rather than in controlled experiments. One of the fundamental statistical methods used by econometricians is regression analysis. (Wikipedia, 2014)

(d) Propensity-Score Matching Method

The idea of using this method is to find a comparison group that looks like the treatment group in all respects except one: the comparison group did not get the programme. However, the problem in practice is always how to define “looks alike” since there are potentially many characteristics one might look for to match against, as it is not clear whether a match has to be “identical” in all characteristics, and if so, how each characteristic should be weigh.

Two groups are normally identified: those households that have the treatment (denoted D_i=1 for household i) and those that do not (denoted $D_i = 0$). Treated units are matched to non treated units on the basis of the propensity score

$$P(X_i) = \text{Prob } (Di = I/X_i)\ (0<P\ (X_i) < 1)\ldots\ldots\ldots\ldots \quad (3)$$

Using the estimated propensity scores, P(X), the matched-pairs are constructed on the basis of how close the scores are across the two samples. The "nearest neighbour" to the i^{th} participant is defined as the non-participant that minimizes $((P(X)-P(Xi))^{2}$ over all j in the set of non participants, where $P(X_k)$ is the predicted odds ratio for observation k i.e., $P(X_k)= P(X_k)/(1 – P(X_k)$ ………………………………………------------------(4)

Letting DY_i denote the gain in a welfare indicator for the j^{th} unit attributed to access to the programme, the PSM estimator of mean impact is:

$$DY = \sum_{j=i}^{T} w_j \left(Y_{ji} - \sum_{j=i}^{C} W_{ij} Y_{ijo}\right) \qquad \text{(5)}$$

Where,

Y_{ji} is the post-intervention welfare indicator, Y_{ijo} is the outcome indicator of the i^{th} non-treated matched to the j^{th} treated, T is the total number of treatments, C is the total number of non treated households, wj's are the sampling weights used to construct the mean impact estimator; and the W_{ij}'s are the weights applied in calculating the average income of the matched non-participants.

In summary, in using the PSM method, one tries to pick an ideal comparison group from a larger survey. The comparison group is matched to the treatment group on the basis of a set of observed characteristics, or using the predicted probability of participation given observed characteristics ("propensity score"). A good comparison group comes from the same economic environment as the treatment group and should be administered the same questionnaire by similarly trained interviewers (Ravallion, 2001).

(e) Double Difference Method

This is a popular approach in non-experimental evaluations. It compares treatment and comparison groups in terms of outcome changes over time relative to the outcomes observed for a pre-intervention baseline. The standard DD estimate of a programme impact is the difference in the income gains overtime between a treatment group of programme participants and the matched comparison group of non participants.

According to Ravallion (2003) and Khandker *et al.* (2010), the "double difference" method entails comparing a treatment group with a comparison group both before and after the intervention. The followings are the main steps:

Step1: A "baseline" survey is required before the intervention is in place, and the survey must cover both non-participants and participants.

Step2: One or more follow up surveys are required after the programme is put in place. These should be highly comparable to the baseline surveys (in terms of the questionnaire, the interviewing method, etc). Ideally the follow-up surveys should be of the same sample. If this is not possible then they should be same geographic clusters, or strata in terms of some other variable.

Step3: Calculate the mean difference between the "after" and "before" values of the outcome indicator for each of the treatment and comparison groups.

Step4: Calculate the difference between these two mean differences.

The double difference method is a tool used in measuring impact (Verner and Verner; 2005). To use this model, information of both project participants and non-participants is often required for before and after the project. A positive double mean difference in income indicates a project impact on the income of the participants, while a negative double mean difference in income value indicates that the project has not increased participants income (Nkonya and Davis, 2008). The model is specified as follows:

$$DD^S = [\,- \qquad (Y_{1ia} - Y_{1ib})] - [\,- \qquad (Y_{oja} - Y_{ojb}) \ldots\ldots\ldots\ldots \quad (6)$$

Where:

Y_{it} = Total revenue or income at time a and b

Time a is = after the project and time b is before the project.

P = Number of participants

C = Number of individuals in the control group (non participants)

Equation (6) can equally be obtained through a regression model by adding covariates to the model. According to Khandker *et al.* (2010), the estimating equation for double difference can be specified as:

$$Y_{it} = \alpha + \beta T_i + yP_i + \delta\,(T_i * P_i) + \varepsilon_{it} \ldots\ldots\ldots\ldots \quad (7)$$

Where:

Y_{it} = The change in income in t period of the project

T_i = Binary variable. 1 if respondent i is a project beneficiary and 0 if otherwise

P_i = Binary variable. 1 indicating after the project and 0 before the project

$(T_i * P_i)$ = An interaction term representing the product of the two binary variables

The value is 1 if after the project, the respondent is a beneficiary.

ε_{it} = the error term of the regression with the variance σ^2

α, β, y, δ are the regression parameters to be estimated.

According to Nkonya *and Davis* (2008), the double difference method compares change in outcomes for pre and post programme for participants and non-participants. It is mostly used especially if selection bias is additive and time invariant. Using this technique, the outcome is not affected by expectations of participation because it usually nets out the selection bias. This method is said to be sensitive to data quality as measurement error is likely to be more serious in comparing changes in variables than comparing levels.

The Double (DD) method essentially compares treatment and comparison groups in terms of outcome changes over time relative to the outcomes observed for a pre-intervention baseline. That is, given a two- period setting where t=o is before the programme and t=1is after programme implementation. Y_t^T and Y_t^c are the respective outcomes for a programme beneficiary and non treated units in time t. Hence, the DD method will estimate the average programme impact as follows:

$$DD = E\,(Y_o^T/T_1 = 1) - E\,(Y_1^C\text{-}T_1^C/T_1 = 0)\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (8)$$

Where;

$T_1 = 1$ denotes treatment or the presence of the programme at t = 1

$T_1 = 0$ denotes untreated areas.

The DD estimator allows for unobserved heterogeneity (the unobserved difference in mean counterfactual outcomes between treated and untreated units) that could have led to selection bias. Also, the DD estimator relies on a comparison of participants and non participants before and after the intervention.

The DD estimator can also be calculated within a regression framework. The estimating equation is specified as follows:

$$Y_{it} = \alpha + \beta T_{i1}{}^{t} + P^T{}_{i1} + Y^t + E_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (9)$$

In equation (9), the coefficient β is the interaction between the postprogram treatment variable (T_{i1}) and time (t=1….T) and which gives the average DD effect of the programme. Thus using the notation from equation (9), β = DD.

In order to apply a DD approach using panel data, baseline data need to be collected on the programme and control areas before programme implementation. Also, follow-up surveys after the programme intervention should also be conducted on the same units. Calculating the average difference in outcomes separately for participants and non participants over the periods and then taking an additional difference between the average changes in outcomes for these two groups will give the DD impact. The double-difference approach described above yields consistent estimates of project impacts if unobserved community and individual heterogeneity are time invariant. (Khandker et al., 2010).

To address the bias due to unobservable characteristics, the double difference (DD) estimator is used to compare the challenges in outcomes of the matched samples of participants & non participants before and after the program started. For example, if the outcome being measured is the number of extension visits demanded by farmers, then

$$DD = (Y_{pt1} - Y_{pto}) - (Y_{nt1} - Y_{nto}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (10)$$

Where;

Y_{pt1} = number of extension visits demanded by programme participants after the program started.

Y_{pt0} = number of extension visits demanded by program participants before the program started.

Y_{nt1} = number of extension visits demanded by non-participants after the program started.

Y_{nt0} = number of extension visits demanded by non participants before the program started.

If the DD is 70 for example, which is significantly greater than zero, then the program had a significant impact on the demand for advisory services. The DD estimator nets out the effects of any additive factor (whether observable or unobservable) that have fixed (time-invariant) impacts on the outcome or that reflect common trends affecting program participants & non participants equally.

Ravallion (2001) discussed two other methods of impact evaluation in addition to those discussed above. These two other methods are randomization and instrumental variation methods.

a. Randomization

The selection into the treatment and comparison groups is random in some well-defined set of people. Then, there will be no difference on average between the two groups besides the fact that the treatment group got the programme.The purpose of randomization is to achieve balance with respect to known and unknown risk factors in the allocation of participants to treatment arms in a study (Hewitt and Togerson, 2009). A premise of basic statistical tests of significance is that the underlying observations are independently and identically distributed. According to Groddkurth *et al.* (1995) a randomized experiment is a type of experimental design in which participants are randomly assigned to a treatment or control group. This type of experimental design is typically the golf standard for impact evaluations because it often produces the least biased results.

b. Instrumental variable methods

Instrumental variables are variables that matter to participation but not to outcomes given participation. If such variables exist then they identify a source of exogenous variation in outcomes attributable to the programme recognizing that its placement is not random but purposive. The instrumental variables are first used to predict programme participation, then one sees how the outcome indicator varies with the predicted values, conditional on other characteristics.

2.1.3.2 Qualitative method of impact evaluation

According to Baker (2009) in Simonyan (2009), qualitative techniques are used for carrying out impact evaluation with the intent to determine impact by relying on something other than the counterfactual to make a causal inference. The focus instead is on understanding processes, behaviors, and conditions as they are perceived by the individuals or groups being studied. The qualitative method and particularly participant observation can provide insight into the ways in which households and local communities perceive a project and how they are affected by it. The qualitative approach is useful for organizational learning objectives. It is worth noting that in the qualitative approach, there is a limited ability to attribute impacts to interventions and there are usually problems of sampling and interviewer biases. Nevertheless, according to the World Bank (1996) in Simonyan (2009), qualitative impact assessment techniques are the techniques that have been developed for rapid rural assessment, which rely on participants' knowledge of the conditions surrounding the project or programme being evaluated, or participants' evaluation in which stakeholders are involved in all stages of the evaluation. That is, the stakeholders help to determine the objectives of the study, identifying and selecting indicators to be used, and participate in data collection and analysis.

2.1.4 Sociological approach of impact assessment

This approach is used mostly in ex-post evaluation where greater emphasis is placed on intermediate ends such as number of activities and of people involved, opinions about activities, knowledge, attitude, skills, aspirations and practices.

Sociological approach has been criticized for emphasizing intermediate ends, which could divert attention from the fundamental issues of return to investment. However, the approach has its special merits for possessing the capacity to capture the often-neglected non-quantifiable costs and benefits which are often manifested in people's attitudes and opinions towards the project being evaluated. It is also particularly useful in evaluating pilot projects where available data may not lend themselves to vigorous statistical analysis (Manza, 1988).

It should be noted that in all methods with the exception of the qualitative method and sociological approach method, a comparison group is used to identify the counterfactual of what would have happened without the programme. The comparison group is designed to be very similar to the treatment group of participants with one key difference: The comparison group did not participate.

The conclusion is that in estimating the impact of a programme, there is no one single evaluation tool which can claim to be ideal in all circumstances. The art of good evaluation is to draw carefully from the full range of tools available to deal pragramatically with the problem at hand in its specific context. The best evaluation studies often combine multiple methods; randomizing some aspects and using econometric methods to deal with the non-random elements.

2.1.5 Farm budgeting analysis

Farm budgeting is a detailed physical and financial plan for the operation of a farm for a certain period. Farm budgeting also involves considering the resources that will be used, the choice of enterprise(s) to pursue and calculation of expected receipts, expenditures and net farm income. The NFI model is presented mathematically as:

$$NFI = GFI - TVC - TFC \text{...--(11)}$$

Where:

NFI = Net Farm Income (₦/ha)

GFI = Gross Farm Income (₦/ha)

TVC = Total Variable Cost (₦/ha)

TFC = Total Fixed Cost (cutlasses, hoes, axes, rake and pumping machine) (₦/ha)

The straight – line depreciation method is usually used to estimate depreciation value for the fixed assets used for the farming activities which include hoe, cutlass, rake, pumping machine, axe etc (Olukosi and Erhabor,2004;Simonyan,2009).

2.1.6The concept of food security

Decades of research have led to substantially improved understanding of the nature of food insecurity. Until the food crisis of 2007/08, a combination of economic growth and targeted programmes resulted in a steady fall in the percentage of the world's population under-nutrition (from 20% in 1990/92 to 16% in 2006). Yet over a billion people still face both chronic and/or transitory food insecurity due to long-standing problems of inadequate income, low-productivity in agricultural production and marketing, and related problems of poor health and absence of clean water. Among the regions of the world, the greatest numbers of the food insecure live in South Asia, while Sub-Saharan Africa has the highest proportion of population that is food insecure.

Achieving adequate food security for such a large number of people is increasingly challenging due to a combination of economic, social, political and environmental factors.

The FAO (1996) considers that food security exists when all people, at all times, have access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active healthy life. This definition, while seemingly straight forward, has several important implications. First, food security requires that all people have access to sufficient food. Having access to food requires that the food be available, but availability does not guarantee access. Thus, a focus on trying to ensure that there is food security simply through increasing food production is incomplete at best, and in some circumstances can actually worsen access to food by pricing the poor out of the market if local production takes place at very high cost.

The USDA (2009) defined food security as "access by all people at all times to enough nutritious food for an active, healthy life." This implies sufficient supplies of food, physical and financial access to those supplies, and nutritional adequacy in terms of dietary needs even if enough food exists at the regional, national, or global levels.

Access involves having both physical access to a place where food is available and economic access-having a socially legitimate claim to that food. This is what Sen (1982) calls an "entitlement to food." This entitlement can come about through owning the food a person has produced himself, having the purchasing power to buy it in the market, or having some other recognized claim to the food, such as being a family member entitled to share household resources or being included in a relief agency's list of those qualifying for food aid. Sen (1982) notes that at the most fundamental level, people are hungry because they do not own enough food.

For the majority of the people in the world, including the majority in low-income countries, access to food comes at least partially through the market-through having the income necessary to purchase an adequate diet rather than produce it entirely by oneself. That is to say, food security implies access to safe food/quality food. Having sufficient income to purchase an adequate diet depends not only on the amount of money one earns but also on the price of food. Here is where the availability and the access dimensions of food security become inextricably linked. Availability reflects effective demand, with food prices linking the two sides of the equation. The price of food, in turn, depends on the cost at which the food can be made available either through local production, commercial imports, or aid. It is the cost of food to the consumer relative to his/her income, not the physical availability per se that is crucial in determining food security.

2.1.7 The concept of rural livelihood

The Oxford Advanced Learners Dictionary of current English (8th Edition) (e-copy) defines rural livelihood as "a means of earning income in order to live by rural households." Ellis (2000) in Nasa'i (2008) stated that at the micro-level, a livelihood can be considered as the "assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediated by institutional and social relations), that together determine the living standard gained by the individual household." What then is sustainable livelihood? Sustainable livelihood consists of activities that promote sustainable human communities. The approach begins with people's assets and capabilities, and seeks to build on them. A livelihood is said to be sustainable if it can adapt to stresses and shocks, maintain and enhance its capabilities and assets, and at best, enhance opportunities for the next generation. This approach recognizes that the root of all human development and economic growth is livelihoods-not jobs per se, but the wide, infinity diverse range of activities people engage in to make their living-together with assets or entitlements they own or can access. Hence, it integrates considerations of income generation; the production of sufficient food, nutrition, women's empowerment; and environmental management (CIDA, 2003).

Livelihood strategies for most men and women in Borno State are based on agriculture. Farming is characterized by a variety of crop and livestock-based production systems. Crops are grown for home consumption as well as for local markets. In the south, maize, sorghum, and cowpea and, to a lesser extent, rice and soybean are major crops. Towards the north, sorghum and millet are the dominant crops. Livestock-small and large ruminants, as well as poultry-are an integral part of the farming system and provide income as well as safety nets. In many parts of Borno State, farmers have been obliged to diversity their livelihood with incomes from outside the sector. (Amaza *et al.*, 2004).

2.2 Review of Impact Evaluation Methodologies

2.2.1 Measurement of household food security status:

The determination of household food security status is achieved through a combination of analytical tools. There is the cost of calorie index and the food security index. The use of a Logit regression model is done to identify the major determinants of household food security.

Using the cost of calorie index method, the food insecurity line is given as

$$\text{In } X = a + bC \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (12)$$

Where X is the adult equivalent food expenditure (in Naira) and C is the actual calorie consumption/adult equivalent of a household (in Kcal). The calorie content of the recommended minimum daily nutrient level (L) by Gohl, (1981) in Amaza *et al*. (2009), was used to determine the food insecurity line (S) using the equation:

$$S = e^{(a + bL)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (13)$$

Where:

S = the cost of buying the minimum calorie intake (food insecurity line)

a & b = parameter estimates from equation 13

L = recommended minimum daily energy (calorie) level (2250 Kcal).

Based on the S calculated, households will be classified as food secure or food insecure, depending on which side of the line they fall (Amaza *et al.,* 2009).

2.2.1.1 Food security index

According to Olayemi (1998) identification is the process of defining a minimum level of nutrition necessary to maintain healthy living. This is referred to as the “Food Security Line”, below which people are classified as food insecure and subsisting on inadequate nutrition. The food security line used in this study was based on the daily-recommended level of calorie and protein, which are 2260 kcal and 65g respectively. In order to generate food security indices, the nutrient content of the food consumed was used to derive both calorie and protein availability.

ǂb

For a household to be food secure, Zi must be greater than or equal to 1 (Zi > 1). If Zi is less than 1 (Zi < 1) the household is food insecure. It must also be noted that the above criterion must be satisfied for both protein and calorie requirements. The quality of crops produced i.e food and food purchased was converted to Kilogram and further to calorie and protein respectively and was divided by adjusted household size and by 365 days to obtain the calorie and protein consumed per day per household and then compared with the standard (2260 Kcal and 65 grammes respectively).The nutrient composition of commonly eaten foods in Nigeriaas used by Oguntona and Akinyele (1995) in Adebayo (2011) was used to estimate the calorie intake of households.

The vector of explanatory variables used include age of household head in years, farm size of a household in Ha, farmers family size, farming experience in years, cooperative membership (D = 1 if the farmer is a member and D = 0 if he/she is not), years of schooling (D= 1 if educated and D=0 if otherwise), distance to input source in km, gender of household head (D = 1 for male; D = 0 for female), marital status of household head (D=1 for married and D=0 if otherwise), number of extension visits, occupation of household head (D=1 if agriculture and D=0 if otherwise). Household's access to credit facilities (D = 1 if there is access; D = 0 if otherwise), and commercialization (i.e. proportion of farm produce sold).

2.2.1.2 Determinants of food security

Amaza *et al*. (2004) used a Logit regression model to estimate the determinants of food insecurity which is:

$$Yi = g\ (Ii) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (15)$$

$$I_i = b_o + \qquad _j\, Xji \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (16)$$

Where,

Yi is the observed response for the i^{th} observation (i.e. the binary variable, Yi = 1 for food secure household and Yi = 0 for a food insecure household).

Ii is an underlying and unobserved stimulus index for the i^{th} observation (conceptually, there is a critical threshold (I_i*) for each household; if Ii < I_i*, the household is observed to be food secure, and if $I_i \geq I_i$* the household is observed to be food insecure).

g is the functional relationship between the field observations (Yi) and the stimulus index (Ii) which determines the probability of being food secure. The Logit model assumes that the underlying stimulus index (Ii*) is a random variable, which predicts the probability of being food insecure. Therefore, for the i^{th} observation (a household):

$$Ii = In\ p/1\text{-}pi = b_0 + \sum_{j=i}^{n} bjXji \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(17)$$

The relative effect of each explanatory variable (Xji) on the probability of being food insecure is measured by differentiating with respect to Xji, using the quotient rule (Green and Ng'ong'ola, (1993) in Amaza *et al.*, (2007).

$$^{d}p^{i}/_{dXji} = \left\{\frac{e^{Ii}}{(1+e^{Ii})^2}\right\}\left\{\frac{Ii}{Xji}\right\} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(18)$$

Where;

Pi = the probability of an i^{th} household being food insecure.

Xi = vector of explanatory variables.

The study by Amaza *et al.* (2007) found the major determinants of food security to be household size, gender of the household head, educational level of the head of household, farm size of the household and type of household farm enterprise. Other determinants were ratio of quantity of food produced to quantity of food consumed, extent of agricultural output commercialization, expenditures on education, household's access to extension agents, access to credit, household head's membership of cooperative/farmers' organization and value of household assets.

Yahaya (2009) used the food security index below to assess the food and nutrition security status of rural farming households; which is:

$$Zi = Yi/R \qquad (19)$$

Where,

Zi = Food security status of the households which takes values 1 for food secure households or O for food insecure households.

Yi = Daily per capita calorie intake of the i^{th} household

R = Recommended per capita daily calorie intake (2260Kcal)

Zi = 1 for Yi greater than or equal to R.

Zi = 0 for Yi less than R.

Calorie availability was determined from the nutrient contents of home produced and purchased food consumed by households. Food security index of each household was calculated after the households' daily calorie intake was obtained through the households' 3-day food consumption recall method.

In order to estimate the determinants of household food security in the study area a multiple regression model was used. The model was stated in its implicit form as well as in its explicit form as follows:

$$Zi = \alpha + \beta i\ Xi + Ui \quad \text{(Implicit form)} \qquad (20)$$

$$Zi = f\ (X_i, X_2, X_3, X_4, X_5, X_6, U_i) \ \text{(Explicit form)} \qquad (21)$$

Where,

Z_i = Food security status

β_i = Parameter estimates

α = Constant term

X_i = Vector of explanatory variables

U_i = The error term

The determinants of food security were found to include household annual income, household size, quantity of food from own production, farm size, education of household head and access to market. While all the factors were significant at 1%, only access to market was significant at 5%. The adjusted R^2 was 0.7 implying that 70% of the total variation in food security status of the households was explained by the specified explanatory variables.

Other studies like the ones by Lawal (2006), Omotosho *et al*. (2006), Makinde (2001), Babatunde *et al.* (2007) ,Falake et al. (2003) and Obamiso (2003) as discussed by Amaza *et al.* (2004) arrived at different determinants of food security in different locations. For example, Lawal (2006) in a study on cereals and farming households, the food security in some selected local government areas of Kwara State revealed that own food production, family size (adjusted) were the major determinants of food security. Makinde (2001) employed the Logit regression model in a study of food security in Bauchi area of the Northern Guinea Savanna of Nigeria. The study showed that initial wealth of the household which was estimated by the size of livestock measured in tropical livestock unit, family size, household income and farm size were the major factors affecting household food security. Falake *et al.* (2003) using the Logit regression model in a study on the determinants of food security in southern Ethiopia found that technology adoption, farming system, farm size, land quality, household size, per capita aggregate production and access to market were the major factors which determined household food security.

2.2.1.4 Consumer price index

A consumer price index (CPI) measure changes in the price level of consumer goods and services purchased by households. It is a measure that examines the weighted average of prices of a basket of consumer goods and services, such as transporting food and medical care. The CPI measures the average change overtime in prices of goods and services consumed by people for day to day living. The construction of the CPI combines economic theory, sampling and other statistical techniques using data from other surveys to produce a weighted measure of average price changes in the Nigeria economy. The weighting occurs to capture the importance of the selected commodities in the entire index (Wikipedia, 2013[a]).

Consumer price indices (CPIs) are index numbers that measure changes in the pricess of goods and services purchased or otherwise acquired by households, which households use directly, or indirectly, to satisfy their own needs and wants. Consumer price indices can be intended to measure either the rate of price inflation as perceived by households, or changes in their cost of living (that is, changes in the amounts that the households need to spend in order to maintain their standard of living.(Wikipedia, 2013[b]).

A Price Index is a normalized average (typically a weighted average) of prices for a given class of goods or services in a given region, during a given interval of time. It is a statistic designed to help to compare how these prices, taken as a whole differ between time period or geographical locations.

Price indices have several potential uses. For particularly broad indices, the index can be said to measure the economy's price level or cost of living. Generally, there are the following consumer/price indices:

1. Paasche Index (Hermann Paasche)

   The Paasche Index $P_{p,}$ is defined as:

$$Pp = \sum_{i=1}^{n} P_i^t q_i^t \Big/ P_p = \sum_{i=1}^{n} P_i^0 q_i^t = \left\{ \sum_{i=1}^{n} \left(P_i^t \Big/ P_i^0 \right)_{\overline{S_i^t}} \right\}^{-1} - \ldots \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(22)$$

Where S_i^t denotes the actual share of the expenditure on commodity i in period t; that is,

$$P_i^t\, q_i^t \Big/ \quad P_i^t\, q_i^t$$

The Passche index is a weighted harmonic average of price relatives that uses the actual expenditure shares in the later period t as weights.

Where;

P^o = Price at base year

P^t = Price in present period

Q^o = Quantity at base year

q^t = Quantity in present period

It uses period and quantities. Its major demerit is that it tends to overstate inflation not taking into account that consumers change quantities in response to changing prices.

A paashe index of 1 indicates that an agent could have consumed the same bundle in the base period as she or he is consuming in the current period, given that income has not changed.

2. Laspeyres (Etienne Laspeyres)

   The Laspeyres price index, P_L, is defined as:

$$P_P = \sum_{i=1}^{n} P_i^t q_i^t \Big/ \sum_{i=1}^{n} P_i^0 q_i^o = \left\{ \sum_{i=1}^{n} \left(P_i^t \Big/ P_i^0 \right)_i^{S_o} \right\} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(23)$$

Where S_i^o denotes the share of the actual expenditure on commodity i in period 0: that is,

$$P_i^t q_i^t \Big/ \sum p \; P_i^o q_i^o$$

P= Relative index of price levels in two periods, where Pt_0 is the base period (usually the 1st yr) and in the period for which the index is computed.It uses period and quantities. It tends to understate inflation not taking into account the consumers reaction to changing prices by changing quantities.

A Laspeyres index of 1 shows that an agent in the current period can afford to buy same bundle as she or he has consumed in the previous period, given that income has not changed.

3. Marshall – Edgeworth Index (Alfred Marshall & Francis Ysidro Edgeworth). Designed to take care of the fact that both Laspeyres and Paasche neglect the fact that consumers respond to prices by changing quantities consumed. It is computed by using the arithmetic mean. It is given as follows:

$$PME = \sum\left[P^{to} \bullet \tfrac{1}{2} \bullet \left(P^{to} + q^{to}\right)\right] \Big/ \sum\left[P^{to} \bullet \tfrac{1}{2} \bullet \left(P^{to} + q^{to}\right)\right]$$

$$= \left[P^{to} \bullet \left(P^{to} + q^{to}\right)\right] \Big/ \sum\left[P^{to} \bullet \left(P^{to} + q^{to}\right)\right] \quad \text{..(24)}$$

4. Fisher Index (Irving Fisher)

The Fisher price index, P_F, is defined as the geometric average of the Laspeyres and Paasche indices, that is, $P_F = \sqrt{P_L . P_P}$

This is usually considered as the ideal price index. This is because it takes care of the overstating or understating of inflation, done by Paasche Index and Laspeyres Index respectively as it provides an overall measurement of relative prices.

Note that these indexes present relative and not absolute value as they are used in comparing one price index to another.

2.3 Review of Empirical Studies:

2.3.1 Impact of agricultural development projects

Studies on the impact of irrigated agriculture have revealed different dimensions of impact of such projects in different locations. One of the impacts discovered was reported by Maredia *et al*.(2006) in Simonyan (2009) that farm output was doubled on irrigated farms. Similarly, Musa (2004) in Simonyan (2009), found that studies on the benefits farmers derived from irrigated agriculture contributed significantly to improved living conditions of the farmers. The study also showed that high level of adoption by farmers of research proven technologies were capable of increasing farmers' income, meeting their required daily food needs and promoting general economic growth.(Wikipedia, 2013[c]).

Different perceptions of farmers on the benefits of agricultural projects have also been reported and documented. It was found that farmers' perception on the benefits they derive from projects greatly influenced the decision taken by farmers to adopt new practices brought by the projects. It was also reported that farmers take good care of project facilities so that they can continue to benefit from the projects. Simonyan (2009) found that farmers when involved in the planning and implementation of projects tend to be happier and more receptive to innovations and actively participate than those not involved because of the knowledge of benefits they derive from the projects.

Rusike *et al.* (2008) found that recent developments in econometric modeling permit the use of both experimental and non experimental data to construct counterfactuals while controlling for observable and unobservable characteristics correlated with outcomes to obtain better estimates of impact. They reported that every unit of analysis has two possible or potential outcomes, Y_1i and Y_0i, where Y_1i is the outcome without treatment, all else fixed. The difference between the two outcomes was the casual effect of the cassava R4D treatment on Y for the individual i. This framework enabled Rusike *et al.* (2008) to examine the impact of their research on yields, impact on cassava uptake and per capita area and impact on household calorie availability and food security.

The study by Sanginga *et al.* (1999) expressed the strong need to focus on the social impact of agricultural technologies in Sub-Saharan Africa where social concerns are higher and more pressing than elsewhere in the world. They justified the use of the social impact tool as an instrument of user-oriented and people centred research. They stated that the social impact Assessment (SIA) framework was developed using a more holistic and comprehensive approach in response to the limitations of the traditional economic impact analysis. They added that SIA represents an effort to analyze the real, or potential impact of technologies upon specific groups of people. It requires analysis of changes that occur in the lives of people as a result of adopting innovation or new policy interventions. It helps to determine how far a technology has been successful in meeting social and economic objectives, and how well such technologies satisfy the needs and aspirations of households or other larger social units in the target population.

Sanginga *et al.* (1999) used Tobit regression model and found that the adoption of soybean had a clear positive impact on household income generation and distribution, material welfare, human capital development, gender relations, resource use, social equity, and other social processes in the community. They concluded that the results of the study provided a strong case for the promotion of soybean as a cheap solution for malnutrition and a means of poverty alleviation for poor people.

Impact assessment of public agricultural research has always been viewed as an important activity to ensure accountability, maintain credibility, and improve internal decision-making processes and the capacity to learn from past experiences (Alene *et al.*, 2004). Impact studies have, however, been faced with both conceptual and empirical challenges, partly due to the complexities of the relationships between agricultural technology and the various dimensions of poverty, with research having both direct and indirect effect on poverty alleviation (Kerr and Kolavalli, 1999; De-Janvry and Sadoulet, 2002). As the goals of agricultural technology development change from increasing food production to the broader aims of reducing poverty, both technology development and studies of its impact become more complex. The sustainable rural livelihoods framework (SRLF) was adapted and used in assessing the impact of new agricultural technologies on livelihoods (Kerr and Kolavalli, 1999; Adato and Meinzen-Dick, 2002). The SRLF is primarily a conceptual framework for analyzing the causes of poverty, people’s access to resources and their diverse livelihood activities; and the relationship between relevant factors at micro, intermediate, and macro levels. The framework has the advantage of allowing researchers to understand the parameters of the “big picture,” and then to narrow the scope of the study to what can have the greatest impact or what is most relevant to the important stakeholders (including the researchers).The SRLF brings in many considerations that are often not included in an impact study dealing with agricultural technologies. Adapting the SRLF for the assessment of the impact of agricultural technologies on rural livelihoods is, therefore, always important.

In impact assessment, the assets upon which people build their livelihoods are of particular interest. This includes a wider range of assets than are usually considered. Rather than looking only at land or other classic wealth indicators, the SRLF suggests consideration of an asset portfolio of five different types of assets.

i. **Natural Capital:** Land, water, forests, marine resources, air quality, erosion protection, and biodiversity.

ii. **Physical Capital:** Transportation, roads, buildings, shelter, water supply and sanitation, energy, technology, communications, or other household assets.

iii. **Financial Capital:** Savings (cash as well as liquid assets), credit (formal and informal), as well as inflows (state transfers and remittances)

iv. **Human Capital:** Education, skills, knowledge, health, nutrition, and labour power.

v. **Social Capital:** Networks that increase trust, ability to work together, access to opportunities, reciprocity, informal safety nets; and membership in organizations (DFID, 1997).

Oakley (1983) while looking at the importance of base-line surveys in evaluation wrote that "as with any monitoring and evaluation (M&E) exercise, it will be impossible to make a judgment on the nature of the process of participation if we are unable to compare this latter situation with the situation before the project was introduced. One assumes that the rural development project in its other more tangible activities will establish the baseline data from which to make later judgments."

Morgan (1985) writing on social impact Assessment showed that there are three areas in any social impact assessment. These are socio-cultural feasibility, spread effects and distribution impact. Socio-cultural feasibility should ascertain that the assessment is based on an accurate understanding of the social organization of productive activities, that is, it should find out how the intended beneficiaries have access to, make use of, and exercise control over natural and productive resources available in the area. Spread effects refer to the likelihood that the new technology introduced to the initial target group will be diffused among others. Distributional impact is concerned with the differential impact of technology, and the distribution of benefits/burdens upon different categories of people, that is, it should find out who has benefited from technology and in what ways.

Morgan (1985) further added that social impacts are changes that have occurred at an individual, household, farm and community level. Impact here should solely be the positive impact on farmers' living standard. The indicators of impact at household level include income, food security, material possession/welfare and human capital development. At the farm level, the impact indicators include increase in output, use and allocation of resources, land use expansion and input use. At the community level, impact can be seen in the changes in attitudes, values, innovativeness, labour and market expansion and sustainability of crops etc.

The European Evaluation Society (EES) (2007) defined impact evaluation as complex, particularly of multi-dimensional interventions such as many forms of development (e.g. capacity building, global budget support), evidence based, rigorous approaches to evaluation that have been used in varying contexts for assessing impact. The EES (2007) deplored one perspective that was being strongly advocated that the best or only rigorous and scientific way of undertaking impact evaluation is through Randomized

Control Trials (RCTs). This was because RCTs represent one possible approach for establishing impact that may be suitable in some situations. For example:

a. With simple interventions where a linear relationship can be established between the intervention and an expected outcome that can be clearly defined.

b. Where it is possible and where it makes sense to 'control' for context and other intervening factors (e.g. where contexts are sufficiently comparable);

c. When it can be that programmes under both experimental and control conditions can be expected to remain static (e.g not attempt to make changes or often for a considerable period of time);

d. Where it is possible and ethically appropriate to engage in randomization and to ensure the integrity of the differences between the experimental and control conditions.

Even in these circumstances it would be 'good practice' not to rely on one method but rather combine RCTs with other methods and to triangulate the results obtained.In comparing RCT with any other method, the RCT approach has considerable limitations that may limit its applicability and ability to contribute to policy, for example,

a. RCT designs are acknowledged even by many of its proponents to be weak in external validity (or generalisability), as well as in identifying the actual mechanisms that may be responsible for differences in outcomes between the experimental and control situations;

b. "Scaling up" across-the-board implementation based upon the results of a limited and closely controlled pilot situation, can be appropriate for those interventions (e.g. drug trials) where the conditions of implementation would be the same as in the trial, but this is rarely the case for most socio-economic interventions where policy or programme fidelity cannot be taken for granted;

c. An RCT approach is rarely appropriate in complex situations where an outcome arises from interaction of multiple factors and interventions, and where it makes little sense to “control” for these other factors. In a development context, as for most complex policy interventions, outcomes are the result of multiple factors interacting simultaneously, rather than a single ‘cause’,

d. RCTs are limited in their ability to deal with emergent and/or unintended and unanticipated outcomes as is increasingly recognized in complex systems research considering the fact that many positive benefits of development interventions will often be related rather than identical to those anticipated at the policy/programme design stage;

e. RCTs generally are less suited than other approaches in identifying what works for whom and under what circumstances. Identifying what mechanisms lead to an identified change is particularly important given the varying contexts under which development typically takes place and is essential for making evidence-based improvements.

The EES (2007) also noted that RCTs are based upon secessionist (sometimes referred to as ‘factual’ model of causality) that neglects the links between intervention and impact and ignores other well understood scientific means of establishing causality.

2.3.2 Farm gross margin analysis

Farm Gross Margin provides a simple method for comparing the performance of enterprises that have similar requirements for capital and labour. A gross margin refers to the total income derived from an enterprise less the variable costs incurred in the enterprise.

According to Olukosi and Erhabor (2004), the gross margin involves evaluating the efficiency of an individual enterprise (or farm plan) so that comparison can be made between enterprise or different farm plans. It is a very useful planning tool in situations where fixed capital is a negligible portion of the farm enterprise as is the case in subsistence agriculture. Gross Margin (GM) by definition is the difference between the gross farm income (GFI) and the total variable cost (TVC), that is,

$$GM = GFI - TVC \qquad (25)$$

Variable costs vary according to output and are incurred on variables inputs which can be attributed to specific enterprise. Costs incurred on fixed inputs are, in the short run, considered sunk and unchanged while costs incurred on variable inputs vary in proportion to the level of output. The gross farm income, also called total value of production, is the total physical product multiplied by the unit price of the product. The net farm income (NFI) can be determined by subtracting the total fixed cost (TFC) from the total gross margin (TGM) of the whole farm or all the enterprises.

$$NFI = TGM - FC \qquad (26)$$

If a farm business is made up of three enterprises e.g rice (r), Yam(y) and maize (m), the total gross margin (TGM) = $GM_r + GM_y + Gm_m$ (27)

Where;

$GM_r = GI_r + VC_r$

$GM_y = GI_y + VC_{y;}$ and

$GM_m + GI_m + VC_m$

The gross margin analysis is highly applicable to subsistence system of farming involving small fixed capital component.

The gross margin is calculated by estimating the annual production costs and income of the enterprise under consideration on a per hectare basis. The basic and broad guideline for calculating the gross margin is that all input costs and the cost of all hired services that contributed towards the income received from the enterprise must factored in.

The calculation of a gross margin is the essential first step in farm budgeting and planning. It enables one to directly compare the relative profitability of similar enterprise and consequently provides a starting point to deciding or altering the farms overall enterprise mix. Gross Margins can be used to analyze actual enterprise performance. That is, one’s gross margins can be compared with others or with standard for a district or province or state.

Gross Margins need to be used carefully when using them as a guide to deciding on farms overall enterprise mix. This is because overhead costs are excluded. Therefore, it is advisable to make only comparisons of gross margins between enterprises which use similar resources (Headslip *et al.,* 2013).

Chapter 3

METHODOLOGY

3.1 Description of the Study Area

Borno State is located in northeast of Nigeria and covers an area of 69,435 sq km. The population of Borno State is estimated to be 5.24million in 2014 from the 4.20million in the 2006 census figure using an annual growth rate of 3%. The population of the project area in the state is estimated to be about 2.40 million in 2013 from the 1.92million in the 2006 census figure. The State is demarcated into four agro ecological zones: the Northern Guinea Savanna (NGS) and Southern Guinea Savanna (SGS) in the Southern part of the state, the Sahel Savanna in the southern and central parts of the State and the Sahel (SS) in the northern part of the State. The annual precipitation ranges from less than 700mm in the north to 1500mm in the south. Rainfall, however, varies from year to year. (Amaza*et al.*, 2004).

The project area covers 39 communities located in three agro ecological zones located between latitude 10^0 and 12^0 north of the equator and longitude 11^0 30^0 and 14^0 east in four Local Government Areas (LGAs) namely: Damboa in the SS, Hawul in the SGS, Biu and Kwaya Kusar in the NGS. Numerous ethnic groups and cultures characterize the area, with approximately 80% of the population being small-scale farmers. Agriculture and trading constitute the major economic activities of the area (Amaza *et al.*, 2004).

The study area is characterized by a relatively wet and humid climate as compared with the drier northern part of the state. Hence, agriculture is more widely practiced in the study area. The annual rainfall ranges from 700mm to 1500mm with about 140 to 150

days of rainfall per year. The raining season starts in May and lasts until October; the humidity is about 49% with an annual evaporation rate of 2034mm.
The temperature varies from 15^0C to 20^0C during the harmatan period (i.e. between December and February) and also from 32^0C to 38^0C during the hot, dry season (i.e. between March and May).

The vegetation of the study area is typical of the savannas, consisting of shrubs interspersed with trees and woodland. Most parts of the area are mountainous with abundant rivers that are, however, seasonal in nature.

According to Amaza (2006), the agricultural activities in the project area can be categorized into cropping activities and animal husbandry. The cropping pattern is almost uniform throughout the area, probably due to similarities in vegetation. There are two cropping seasons. One is the wet cropping season that starts with the on set of rain and lasts to the end of the rainy season, when most crops are harvested. The other is the dry cropping season, which starts soon after this. Crops are grown sole, multiple, mixed or in relay. Crops are also grown in rotation depending on preference. The major crops grown in the area are maize, sorghum, cowpea, groundnut, soybean and vegetables. The animals are cattle, sheep, goats, pigs, and poultry.

3.2 Sampling Procedure

Three of the four LGAs under the project area were covered for the purpose of data collection. The three LGAs studied were selected at random to include Biu, Hawul and Kwaya Kusar LGAs. The sampling frame was the 39 communities in which the project was implemented and which were spread across four LGAs in the project area. Two communities from the list of communities in the LGA were selected at random in each of the three LGAs. The communities selected in each LGA were as follows: Biu LGA (Miringa, Filin Jirgi, Tum and Burutai); Hawul LGA (Marama, Tilla/Kwaya Bura, Kayamda and Vinadam); and Kwaya Kusar LGA (Wandali). The selection was carried out randomly using a table of random numbers. In each of the selected communities, a random selection of 20 households was carried out from the list of households in the community. That is, a total of 180 farming households from the project area were studied.

To ensure gender balance, the survey was designed so that nearly 15% of all respondents were female household heads. That is, stratified sampling was used to achieve nearly 15% of the respondents to be female household heads. This implied that at least 15% of the respondents were female headed household heads while the remaining household heads were male household heads. This was achieved by ensuring that after the household listing, female headed households were identified and selected purposively.

Of the four adjoining LGAs, two were selected at random for the study and the non project participants were drawn from Shani, and Bayo LGAs. Bayo LGA is located to the South West of Hawul LGA and Kwaya Kusar. These non project LGAs served as the counterfactuals.

The selection of non project participants was done using similar procedures as discussed above. Four communities were selected at random from the list of communities in each of the two LGAs studied. In each of the four communities, 20 households were selected at random in two of the communities and 25 households were selected in the other two communities based on the population of the four communities; of which 15% of them were female headed households while the remaining were male headed households. That is, a total of 180 households of the non project participants were studied in each of the two LGAs. The following communities were selected: Bayo LGA Biryel (20), Wuyo (25), Geidam (25) and Tasha (20) and in Shani LGA, Shani (25), Walama (25), Brakulog (20) and Kimtir (20)). The numbers in bracket represent the number of households studied.

3.3 Data Collection:

Primary data was used for this study. The primary data was generated from farmers through the use of a structured questionnaire which was administered by trained enumerators under the supervision of the researcher. The data covered household demographic characteristics in terms of marital status, gender of household head, household size, age of household head, and level of education of household head; employment status of the head of the household, the level of food self-sufficiency of the household; size of family labour, size of hired labour, household production enterprise portfolio i.e. inputs, outputs etc, total household farm size, access to agricultural extension services, etc.

Data on institutional factors such as membership of cooperative societies as well as data on vulnerability factors such as the level of valuable and disposable assets owned by a household was also collected from the farmers in the project area as well as in the non project area. Data on yield and production estimates for households, current sources of farm inputs, sources of seeds, major buyers of farm produce, improved technologies and practices in use, soybean usage etc were also collected.

Secondary data was also used in the study which was generated from publications and records of the PROSAB project. Most importantly, secondary data on the socio-economic baseline data and the livelihood data of the project area was used for purposes of comparison of the "before" and "after" situation and also between project participants and non-participants. That is, data from the primary sources was also used to compare with data from the secondary sources; in particular respect to socio-economic baseline data collected at project inception in 2004.

3.4 Analytical Techniques:

Various tools were used to analyze the data collected from farming households in the five LGAs. These include descriptive statistics, budgetary analysis, logit regression, double difference, and consumer price index and Focused Group Discussions.

3.4.1 Descriptive statistical analysis:

For household socio-economic analysis, descriptive statistics, such as mean, variance, frequency distribution and percentages were computed and used. The frequency distribution and percentages were used to show the occurrence of given sample characteristics. The specific characteristics of the farming households were analyzed using these descriptive statistics to achieve objectives (i), (iv), and (v).

3.4.2 Farm budgetary analysis:

Analytical Techniques

According to Olukosi and Erhabor (2004), a farm budget is a detailed physical and financial plan for the operation of the farm for a certain period using the same database.

Farm budgeting technique involves considering the resources to use, the choice of enterprise to pursue, and a calculation of expected receipts; cost and gross margin.

For the purpose of evaluating the profitability of farm production activities, budgetary analyses, involving the computation of Gross Margin (GM) and Returns Per Naira (RPN) was conducted. This was carried out separately for crop and livestock production enterprises and for PROSAB farmers and non-PROSAB farmers. The monetized values of variable inputs and incidental production costs were subtracted from Gross Revenue (GR) to arrive at GM estimate for crop based enterprises and livestock enterprises respectively. The RPN was calculated by finding the ratio of the GM to the total variable cost (TVC). That is:

$$GM = GR - TVC \quad \text{……………………………………………..(28)}$$

$$RPN = GM/TVC \quad \text{…………………………………………….(29)}$$

This was used to achieve objective (ii)

3.4.3 Measurement of household food security status:

The approach adopted in this study for the determination of food security index followed the identification and aggregation procedures. According to Olayemi, (1998) identification is the process of defining a minimum level of nutrition necessary to maintain healthy living. This is referred to as the “Food Security Line”, below which people are classified as food insecure and subsisting on inadequate nutrition. The food security line used in this study was based on the daily-recommended level of calorie and protein, which are 2260 kcal and 65g respectively. In order to generate food security indices, the nutrient content of the food consumed was used to derive both calorie and protein availability.

―――――――――――――――――――――…...(30)

In order to measure household food security, a Food Security Index (FSI) was constructed. The nutrient composition of commonly eaten foods in Nigeria was used to estimate the calorie intake of households (Appendix III). The quantity of food produced and purchased for consumption was converted to Kilogram and further to calorie and protein respectively and then divided by household size adjusted for adult equivalent male adult scale weights in Appendix IV. To obtain the calorie and protein consumed per day per household, the result was further divided by 365 days and then compared with the standard (2260 Kcal and 65 grammes) respectively. The households whose daily capita calorie intake was up to 2260 Kcal and 65 grammes of protein were regarded as food secure while those whose daily capita calorie intake was below 2260 Kcal and 65 grammes of protein were regarded as food insecure.

For a household to be food secure, Zi must be greater than or equal to 1 ($Zi > 1$). If Zi is less than 1 ($Zi < 1$) the household is food insecure. It must also be noted that the above criterion must be satisfied for both protein and calorie requirements. The quality of crops produced i.e food and food purchased was converted to Kilogram and further to calorie and protein respectively and was divided by adjusted household size and by 365 days to obtain the calorie and protein consumed per day per household and then compared with the standard (2260 Kcal and 65 grammes) respectively. This was used to achieve objective (iii).

The nutrient composition of commonly eaten foods in Nigeria (Oguntona and Akinyele, 1995 in Adebayo (2011) was used to estimate the calorie intake of households.

3.4.4 Determinants of Food Security Status

The specification of the logit regression model is as follows:

$$Li \quad — \quad = \beta_1 + \beta_2 X_i + U_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (31)$$

Where Li = Logit

P_i = Probability of an outcome where $Y_i = 1$

$I - P_i$ = Probability of an outcome where $Y_i = 0$

β_2 = The slope which measure change in L for a unit change in X

β_i = The intercept which is the value of the log-odds in favour of being food secure as X_i changes by a unit.

U_i = The stochastic error term.

One of the key features of the logit model is if L, the logit, is positive, it means that when the value of the regressor(s) increases, the odds that the regressands equal 1 (meaning some event of interest happens) increases. If L is negative, the odds that the regressand equals 1 decreases as the value of X increases (Gujarati and Sageetha, 2007).

In this study, the vector of explanatory variables included age of household head in years, farm size of a household in Ha, farmers household size, farming experience in years, cooperative membership (D = 1 if the farmer is a member and D = 0 if he/she is not), level of a farmer's education in years. Educated = 1 and not educated = 0.

Farming experience in years, distance to input source in km, gender of household head (D = 1 for male; D = 0 for female), marital status of household head (D=1 for married and D=0 if otherwise), number of extension visits, occupation of household head (D=1 if agriculture and D=0 if otherwise). Household's access to credit facilities (D = 1 if there is access; D = 0 if otherwise), and commercialization (i.e. proportion of farm produce sold).

This was used to achieve objectives (iv).

3.4.5 Double difference method

The impact of a policy on an outcome can be estimated by computing a double difference, one over time (before-after) and across subjects (between beneficiaries and non beneficiaries). The “double difference” method entails comparing a treatment group with a comparison group both before and after the intervention.

The model is specified as follows:

$$\text{DDs} = \left[\frac{1}{P}\sum_{i=1}^{p}\left(Y_{1ia} - Y_{1ib}\right)\right] - \left[\frac{1}{C}\sum\left(Y_{oja} - Y_{ojb}\right)\right] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(32)$$

Where:

Y_{it} = Revenue (income) at time a & b

Time a and b = after and before the project respectively

P = Number of participants.

C = Number of individuals in the control group (i.e non participants)

DD^s = The difference between the average changes in the income for the participants and non participants.

This tool was used to achieve objective (iii).

3.4.6 Fishers index

The Fisher index is calculated as a geometric mean of Paasche and Laspeyres indexes and is given as $P_F = \sqrt{P_P.P_L}$ …………………………………………………………(33)

Where:

P_F = Fishers index

P_P = Paasche index which is given as

$$Pp = \sum_{i=1}^{n} P_i^t q_i^t \Big/ P_p = \sum_{i=1}^{n} P_i^0 q_i^t \quad = \quad \left\{ \sum_{i=1}^{n} \left(P_i^t \Big/ P_i^0 \right)_{\overline{S_i^t}} \right\}^{-1} \text{ – ....(34)}$$

P_L = Laspeyres index which is given as

$$= \quad \left\{ \sum_{i=1}^{n} \left(P_i^t \Big/ P_i^0 \right)_i^{S_o} \right\} \text{ .... (35)}$$

The Fishers index was used to estimate the consumer price indexes of group of crops, livestock and household items. This is because it takes care of the overstating or understating of inflation done by the other indexes and therefore provides an overall measurement of relative prices. It was used to achieve objective (iii).

3.4.7 Focused group discussion

The Oxford Advance Dictionary (8th edition e-copy) defines a focus group as a small group specially chosen to represent different social classes who are asked to discuss and give their opinions about a particular subject. Talking to participants and non participants can be a valuable complement to quantitative surveys data, even though it is unlikely to provide a credible evaluation on its own.In this study, focused group discussions for three farmer groups namely women, men and youth in five project communities comprising: Maina Hari and Yawi in Biu LGA, Hema and Azare in Hawul LGA and Guwal in Kwaya Kusar LGA were used to determine farmers' opinions on the project impact on food security and improved seeds. The data was subject to statistical analysis of percentages. This was used to achieve objective (V).

3.4.8 Hypothesis testing

3.4.8.1 Analysis of variance (f-test) & mean (t-test)

The analysis of variance using the f-test is a technique which aims to test whether the variance between the two group of farmers (i.e PROSAB farmers and non-PROSAB farmers) for example in respect of age to the farmers in the two groups, family size, and years of farming experience of household head is significant or not. The variance for each group of farmers was used for the calculation using the formular below. That is, to obtain the calculated value, the bigger variance became the numerator while the smaller variance became the denominator.

The value (that is, the calculated value) is then compared with the table value at 95% confidence interval. The null and the alternative hypothesis are stated as:

Null hypothesis: $H_O: \sigma_1^2 = \sigma_2^2$ ……………………….(36)

Alternative hypothesis: $H_A: \sigma_1^2 = \sigma_2^2$ ……………………….(37)

Where σ_1^2 and σ_2^2 are the sample variances of the two groups of farmers under consideration. Where the calculated value was found to be less than the table value, we rejected the H_o and conclude that the difference between the two variances was significant.

$$\text{Where} \quad \sigma_1^2 = \frac{\Sigma\,(X- \;_1)^2}{n_1} \quad \text{and} \quad \sigma_2^2 = \frac{(X- \;_2)}{n_2} \qquad \text{……………….(38)}$$

The t-test was used to test whether the mean values between the two groups of farmers was significant or not. This was done by providing null and alternative hypotheses. The hypothesis was stated in a statistical form as:

Null hypothesis: $H_O: \;_1 = \;_2$ ………………………………(39)

Alternative hypothesis: $H_A: \;_1 \neq \;_2$ ………………………………(40)

Where X_1 and X_2 are the sample means of the two groups of farmers in respect to any socio economic characteristic of the two groups.

The t-values were calculated using the formular below. Whereas the table values were obtained from the table by adding the two samples n_1 and n_2 and subtracting 2 to obtain the degrees of freedom; the calculated values and table t-values were compared. Where the calculated value was less than the table value, the null hypothesis was rejected and the alternative hypothesis accepted. That is, the difference between the two means was then said to be significant.

$$t = \frac{\left(\overline{x} - \overline{x}\right)}{\sqrt{\frac{(n_1 - 1)S_1^2 + (n_2 - 1)S^2}{n_1 + n_2 - 2}} - \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(41)$$

Where $S_1^2 = \left(\frac{x - \overline{x}_1}{n_1}\right)^2$ ……………………………………………………………………………(42)

$$S_1^2 = \left(\frac{X - \overline{x}_2}{n_2}\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(43)$$

n_1, n_2 represent the two sample sizes

X_1, X_2 represent the means of the two samples selected

According to Frank and Aithoen (1994), the paired t – statistics is often used to test differences between two populations exposed to different treatments.

The paired t – statistics was used to test the socio-economic characteristics of farmers in the project and non project area. The model is specified as follows:

$$tp_1 - tp_2 = \frac{\frac{X_1}{N_I} - \frac{X_2}{N_2}}{\sqrt{Pq\,\frac{(N_1 + N_2)}{N_1 + N_2}}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (44)$$

Where,

$t_{p1} - t_{p2}$ = Calculated t – value

$\frac{X_1}{N_1}$ = Mean value of participant's gross margin and profitability

$\frac{X_2}{N_2}$ = Mean value of non-participant's gross margin and profitability

Pq = Expected value of co-variance of participants and non participants.

N_1 and N_2 = Corresponding sample sizes associated with project participants and non participants gross margin, profitability respectively.

The paired t-statistics was used to test hypothesis (i) and (ii).

Chapter 4

RESULTS AND DISCUSSION

4.1 Socio-economic Characteristics of Farm Households

4.1.1 Gender of household heads

The result of the analysis of the gender of household heads shows that over 71% of the respondents in each of the two groups of farmers studied were male. The proportion of female headed households among non-PROSAB farmers was lower (14.4%) than that of female headed households among the PROSAB farmers which was 28.9%. This finding is similar to that of Amaza *et al.* (2007) which found an average of 76% of male headed households. A similar study in the area excluding the non-PROSAB farmers in 2009 found an average of 85.5% of male headed households (Amaza *et al.*, 2009).

According to PROSAB (2004), the relationship between the food security status of a household and the gender of the head of the household cannot be determined a priori. This is because while several studies have revealed that female – headed households are likely to be food insecure than male – headed households (Makinde, 2001), others have found that male – headed households are more food secure than female headed households (Amaza, *et al.*, 2009; PROSAB, 2004).

4.1.2 Age of household heads

The result of the analysis of the age of household heads presented on Table 1 shows that the mean age of PROSAB farmers was 45 years while that of non-PROSAB farmers was 42. Nearly 64% of PROSAB farmers were below 50years old and nearly 74% of the non-PROSAB farmers were below 50years. The age of a farmer determines the quality and quantity of work that can be done on the farm. Age is therefore an important measure of farm productivity. Babatunde *et al*. (2007) in Adebayo (2011) found that the older the household head, the lower the probability that the household would be food secure. Dercon and Krishman, (1996) in PROSAB (2004) found that age affects the rate of household adoption of new technologies, which, in turn, affects household livelihood strategies.

According to Amaza *et al.* (2009), the significance of age on farm output has been examined extensively by Rongoor et al. (1988) where it was established that the influence of age on farm productivity was very diverse. For example, Kalirajan and Shand (1985), Stefanou and Sexena (1988) found that age has a positive effect on productivity. Similarly, Adubi (1992) showed 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 been found to determine how active and productive the head of the household would be. Amaza *et al*. (2009) concluded that the predominance of active and productive heads of households in the project area has a direct bearing on (1) increased availability of able bodied labour for primary production, (2) ease of adoption of innovations; and (3) reduction in the degree of risk-aversion. All these have great potential for increasing agricultural productivity and production and, hence, for improving household livelihoods and reducing poverty in the PROSAB project area.

Estimates of variances of PROSAB and non- PROSAB farmers were used to conduct the test of significance relating to whether there is significant difference between the two ages of the different groups or not. In view of the fact that the F calculated is 1.30 which is greater than the f table value of 1.22 i.e. 1.30 > 1.22, we fail to accept the null hypothesis and conclude that there is significant difference in the ages of the household heads of both groups.

Table 1: Distribution of Household Heads by Age in 2010

Age (Years)		PROSAB Farmers Frequency	Percent	Non-PROSAB Farmers Frequency	Percent
10-19		0	0	1	0.6
20-29		20	11.1	15	8.3
30-39		41	22.8	67	38.9
40-49		54	30.0	47	26.1
50-59		36	20.0	30	16.7
60-69		22	12.2	13	7.2
70+		7	3.9	4	2.2
Total		**180**	**100.0**	**180**	**100.0**
Mean age (years)	-	45.40		42.10	
Variance	-	159.24		122.78	

4.1.3 Family size of households.

The result of analysis of family size of households contained in Table 2 shows that the mean family size of PROSAB farmers was found to be 7.5 per household while that of non-PROSAB farmers was found to be 6.7 per household. As Adebayo (2011) posited; in subsistence agriculture as practiced in the study area, household size is very important as it determines to a large extent the supply of labour to the farm. However, where a sizable percentage of the family members are children and the elderly, a large family size may be of little or no advantage to the household on the farm. Amaza *et al.* (2009) stated that “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". While this is true only if members of the household partake in the family farm business, a large household with many members could get involved in other livelihoods which could be sources of wealth to aid the family with income which could be used to purchase farm inputs for farm production, purchase food or payment of children school fees or meet some other family needs.

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 household. According to Musa (2009), the implication of the result of a large family size is in that farmers have more hands to be employed for labour because of the number of the working persons in the family.

The implication of the family size is that where a majority of the family members can be productively used on the farm, this will most likely increase the possibility of the household being food secure. On the other hand, if members of the household are involved in some other productive ventures where they earn incomes, such incomes can be applied towards buying food which also make the family food secure. If however, a large family size is not used on the farm or some other productive employment, it may likely cause the household to be food insecure.

The F calculated is 1.18 while the F table is 1.22. Therefore, since the F calculated 1.18 < the F tabulated (1.22), we accept the null hypothesis and reject the alternative hypothesis that there is no significant difference between the family size of the two group of farmers

Table 2: Distribution of Respondents According to Family size of Households

	PROSAB Famers		Non-PROSAB Farmers	
Family size	**Frequency**	**Percent**	**Frequency**	**Percent**
1-4	33	18.3	48	26.7
5-9	94	52.2	102	56.6
10-14	49	27.2	27	15.0
15-20	3	1.7	2	1.1
21+	1	0.6	1	0.6
Total	**180**	**100.0**	**180**	**100.0**
Mean of family size		7.45		6.66
Variance		11.03	9.36	

4.1.4 Years of schooling

The result of the analysis of the years of schooling of households' heads presented in Table 3 shows that 28.3% of PROSAB farmers had no years of schooling and nearly 26% of non-PROSAB farmers also had no years of schooling. On the other hand, while nearly 33% of PROSAB farmers had less than 6 years of schooling, nearly 32% of non-PROSAB farmers had less than 6 years of schooling. The implication of this finding is that the level of farmers' education is believed to influence the use of improved technology in agriculture, and hence farm productivity. The years of schooling determines the level of opportunities available to improve livelihood strategies, enhance food security, and reduce the level of poverty. It affects the level of exposure to new ideas and managerial capacity in production and the perception of the household members on how to adopt and integrate innovations into the household's survival strategies. Adebayo (2011), agrees with this assertion when he stated that education in agricultural production will assist the farmers to accept and test innovations available to them. It enhances the ability to make informed and accurate decisions on the management of the farm. The implication of lack of education by the household head is that such a household is more likely to be poorer than average and by extension, food insecure (Adebayo, 2011).

Household heads who lacked formal education as shown in our finding were 28.3% of PROSAB farmers and 25.6% of non-PROSAB farmers has implication in the farmer's ability to understanding some logistics of farm management which would obviously be low compared to those that have formal education. Based on the above, the need for education in agricultural production is very important and cannot be over emphasized. This was why Imonikhe (2004) in Musa (2011), was of the opinion that education would significantly enhance a farmer's ability to make meaningful management decisions. It could also enhance knowledge of improved methods of farming such as how to use recommended packages etc.

Table 3: Distribution of Household Heads according to Years of Schooling in 2010

	PROSAB Farmers		**Non PROSAB Farmers**	
Years of Schooling	**Frequency**	**Percent**	**Frequency**	**Percent**
0	51	28.3	46	25.6
1-6	60	33.3	59	32.8
7-12	37	20.6	43	23.9
14-18	32	17.8	32	17.7
Total	**180**	**100.0**	**180**	**100.0**

The result of the analysis of level of education attained by household heads was cross tabulated with gender which is in Table 4 for PROSAB farmers and in Table 5 for non-PROSAB farmers. The result of the analysis shows that while 22.3% of the male PROSAB farmers had no years of schooling, only 5.6% of the female farmers had no years of schooling. The results are similar in the case of male and female non-PROSAB farmers. The cross tabulation of gender and level of education for PROSAB farmers shows that a higher percentage of males (22.3%) than females had zero literacy. This situation was found to be similar among non-PROSAB farmers where it was found that 20% of the males as compared to only 5.6% of the females had zero literacy. As earlier mentioned, the implication of this finding is the absence of literacy will impact negatively on the household in terms of food security, their livelihood and farm incomes. First, low or absence of literacy will limit a farmer's ability to understand some logistics of farm management and their ability to take meaningful management decisions. Secondly, Awotide *et al.* (2011) found that gender, years of formal education and status of household farm income were positively and significantly related to the respondents food security status. Iorlamen *et al.* (2010) found the food security incidence was higher (0.34) in female headed households than in male headed households (0.32). He explained that this was likely a reflection of higher dependency tendencies possible in the female headed households where dependency is mainly on either widowed or unmarried.

The percentage differences observed for zero literacy between PROSAB male farmers and non-PROSAB farmers is not significant. There is no difference either between the zero literacy observed between the PROSAB female farmers and non-PROSAB female farmers.

Table 4:Distribution of respondents according to Gender and Education attained by Household Heads of PROSAB Farmers in2010.

Level of Education attained	**Male**		**Female**	
	Frequency	**Percent**	**Frequency**	**Percent**
No formal school	40	22.3	11	5.6
Primary or less	48	26.8	12	6.7
Secondary or less	23	12.8	14	7.8
Tertiary	17	9.5	15	8.4
Total	**128**	**71.5**	**52**	**28.5**

Table 5: Distribution of respondents according to Gender and Education attained by Household heads of Non-PROSAB Farmers in 2010

Level of Education attained	**Male**		**Female**	
	Frequency	**Percent**	**Frequency**	**Percent**
No formal school	36	20.0	10	5.6
Primary or less	51	28.4	8	4.4
Secondary or less	38	21.1	5	2.8
Tertiary	30	16.8	2	1.1
Total	**155**	**86.1**	**25**	**13.9**

4.1.5 Years of farming experience of household heads

The result of the analysis of years of farming experience of household heads in Table 6 shows that the mean years of farming experience of PROSAB farmers was 23.3 years while that of non-PROSAB farmers was 20.3years. The number of years of farming experience of 10-19years was higher for both groups of farmers. For example, while the PROSAB farmers had 37.2% of the farmers within that range; in the case of non-PROSAB farmers, 35.5% of the farmers fell within this range. The farmer with the highest number of years of experience was a PROSAB farmer with 71years while the highest for non-PROSAB farmers was 65years. According to Amaza *et al.* (2009), farming experience is an important factor determining both the productivity and the production level in farming. They posited that 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 practices and techniques to those that are modern and improved. Adebayo (2011) agrees with this when he stated that years of experience in farming has great influence on production, storage and marketing of farm output because it is an indication of the farmer's expertise in farming.

The F calculated was found to be 1.21 while the F tabulated was found to be 1.22. Therefore, since the F calculated (1.21) < F table (1.22), we accept the null hypothesis and conclude that the difference in the years of farming experience between the two groups is not significant. What this means is that the number of years of farming experience did not influence their farm outputs. If however, there had been significant difference in the years of farming experience between PROSAB farmers and non-PROSAB farmers, what it would have meant would have been that there would have been observed differences in the outputs of the two groups of farmers. Awotide *et al.* (2011) found that farming experience negatively and significantly related to the respondents' food security status. The coefficient was -0.146 while the t-value was 1.176.

Table 6: Distribution of Respondents According to Years of Farming Experience of Household Heads in 2010

	PROSAB Farmers		Non-PROSAB Farmers	
Years of Experience	**Frequency**	**Percent**	**Frequency**	**Percent**
1-9	9	5.0	28	15.6
10-19	67	37.2	64	35.5
20-29	48	26.7	46	25.6
30-39	33	18.3	29	16.1
40-49	18	10.0	10	5.5
50-59	2	1.1	2	1.1
60-69	2	1.1	1	0.6
70+	1	0.6	0	0
Total	**180**	**100.0**	**180**	**100.0**
Mean -	23.29		20.25	
Variance -	147.70379		122.01	

4.1.6 Households' off-farm activities

The result of the analysis of household off- farm activities show that 52.2% of PROSAB farmers worked off-farm while 44.4% of non-PROSAB farmers also worked off-farm. On the other hand, more non-PROSAB farmers (55.6%) did not work off-farm compared to 47.8% of PROSAB farmers who did not work off-farm. The difference between the PROSAB farmers and that of non-PROSAB farmers might have been due to the fact that participation in the PROSAB project left little time for farmers to get involved in off-farm activities.

Table 7 shows the specific off farm activities undertaken by the farmers. These off -farm activities are usually undertaken by the farmer during his/her spare time whether during the rainy season or during the dry season but which do not fall into the category of secondary occupations. It was found that 44.4% of PROSAB farmers were not involved in off -farm activities as against 51.1% of non-PROSAB farmers who did not participate in any off-farm activities. Among the off -farm activities, trading was the most dominant off -farm activity as indicated by 28.9% of PROSAB farmers while only

14.4% of non-PROSAB farmers were involved in trading. 26.1% of non-PROSAB farmers were involved as artisans/tailors while only 12.2% of PROSAB farmers were also involved as artisans/tailors. The implication for this finding is that off-farm activities have the tendency of distracting some of the farmers from farm operations. However, where they earned some extra income which could be used on the farm to pay hired hands for farm operations, off-farm activities may have enhanced farm operations and probably led to increased farm production.

Table 7: Off Farm Activities Engaged in by Household heads in 2010

Activity	PROSAB Farmers Frequency	PROSAB Farmers Percent	Non-PROSAB Farmers Frequency	Non-PROSAB Farmers Percent
None	80	44.4	92	51.1
Comm. m/cycle rider	14	7.8	6	3.3
Trading	52	28.9	26	14.4
Milling machine operator	1	0.6	2	1.1
Hunting	11	6.1	7	3.9
Artisans/tailoring	22	12.2	47	26.1
Total	**180**	**100.0**	**180**	**100.0**

4.1.7. Land ownership structure

The result of the analysis of land ownership structure is in Table 8 which showed that the pattern of land ownership was as follows: 45.9% of PROSAB farmers and 41.8% of non-PROSAB farmers were cultivating family land. Also, nearly 25% of PROSAB farmers had individual land (inherited), and 26.9% of non-PROSAB farmers also had individual land (inherited). According to Adebayo (2011), closely related to farm size is the land tenure system. Ownership of land determines the level of production of a farm household. Also, ownership of land will have impediments to increased production for especially households who do not inherit land and have little or no money to acquire one. In this case, 15.6% of PROSAB farmers and 10.1% of non-PROSAB farmers had land that was purchased. The other implication for land ownership is that land is not inherited by female members of the household which placed restriction on the land available for agricultural production, which is to say, agricultural production is limited since every member of the family who wishes to farm may not have land with which to do so. To that extent, agricultural production will be limited. In some extreme cases, land may be available but there may be restriction to the crops that could be grown on such lands. In some cases as we found, land may be available but there may be restriction to the crops that could be grown on such lands. This was the case in the project area because of low soil fertility in some areas and high infestation of striga in some others.

Furthermore, the result of the analysis showed that a majority of the land ownership (91%) was by men while only 9% of the land was owned by women. This has implication on farm production as women willing to farm may not have the land with which to do so. According to Musa (2011), a finding like this may be attributed to the tradition and custom of the people in the study area where land is owned mostly by males while the women are into other non-farm activities and also domestic activities such as taking care of the family and cleaning of the house. In southern Borno state, women have restricted ownership of land as allowed by the customs and traditions of the ethnic nationalities in the area. However, they could access land from their households or neighbors to farm.

Table 8: Land Ownership Structure of Households in 2010

	PROSAB Farmers		**Non-PROSAB Farmers**	
Ownership Type	**Frequency**	**Percent**	**Frequency**	**Percent**
Individual (inherited)	62	25.4	56	26.9
Family	112	45.9	87	41.8
Community	2	0.8	9	4.3
Rented	24	9.8	26	12.5
Purchased	38	15.6	21	10.1
Other	6	2.5	9	4.4
Total	**244**	**100.0**	**208**	**100.0**

The result of the analysis of the combination of type of land cultivated by households in 2010 is on Table 9 which shows the various combinations of land ownership among the farmers. Whereas the combinations were different between the PROSAB farmers and the non-PROSAB farmers, however, it is evident that the major land ownership among the farmers was family land as 35.5% of PROSAB farmers and 38.3% of non-PROSAB farmers had family land. This was closely followed by land inherited as 18.3% of PROSAB farmers and 27.2% of non-PROSAB farmers had this kind of land. The finding also indicated that certain households had land with different form of ownership. For example, among PROSAB farmers, 9.4% of the farmers had family land and land rented followed by 7.2% of the farmers having inherited land and family land. In the case of non-PROSAB farmers, 5% of the farmers had inherited land and family land followed by 4.4% of the farmers who indicated they were having family land and rented land.

According to Amaza *et al.* (2009), in traditional agriculture, land is considered to be one of the most important factors of production. The individual (inherited) land tends to promote security of tenure, as opposed to family land and community land. Family land lends itself to fragmentation as a response to an increased number of family members as there would be need to give each member of the family a “fair” share of the right to land use.

Table 9: Combination of Land Ownership Structure by Households in 2010

Combination of Land Tenure	PROSAB Farmers		Combination of Land Tenure	NON-PROSAB Farmers	
	Frequency	Percent		Frequency	Percent
Inherited land	33	18.3	Inherited land	49	27.2
Family land	64	35.5	Family land	69	38.3
Community land	2	1.1	Community land	7	3.9
Rented land	4	2.2	Rented land	10	3.6
Purchased land	12	6.7	Purchased land	11	6.1
Other form of ownership	6	3.3	Other form of ownership	9	5.0
Inherited/Family land	13	7.2	Inherited/rented land	2	1.1
Inherited/Comm. Land	1	0.6	Inherited/others	2	1.1
Inherited/purchased land	11	6.1	Family/rented	8	4.4
Family/rented land	17	9.4	Family/purchased	3	1.7
Family/purchased land	11	6.1	Family/others	4	2.2
Comm./rented land	1	0.6	Rented/purchased	4	2.2
Inherit/family/rented land	1	0.6	Rented/others	1	0.6
Inherit/family/purchased	3	1.7	Inherit/rented/others	1	0.6
Family/rented/purchased	1	0.6			
Total	**180**	**100.0**		**180**	**100.0**

4.1.8 Farm size

The result of the analysis on farm size of households is on Table 10 and shows that the majority of PROSAB farmers (32.8%) had farm size of 2-2.9 Ha, However, in the case of non-PROSAB farmers, the majority of the farmers (78.9%) had farm size of 1.0-1.9 Ha. The spread of farm holdings was more among PROSAB farmers than among non-PROSAB farmers. The mean farm holding was 2.8 Ha and 1.3 Ha among PROSAB farmers and non-PROSAB farmers respectively. 83.9% of PROSAB farmers indicated that they had farm sizes of 0.1-3.9 Ha, as against 98.9% of non-PROSAB farmers who indicated that they had farm sizes of 0.1-3.9 Ha also. This implies that most of the farms are small scaled. Small farm size impedes productivity, crop diversification and consequently, the food security status of farm households. The disparity between the minimum and the maximum farm sizes is quite large in the case of PROSAB farmers with a minimum farm size of 0.5 Ha and a maximum farm size of 51Ha as against non-PROSAB farmers with a minimum farm size of 1 Ha and a maximum farm size of 5 Ha.

According to Imonikhe (2004) in Adebayo (2011), farm size is an important fixed factor in agricultural production. This is because it determines to a large extent the level of agricultural production. The size of the farm cultivated by a farmer is a function of population pressure, family size, labour availability and experience of the farmer. Some other factors like availability of factors of production like farm inputs, farm credit, remittances received/money available to pay for hired labour will determine the farm size cultivated at any particular time.

The F calculated is 6.40 while the F tabulated at 0.05 is 1.22. We reject the null hypothesis and instead accept the alternative hypothesis that the differences in the farm sizes in the two groups is significant since the F calculated (6.40) > F tabulated (1.22). What this means is that the observed differences in the mean farm sizes of PROSAB farmers and non-PROSAB farmers were not by mere chance. That is, the differences observed existed. The mean farm sizes of PROSAB farmers were actually higher than those non-PROSAB farmers. This was due to the fact that PROSAB farmers devoted more time to farming than non-PROSAB farmers.

Table 10: Distribution of Respondents by Farm Size in 2010

	PROSAB Farmers		Non PROSAB Farmers	
Farm size (Ha)	**Frequency**	**Percent**	**Frequency**	**Percent**
0.1-2	49	27.2	142	78.9
2.1-4	102	56.7	36	20.0
4.1-6	20	11.1	2	1.1
6.1-8	6	3.3	0	0.0
8+	3	1.7	0	0.0
Mean (Ha)	2.8		1.3	
Variance (Ha)	3.2		0.5	

4.1.9 Farm enterprises

The result of the analysis of the farm enterprises of the households in 2010 is on Table 11. It shows that nearly 38% of PROSAB farmers and 51.2% of non-PROSAB farmers had staple food crops as the major farm enterprises. This was followed by cash crops (30.4%) among PROSAB farmers and 28% among non-PROSAB farmers. The farm enterprises undertaken by these farmers may have been determined by the soil, individual farmer's objectives (whether producing for the market or the family), climate, and availability of inputs (especially inorganic fertilizer), land, labour, and capital (Adebayo, 2011). In addition, other factors which might have determined which enterprise the farmer was to be involved in among PROSAB farmers may have been the extent to which the farmer's field was infested with striga, whether the farmer wished to try the new crop of soybean being introduced and the market available for especially soybean and the colour of the cowpea variety to be sown (planted).

The major crops grown were cereals like sorghum and millet which are classified as staple food crops in this study. However, rice and maize though cereals grown in the study area have been classified as cash crops in the area. The other crops grown were the legumes which include cowpea, soybean, groundnut and bambara nuts. These were also classified as cash crops. As can be seen in table 11 both PROSAB households and non-PROSAB households kept livestock. However, more PROSAB households (24.2%) compared to non-PROSAB households (14.8%) had livestock enterprises. The difference can be explained by the fact that the project i.e PROSAB had a limited intervention in livestock development in the terms of fodder development, goats and sheep share scheme and linkage to animal drug dealers.

Table 11: Distribution of Respondents by type of Enterprise owned in 2010

Type of enterprise	**PROSAB Farmers**		**Non-PROSAB Farmers**	
	Frequency	**Percent**	**Frequency**	**Percent**
Staple food crops	129	38.1	93	51.2
Livestock	82	24.2	27	14.8
Cash crops	103	30.4	51	28.0
Tree crops	12	3.8	6	3.3
Vegetables Crops	13	3.8	5	2.7
Total	**339**	**100.0**	**182**	**100.0**

The finding on Table 12 shows the different combination of enterprises among PROSAB farmers and non-PROSAB farmers. For example, while only 18.3% of PROSAB farmers had only staple food crops, 50.6% of non-PROSAB farmers had grown staple food crops. However, in terms of spread, PROSAB farmers had a wider spread of the different combinations of the enterprises than the non-PROSAB farmers. For example, 15.6% of PROSAB farmers had both staple food crops and cash crops while only 1.1% of non-

PROSAB farmers had s similar combination. Also, while 32.8% of PROSAB farmers had staple food crops, livestock and cash crops, no non-PROSAB farmer had such combination.

The implication of these findings is that most households which indicated that they were into stable food crops were likely to use some or most of the food produced in their households. This was likely to make them more food secure than those in mainly cash crop enterprises. There existed the possibility that the revenue realized from the sale of cash crops could have been used to purchase some of the additional food items from the market required in the various households. However, the chances existed that most households would often use the revenue realized from such sales for other purposes other than on food. In this way, food security of the household cannot be guaranteed.

Table 12: Combination of Enterprises Owned by the Households in 2010.

Combination of enterprises	**PROSAB Farmers**		**Non-PROSAB Farmers**	
	Frequency	**Percent**	**Frequency**	**Percent**
Staple cereal food crops	33	18.3	91	50.6
Livestock	12	6.7	27	15.0
Leguminous crops	13	7.2	49	27.2
Tree crops	11	6.1	6	3.3
Others	13	7.2	5	2.8
Staple cereal crops/livestock	8	4.4	0	0.0
Staple cereal crops/leguminous crops	28	15.6	2	1.1
Livestock/leguminous crops	2	1.1	0	0.0
Cereal/livestock/leguminous crops	59	32.8	0	0.0
Cereal/livestock/leguminous/tree crops	1	0.6	0	0.0
Total	**180**	**100.0**	**180**	**100.0**

4.1.10 Crops grown

The result of the analysis of the crops grown in 2010 is in Table 13 which shows the various types of crops grown. Crops cultivated were either as sole or in mixtures of two or three crops. Our finding was that maize, soybean, cowpea and sorghum were the most important crops grown by both PROSAB farmers and non-PROSAB farmers. The most widely grown crops were cereals. Of the cereals, maize followed by sorghum were the predominant crops grown among the farmers. Next in importance were the legumes. Nearly 33.3% of PROSAB farmers cultivated soybean as against13.3% of non-PROSAB farmers. This was followed by cowpea and groundnut. 5.6% of PROSAB farmers grew other crops while 19.5% of non-PROSAB farmers also grew other crops. These other crops include tree crops, cassava, tomatoes, bambara nuts etc.

The implication of this finding is that the type of crop grown and the output have implication for food security. Where a greater part of the food crops is consumed by members of the household, the incidences of food shortage was likely to be minimal. If, however, a larger part of the food produced was sold rather than consumed, the incidence of food insecurity was likely to be higher particularly if the proceeds from the sales were not used to procure food items for members of the household. Similarly, if a higher percentage of the cash crops were sold and the proceeds used to procure food for the household, the incidence of food shortage or food insecurity may be low. If farm outputs for food crops and cash crops were low and without adequate strategies to cope, the incidences of food insecurity would be higher. If farm outputs were sold for cash and such cash used in the household, farm income would have increased and the standard of living would have most likely improved if such cash was put into use like purchase of food, household items, house renovation or the building of new houses.

Table 13: Distribution of Respondents by Crops grown in 2010

Crop grown	**PROSAB Farmers**		**Non-PROSAB Farmers**	
	Frequency	**Percent**	**Frequency**	**Percent**
Maize	71	39.4	60	33.3
Soybean	60	33.3	24	13.3
Cowpea	15	8.3	9	5.0
Sorghum	7	3.9	11	6.1
Groundnut	5	2.8	7	3.9
Millet	4	2.2	9	5.0
Rice	3	1.7	10	5.6
Cocoyam	2	1.1	8	4.4
Pepper	3	1.7	7	3.9
Others	10	5.6	35	19.5
Total	**180**	**100.0**	**180**	**100.0**

4.1.11 Farmers' access and use of agricultural credit

The result of the analysis on agricultural credit showed that only 12.2% and 8.3% of PROSAB farmers and non-PROSAB farmers respectively had access to credit while a vast majority of the farmers did not. 87.8% of PROSAB farmers and 91.7% of non-PROSAB farmers did not have access to credit. It is very clear from the result of the analysis of agricultural credit that credit has been a serious constraint to farmers in southern Borno. Table 14 shows the sources of credit and average amounts accessed by the farmers. The most dominant source of credit was the Bank of Agriculture at Biu, formerly, Nigeria Agricultural, Cooperative and Rural Development Bank Ltd (NACRDB). Not only was it the most dominant source but it also provided the highest amount of credit per applicant with an average of ₦124,000 for PROSAB farmers and ₦100,000 for non-PROSAB farmers. The difference in terms of the amount and the number of beneficiaries may have been because of the intervention by officials of PROSAB in favour of PROSAB farmers during project implementation. There was no credit from commercial banks, cooperative societies and money lenders. The ‘other’ source was the Development Exchange Centre (DEC) which was able to disburse some loans whose amounts were relatively smaller compared to the other sources. Also, the loans from the DEC were intended to be accessed by only the female farmers. Ala *et al.* (2010) found that the sources of agricultural credit was both formal and informal sources. However, unlike our finding, their respondents obtained credit from commercial banks (29%) as against our respondents who did not accessed credit from commercial banks.

The implication of the lack of credit from commercial banks can be well understood when viewed from the point that credit is an important input in agricultural development. Small farmers in developing countries like Nigeria cannot generate enough of this capital from their own savings. If they are to expand their agricultural production, they have to raise some additional capital through formal or informal sources of credit (Ala *et al.*, 2010). In view of the fact farmers had shown a great desire for credit from formal sources; the lack of it hindered their ability to expand their production. The non expansion of farm operations was likely to negatively affect food security, reduce farm income, and livelihoods and living standards.

The finding clearly point to the near absence of farm credit to other farmers. Since most of the farmers were small holders and lack the resources to be used on the farm, the lack of credit or its inadequacy was most likely to affect farm operations negatively. This may not assist in reducing food insecurity and may not have enhanced the improvement in the living standards of the farmers.

According to PROSAB (2004), the use of credit by households is vital to agricultural production. It is more important in an agrarian society like southern Borno state where the livelihood of the people depends so much on agricultural production and services. It is true that access to and the use of credit is vital to agricultural production; as this may be true only to the extent that the quality and quantity of credit available to the farmer is high. However, when the quantity and quality of credit is low, it is not likely to influence agricultural production as much not to talk of achieving high food security by the households.

Table 14: Distribution of Respondents by Sources of Credit and Amounts Received As Loan in 2010.

Source	**PROSAB Farmers**		**Non-PROSAB Farmers**	
	Frequency	**Average loan received (₦)**	**Frequency**	**Average loan received (₦)**
Agric. Bank (NACRDB)	18	124,000	9	100,000
Coop. Society	1	0	0	0
Friends /Relations	1	30,000	4	25,000
Dev. Association & Local Adashe	3	10,000	2	10,000
Total	**22**		**15**	

There are usually problems (challenges) encountered by farmers in their quest to access credit. The major challenge indicated by PROSAB farmers was delay in obtaining the credit (29.4%) while 28.8% of non-PROSAB farmers had a similar problem. The next most important challenge was high interest rates charged followed by insufficient credit. It is to be noted that the challenges of delay in obtaining credit faced by both PROSAB farmers and non-PROSAB farmers was mainly from the formal sources while the second challenge of high interest rates and insufficient credit was mostly from the informal sources.

Our finding agree with that of Ala *et al.* (2010) which found that informal loan beneficiaries recorded a high volume of credit supply gap that the formal loan beneficiaries which recorded figures of N52,662 and N49,063 or 60% and 36% of the total requested amount implying that the loanees from formal sources got 60% of the amount requested while the loanees from informal sources got only 40% of the loan they demanded.

These findings were similar to those of Ellis-Jones and Amaza (2007), in which they found that 90% of their respondents did not use credit, with no significant differences between gender, age, education or being members of groups. They also found that of those that received credit, 40% sourced funds from banks including NACRDB, 27% through relatives or friends, 24% through PROSAB and 5% through savings schemes.

The result of the analysis of the problems encountered by the households in obtaining credit in 2010 is on Table 15. Delay in obtaining credit was the major challenge faced by PROSAB farmers and non-PROSAB farmers alike.

Table 15: Problems Encountered by Household Heads in Obtaining Credit in 2010.

Problem Experienced	PROSAB Farmers		Non-PROSAB Farmers	
	Frequency	Percent	Frequency	Percent
Delay in obtaining credit	53	29.4	41	28.8
High interest rate	46	25.6	41	22.8
Insufficient credit	34	18.9	35	19.4
Lack of collateral	25	13.9	32	17.8
No response	22	12.2	31	17.2
Total	**180**	**100.0**	**180**	**100.0**

Note: Other problems – the credit was in kind rather than in cash and also, the credit was given in exchange for farm produce at harvest time.

4.1.12 Improved farm inputs used by farm households

The result of the analysis of improved farm inputs used on the farm for PROSAB farmers and non-PROSAB farmers is in Table 16. Table 17 is the result of the analysis of the improved farm inputs used by households between 2004 and 2010 for PROSAB farmers and between 2004 and 2010 for non-PROSAB farmers on Table 18.

The result of the analysis on Table 16 shows that improved seeds were the most common improved farm input used by PROSAB farmers while inorganic fertilizer was the most common farm input used among non-PROSAB farmers. Comparing pre – PROSAB period (2004) and 2010 among PROSAB farmers as shown in the result of the analysis on Table 17 showed that, there was an increased use of improved seeds from 11.2% to 32.1%, inorganic fertilizer (14.5% to 30.8%) and agrochemicals from 1.6% to 48.1%. This may have been because of the increased awareness created by the extension agents and training carried out among PROSAB farmers. Comparing pre- PROSAB period (2004) and 2010 among non-PROSAB farmers for which the result of the analysis is on Table 18 also showed an increase in the use of improved seeds from 11.2% to 15.2%, inorganic fertilizer

(14.5% to 36.3%) and agrochemicals from 13.9% to 30.4%. There was equally a drop in the use of other farm inputs from 48.1% to 7.9% among non-PROSAB farmers. This may have been due to the increased use of improved farm inputs which may have led to the reduction in the use of the other farm inputs. The implication for the finding in Table 17 is that of sustainability of the project benefits. The challenge before PROSAB farmers and the other development partners in PROSAB like the Borno State Agricultural Development Project, University of Maiduguri and International Institute of Tropical Agriculture (IITA) is the need for continuous training, linkage with input dealers and for the Borno State government to assist the farmers with farm inputs. The need for the provision of certified seeds especially those of maize, sorghum, soybean, cowpea and rice is important. In case of non-PROSAB farmers, similar actions are required to ensure a sustained increase in farm production which will lead to increased food security, farm income, increased livelihoods and living standards among the population especially in the rural areas.

Table 16: Distribution of Respondents by type of Improved Farm Inputs in 2010

Type of Improve Farm input	**PROSAB Farmers**		**Non-PROSAB Farmers**	
	Frequency	**Percent**	**Frequency**	**Percent**
Improved seeds	170	32.1	54	15.2
Inorganic fertilizer	163	30.8	129	36.3
Agrochemicals	159	30.0	108	30.4
Veterinary drugs	21	4.0	29	8.2
Livestock feed	8	1.5	7	2.0
Others	9	1.5	28	7.9
Total	**530**	**100.0**	**355**	**100.0**

Table 17: Distribution of Respondents by Improved Farm Inputs used by PROSAB households in 2004 and 2010.

Type of input	**2004**		**2010**	
	Frequency	**Percent**	**Frequency**	**Percent**
Improved seeds	168	11.2	170	32.1
Inorganic fertilizer	218	14.5	163	30.8
Agrochemicals	208	13.9	159	30.0
Veterinary drugs	114	7.6	21	4.0
Livestock feed	70	4.7	8	1.5
Combination of inputs	722	48.1	9	1.6
Total	**1500**	**100.0**	**530**	**100.0**

Table 18:Distribution of Respondents by Farm Inputs used by Non PROSAB Households in 2004 and 2010

Type of Improve Farm input	**2004**		**2010**	
	Frequency	**Percent**	**Frequency**	**Percent**
Improved seeds	168	11.2	54	15.2
Inorganic fertilizer	218	14.5	129	36.3
Agrochemicals	208	13.9	108	30.4
Veterinary drugs	114	7.6	29	8.2
Livestock feed	70	4.7	7	2.0
Combination of inputs	722	48.1	28	7.9
Total	**1500**	**100.0**	**355**	**100.0**

The explanation given by households for non use of improved farm inputs in 2010 among PROSAB farmers and also among non-PROSAB farmers are on Table 19. It shows that 46.6% of PROSAB farmers indicated that they were not financially buoyant to buy farm inputs. This similar explanation of not being financially buoyant was indicated by 31.1% by non-PROSAB farmers.

Table 19: Explanation For non- use of Improved Farm Inputs by Households in 2010.

Reason	PROSAB Farmers		Non-PROSAB Farmers	
	Frequency	**Percent**	**Frequency**	**Percent**
Not financially buoyant to buy	7	46.6	19	31.1
Farm inputs are expensive	1	6.7	17	27.9
Presently use animal dung/local manure	2	13.3	10	16.4
Farm inputs not available	1	6.7	8	13.1
Crops planted do not need much fertilizer	2	13.3	5	8.2
Do not know how to use them	1	6.7	2	3.3
No response	1	6.7	0	0.0
Total	**15**	**100.0**	**61**	**100.0**

4.1.13 Rural livelihoods of households

4.1.13.1 Occupations of household heads

The result of analysis of occupations of household heads is shown in Table 20. Majority (84.4%) of PROSAB farmers indicated farming as their primary occupation while among the non-PROSAB farmers nearly 59% of the farmers indicated farming as their primary occupation. The other primary occupation in order of importance was government salaried jobs (12.8%) among PROSAB farmers and 26.7% of non-PROSAB farmers. Only an insignificant 0.6% of PROSAB farmers had no primary occupation and 1.1% of non-PROSAB farmers. Based on these findings, more PROSAB farmers depended on farming as a means of livelihood than non-PROSAB farmers. This finding justifies the decision to implement the project which was targeted at enhancing agricultural production among farmers.

This finding is similar to the finding by Amaza *et al.* (2009) which found that farming was the most important occupation of the household heads among PROSAB farmers (an average of 69%) and civil service jobs (government salaried jobs) was the second most important occupation. This finding according to them has an important implication for farm production decisions by the households. The dependence of farm families on farming as the predominant occupation may have a positive or negative effect on agricultural production depending on the availability and allocation of household resources. The diversification of primary occupations among non-PROSAB farmers was found to be higher than among PROSAB farmers. This was because most of the non-PROSAB households had more occupations than PROSAB households in 2010.

Table 20: Distribution of Respondents by their Primary Occupations in 2010

Primary occupation	**PROSAB Farmers**		**Non-PROSAB Farmers**	
	Frequency	**Percent**	**Frequency**	**Percent**
No response	1	0.6	2	1.1
Farming	152	84.4	106	58.9
Government salaried job	23	12.8	48	26.7
Private salaried job	1	0.6	11	6.1
Crafts and artisans	0	0.0	3	1.7
Trading	3	1.7	3	1.7
Hunting, herbalist, commercial motorcyclists	0	0.0	6	3.3
Total	**180**	**100.0**	**180**	**100.0**

The result of analysis of secondary occupations of households in 2010 is on Table 21.The predominant secondary occupation among PROSAB farmers was trading (31.1%) and farming (30%) among non-PROSAB farmers. Nearly 23% and 27% among PROSAB and non-PROSAB farmers respectively indicated they did not have a secondary occupation. Like in the case of primary occupation, the diversification of secondary occupations was higher among non-PROSAB farmers than among PROSAB farmers.

The implication of this finding is similar to what Ellis (1998) in Nasai (2008) pointed out, "that the rural poor have developed capacity to cope with increasing vulnerability associated with agricultural production – diversification, intensification and migration or moving out of farming. Diversification as a strategy involves the attempt by individuals and households to find new ways to raise income and reduce environmental risk. Ellis, (1998); in Nasai (2008) stated that it is evident that rural households in Nigeria engage in multiple activities as trading (marketing or adding value to commodities), small scale business enterprises (carpentry, radio and bicycle repairs), processing of agricultural goods and arts and crafts (weaving, mats and basket making) in order to supplement earnings from agriculture. The implication of this diversification observed in the finding above is that in the event of any challenge with agriculture; non-PROSAB farmers would most likely cope better than PROSAB farmers.

Table 21: Distribution of Respondents by their Secondary in 2010.

Secondary occupation	**PROSAB Farmers**		**Non-PROSAB Farmers**	
	Frequency	**Percent**	**Frequency**	**Percent**
No response	43	23.9	48	26.7
Farming	27	15.0	54	30.0
Government salaried job	11	6.1	14	7.8
Private salaried job	11	6.1	10	5.6
Crafts and artisans	7	3.9	8	4.4
Trading	56	31.1	24	13.3
Hunting, herbalist, commercial motorcyclists	25	13.9	22	12.2
Total	**180**	**100.0**	**180**	**100.0**

The result of our findings in Tables 20 and 21 showed that most of the PROSAB and non-PROSAB farmers were into agriculture as a primary occupation and as a secondary occupation. For example, the finding showed that 84.4% of PROSAB respondents had agriculture as a primary occupation while 15% of PROSAB respondents had agriculture as a secondary occupation. Among the non-PROSAB farmers, 58.9% of the farmers indicated farming as their primary occupation while 30% of non-PROSAB respondents indicated they had farming as a secondary occupation. It is evident from this finding that a majority of the households among the PROSAB respondents and the non-PROSAB respondents were into agriculture. Therefore, any policy to improve the standard of living of these households should target agriculture.

The finding indicated that only 15% of PROSAB respondents and 40% of non-PROSAB respondents had other occupations other than agriculture. This finding is different when we look at secondary occupations. If we exclude those without secondary occupation and those who had farming as a secondary occupation, nearly 61% of PROSAB respondents and nearly 43% non-PROSAB respondents had other secondary occupations other than farming. This suggests also that any policy aimed at improving the standard of living of the rural households in southern Borno should at least target these other occupations. This is particularly necessary because it has been observed that some of the farmers are tending to shift from food crops to cash crops and also the decrease in the percentage of households who had farming as a primary occupation in 2004 as discussed by PROSAB (2004). Therefore, any efforts aimed at improving the livelihood strategies of households should focus more on these occupations.

This finding is in consonance with previous findings in the area. For example, the study by PROSAB (2004) at project inception i.e. the bench mark study showed that 88.1% of the population in Biu LGA, 88.5% in Hawul LGA and 94.1% in Kwaya Kusar (with an average of 90.1% including Damboa LGA) were into crop farming. Similarly, an average of 78.8% of the population was into livestock farming and 40.3% of the population was found to be involved in crop and livestock farming.

In addition to these and as is the practice in many rural economies nowadays, the rural households in the study area had highly diversified income generating activities. The major types of these incomes generating activities or livelihood strategies were identified as can be seen in Tables 20 and 21. Based on this, it can be said that these households have a rich and varied livelihood portfolio with displays of infinite resourcefulness to make ends meet. Therefore, any effort aimed at improving the livelihood strategies of households in southern Borno should focus on these occupations and off-farm activities. Most households rely on income from a number of sources – from the farm (sale of crops and livestock), secondary occupations, off-farm activities, remittances from members of the household resident elsewhere and incomes from other household members.

4.1.13.2 Ownership of households assets

Table 22 shows households' ownership of various assets. Bicycles were the most common asset among PROSAB farmers (16.4%) and among non-PROSAB farmers (14.1%). This was followed by sewing machines (11.1%), livestock (9.7%) and motorcycles (9.6%) among PROSAB farmers. However, among non-PROSAB farmers, ownership of bicycles (14.3%) was followed by ownership of sewing machines (14.1%), livestock (12.1%) and motorcycles (10.5%).The assets listed under others include inorganic fertilizer, agrochemicals, sprayers and crop processing equipment.

According to Hassan and Babu (1991), assets ownership by the household measures its endowments and provides a good measure of livelihood resilience in times of food crisis resulting from famine, crop failures or natural disasters. According to them, it is believed that the household can easily fall back on these assets in times of need by outright sales of these assets or by leasing them.

Similarly, according to Bender and Hunt (1991), and Barney and William, (1994), the level of valuable, disposable assets owned by a household is regarded as a factor determining the degree or vulnerability of the household to food insecurity, poverty incidence, and poverty intensity. This is because these disposable assets can be sold in times of need and, to that extent, constitutes a determinant of the probability of a household being food insecure or poor. These assets could also serve as a measure of household wealth and, hence, the level of their possessions is expected to have a negative relationship with poverty status. That is, given other factors, the higher the value of disposable household assets possessed, the lower the probability of the household's food insecurity and poverty, and vice versa.

Table 22: Distribution of Respondents by Household Assets Owned in 2010

Asset	PROSAB Farmers		Non-PROSAB Farmers	
	Frequency	**Percent**	**Frequency**	**Percent**
Land	56	7.0	49	7.7
Car/pick up	35	4.3	22	3.5
Motorcycle	77	9.6	67	10.5
Bicycle	132	16.4	91	14.3
Ox-plough, ox-ridger, ox-harrow	21	2.6	20	3.1
Work bull	66	8.2	50	7.8
House (new)	49	6.1	38	6.0
House (renovated)	73	9.1	47	7.4
Sewing Machine	89	11.1	90	14.1
Bank account	24	3.0	26	4.1
Livestock	78	9.7	77	12.1
Clothes, hand hoes, cutlasses, sickles	104	12.9	60	9.4
Total	**804**	**100.0**	**637**	**100.0**

4.2 Off Farm Incomes and Profitability of Farm Enterprises

4.2.1 Off-farm incomes

The result of the analysis of incomes earned from off farm activities such as commercial motorcyclists, trading, grain milling, hunting, artisans/tailoring etcis on Table 23. The result showed that only 48.9% of PROSAB farmers and 74.4% of non-PROSAB farmers earned incomes of between ₦1,000 and ₦40,000 in 2010. 20% of PROSAB farmers earned between ₦40,001 to ₦80,000 while 15.0% of non-PROSAB farmers earned similar income in 2010. Only 3.4% of PROSAB farmers and 1.7% of non-PROSAB farmers earned an income of ₦360,000 and above in 2010. The result showed that PROSAB farmers had a mean income of ₦87,896.76 which was higher than that of non-PROSAB farmers of ₦29,373.63. The F calculated is 6.25 which is greater than the F tabulated of 1.22. In view of this, we reject the null hypothesis and accept the alternative hypothesis and conclude that the difference between the mean incomes from off farm activities for PROSAB farmers and non-PROSAB farmers is significant. Our finding was that 68.9% and 89.4% of PROSAB and non-PROSAB households had off farm income of ₦120,000 and below as against Adebayo (2011)'s finding that 16.1% and 9.6% of the beneficiaries and non-beneficiaries had off farm income of ₦100,000 or less. We also found that only 3.4% and 1.7% of PROSAB and non-PROSAB households had off farm income of above ₦360,000 while Adebayo (2011) found that 8.9% and 10.2% of the beneficiaries and non-beneficiaries had off-farm higher than ₦400,000. Based on these findings, our respondents had relatively lower off-farm incomes than those observed by Adebayo (2011).

Adebayo (2011) found that the significant variables that increased income diversification strategies of farm households were educational level, farm size, membership of cooperatives and non farm income. Also, he found that households that combined crop production with one off-farm enterprise had highest food security status of 45% and 47% for beneficiaries and non-beneficiaries respectively.

Our finding as well as that of Adebayo (2011) underscores the fact that off-farm incomes if and when put into proper use by a household are capable of improving household food security, farm income and livelihoods of the rural households.

Table 23: Distribution of Off-Farm incomes of Households in 2010

Income (₦)	**PROSAB Farmers**		**Non-PROSAB Farmers**	
	Frequency	**Percent**	**Frequency**	**Percent**
1,000-40,000	88	48.9	136	75.5
40,001-80,000	36	20.0	27	15.0
80,001-120,000	17	9.4	7	3.9
120,001-160,000	11	6.1	3	1.7
160,001-200,000	5	2.8	2	1.1
200,001-240,000	8	4.4	0	0.0
240,001-280,000	3	1.7	3	1.7
280,001-320,000	4	2.2	0	0.0
320,001-360,000	2	1.1	0	0.0
360,000+	6	3.4	2	1.1
Total	180	100.0	180	100.0
Mean	87,896.76			29,373.63
Variance	33,849,946,187.74			5,416,120,871.04

4.2.2 Gross margin analysis

Gross margin is a measure of profitability of farm enterprises. In this study, the aim is to determine the gross margin of PROSAB farmers and that of non-PROSAB farmers for crop crop based enterprises and livestock based enterprises and compare them. The aim is to determine whether the farmers' crop based and livestock enterprises are profitable or not.

4.2.2.1 Gross margin analysis of crop based enterprises

The gross margin was computed using production values for maize, soybean and cowpea. The average gross revenue and average variable costs etc are as shown on Table 24. The average gross revenue among PROSAB farmers was found to be ₦168, 866.93 per annum as against the average gross revenue for non- PROSAB farmers which was found to be ₦136,116.50. The calculated t value is 1.24 while the table t value is 1.65 at 0.05. This means that since the calculated t value of 1.24 is less that the tabulated t value at 0.05, we reject the null hypothesis that there is no difference in the mean gross revenues between PROSAB farmers and non-PROSAB farmers and accept the alternative hypothesis that the difference in the mean gross revenues of the two groups of farmers is significant at 95%. The result of the analysis of the gross margin for crop based enterprises is on Table 24. This finding suggest that in respect to the crop based enterprises, the project i.e. PROSAB made some positive impact on the farmers. The implication of this finding therefore is that PROSAB farmers who earned higher profits from their crop based enterprises were most likely to be more food secure than non-PROSAB farmers. Our finding above when compared with that of PROSAB in 2004 (PROSAB, 2004) showed that overall gross margin for crop production in the project area was ₦85,427.74 which showed that the gross margin had increased. Similarly, the RPN in 2004 was ₦0.13.

The Return Per Naira outlay (RPN) for PROSAB farmers was found to be ₦1.94 while that of non-PROSAB farmers was found to be ₦1.82. The difference between the two RPNs was found to be small though in favour of PROSAB farmers. This small difference of the RPN is due to the higher Total Variable Cost (TVC) of ₦57,371.30 among PROSAB farmers as against that of non-PROSAB farmers which was ₦48,109.54. If the TVC had been lower, then the RPN would have been much higher. The low difference in RPN between PROSAB farmers and non-PROSAB farmers does not call for so much concern.

Variations in RPN are a reflection of variations in both variable costs and gross margin as the RPN outlay is defined as gross margin per Naira of variable costs incurred. What this means is that the RPN shows how many times surplus earnings/ha are available to cover variable costs. With regard to crop based enterprises the average gross margin per household and the RPN per household are higher among PROSAB farmers than among non-PROSAB farmers. The F calculated was found to be 1.24 while the F tabulated was found to be 1.22. In view of this, we reject the null hypothesis and accept the alternative hypothesis that the difference in the average gross revenues is significant because F calculated (1.24) > F tabulated (1.22) The fact that the F test was significant means that the observed differences between the two groups of farmers were not by mere chance. That is, the crop based enterprises among the PROSAB farmers were more profitable than those by the non-PROSAB farmers.

.

Table 24: Gross Margin Analysis For Crop Based Enterprises for PROSAB and non PROSAB Farmers in 2010(₦/Ha).

Variable	**PROSAB Farmers(₦/Ha)**	**Non-P ROSAB Farmers(₦/Ha)**
Average gross Revenue	168,866.93	136,116.50
Average variable cost	57,371.30	48,109.54
Average gross margin	111,495.63	88,006.96
Average return per Naira Outlay (RPN)	1.94	1.82

The differences in the average gross revenues (incomes) of the two groups which was found to be significant at 5% level of significance is an indication of the impact created by the project among PROSAB households.

Based on the test of hypothesis on the finding in Table 24 that the mean gross revenue of ₦129,890.96 and mean profit of ₦65,175.53 for PROSAB farmers for crop based enterprises is greater than the mean for non-PROSAB farmers in terms of revenue of ₦90,744.33 and in terms of profit of ₦42,634 we reject the null hypothesis and accept the alternative hypothesis to enable us conclude that the difference is significant.

4.2.2.2 Gross margin analysis of livestock enterprises

The result of analysis of the gross margin of livestock based enterprises is on Table 25. The average gross revenue was higher among non-PROSAB farmers than among PROSAB farmers with average gross revenue of ₦95,683.78 and ₦84,733.33 respectively per household. The average gross margin was still higher among non- PROSAB farmers than for PROSAB farmers with ₦91,736.76 and ₦81,108.89 respectively. The average variable costs were found to be low which may be due to the fact that most of the livestock may be on free range rather than intensive care.

The Return Per Naira (RPN) for livestock was found to be much higher for livestock based enterprises than for crop based enterprises. This may be due to the higher revenues earned from livestock based enterprises than from crop based enterprises. The RPN for PROSAB farmers was found to be ₦22.38 per household and among non-PROSAB farmers it was found to be ₦23.24 per household. This is because though PROSAB farmers kept more of different animals per household on the average, the number of livestock per household for non-PROSAB household were higher in number.

The F calculated was found to be 0.88 while the F tabulated was found to be 1.21. In view of this, the null hypothesis is accepted since F calculated (0.88) < F tab (1.21) in view of which we conclude that the difference in the average gross revenue for PROSAB farmers and for non-PROSAB farmers was not significant meaning that theobservable difference in the gross margins and RPNs were mere chance. Such observed differences should not be taken seriously.

The findings suggest that in respect to livestock enterprises the project did not make the kind of impact envisaged. This may have been because of the limited intervention made by the project in respect of the animal share scheme, feed trials and animal health. These interventions did not create the desired impact as envisaged. This finding should be so because the scope of PROSAB intervention in livestock was quite low and almost negligible.

Table 25: Gross Margins Analysis for Livestock Enterprises for PROSAB and non-PROSAB Farmers in 2010.

Variable	PROSAB Farmers	Non-P ROSAB Farmers
Average gross Revenue	84,733.33	95,683.78
Average variable cost	3,624.44	3,947.02
Average gross margin	81,108.89	91,736.76
Average return per Naira		
Outlay (RPN) (₦)	22.38	23.24

Based on the test of hypothesis which showed that the average gross revenue of ₦164,332.43 and mean profit of ₦160,385.41 for non-PROSAB farmers is higher than those of PROSAB farmers in terms of the average gross revenue of ₦101,457.69 and in terms of mean profit of ₦98,292.31, we again reject the null hypothesis and accept the alternative hypothesis in the case of livestock based enterprises. Hence we can conclude that the difference in the mean gross revenue and mean profit is significant.

4.3 Food Security Status of Households

4.3.1 Food security status of households before and after PROSAB

This section aims to examine the food security status of participating households before PROSAB intervention and after PROSAB intervention. The intention is to determine whether PROSAB intervention for nearly six (6) years led to an improvement in the food security status of the households in the project area i.e. among PROSAB farmers and also if there was any improvement in the food security status among the non PROSAB farmers.

4.3.1.1 Comparison of food security status of households and non-PROSAB households.

The result of the analysis of the food security status of households is on Table 26. The result of the analysis showed that the percentage of households that were food secure among PROSAB households was 57.2% as against 35.6% of non-PROSAB households. The difference is 21.6%. The result of the analysis also showed that 42.8% of PROSAB households were food insecure as against 64.4% of non-PROSAB households (57.2%) that were also food insecure.What this means is that 103 PROSAB households had a daily Kilocalorie (Kcal) consumption of 2260 and 65 grammes of protein and above. The remaining 77 PROSAB households (42.8%) had a daily Kilocalorie consumption of less than 2260 and 65 grammes of protein. This has similar implication for the non PROSAB households too.

The food security index is a ratio of the daily Kilocalorie and protein availability over the recommended Food and Agriculture Organization (FAO) recommended 2260 Kcal and 65 grammes of protein.The result also showed that household daily calorie consumption (Kcal) is 3231.80 for PROSAB households and 2703.14 for non-PROSAB households. For the food insecure households, the household daily average calorie consumption for PROSAB households is 1067.52 Kcal and 883.96 Kcal for non-PROSAB households.

The result of our analysis furthered showed that some of the households might have been unable to meet the recommended Kcal not due to lack of enough food but due to the consumption of unbalanced diets. Given that food is available, a household's food security depends on how well the food was prepared and utilized as differences in preparation and storage could have led to different levels of food security even in the same level of food availability. However, unlike the finding of Adebayo (2011) which found that fewer households of the beneficiaries (34) were food secure and 105 households of the non-beneficiaries were food insecure; our finding was the reverse as we found higher number of households of the beneficiaries (PROSAB) households were food secure compared to the households of the non-beneficiaries (non-PROSAB households).

Table 26: Indices of Food Security Status for PROSAB and Non PROSAB Farmers in 2010.

Variable	**PROSAB Households**	**Non-P ROSAB Households**
Food secure households (No)	103.00	64.00
Food secure households (%)	57.20	35.60
Food secure index	1.43	1.10
Food insecure households (No)	77.00	116.00
Food insecure households (%)	42.80	64.40
Food insecurity index	0.33	0.23
Mean household size	7.40	6.70
Household daily calorie consumption (Kcal) for the Food secure household	231.80	2703.14

4.3.1.2 Comparison of the food Security status before PROSAB intervention and after PROSAB intervention.

According to PROSAB (2004), 58% of all households sampled were food insecure. When compared to the result of the analysis of the indices of food security for PROSAB farmers on Table 26 which showed that 42.8% of the PROSAB households were food insecure, it can be said that the food insecurity status in the project area fell from 58% in 2004 to 42.8% in 2010.Conversely, given that only 42% of the households prior to the project implementation in 2004 were food secure; as at 2010, 57.20% of the PROSAB households were found to be food secure. It can be said that the number of households that were food secure increased from 42% in 2004 to 57.20% in 2010. The increase of 15.2% over the period can be said to be a good achievement. In view of this, the implication of this finding is that given the massive investment of resources in the project area, the reduction in the number of households that were food insecure have made the investment worthwhile. This implies that the project made some positive impact on the beneficiaries.

4.3.2 Determinants of households' food security

The purpose of this section is to determine which of the variables included in the Logit Regression Model used are the determinants of the food security status of the households in the study area and the level of significance.

The result of analysis of the Logit Regression model for the determinants of households' food security status is shown on Table 27. The result showed that a number of socio-economic and demographic variables affect household food security. These variables which include gender, age, use of modern farm inputs on the farm, years of farming experience and membership of a cooperative society were found to be statistically significant at 1%. Also, the result showed that the number of extension visits made to the household, was statistically significant at 5%. The coefficients of gender, years of farming experience, number of extension visits to the household, and cooperative membership were found to be positive while the coefficients of age and use of modern farm inputs were found to be negative. A positive coefficient indicates that higher values of the variable tend to increase the likelihood of being food secure. Similarly, a negative value of the coefficient implies that a higher value of the variable would decrease the probability of food security.

Gender (X_1) had a regression coefficient of 2.41 which implies that more of male household heads will increase the probability of being food secure. This could have been so because relatively fewer male headed households experienced less food shortage than the female headed households among both groups of farmers. This finding also suggests that more males were likely to have been involved in the farm work than females.

Age (X_2) had a regression coefficient of -0.01. The negative and significant coefficient of age means that the older a household head becomes the higher the likelihood that the food security status of the household will be reduced by 0.01. This finding confirms the earlier finding that the older a farmer becomes, food production will not be enhanced and ultimately the food security status of the household will be affected negatively.

Use of modern farm inputs (X_6) had a regression coefficient of -2.97. The negative and significant coefficient of use of modern farm inputs suggest that the use of modern farm inputs up to a certain level beyond which an increase in the quantity of such inputs used will negatively affect food security. What this suggests is that the higher the quantity of improved inputs used will not necessarily lead to increased outputs especially above the optimum technical level of efficiency, rather, increased use of modern farm inputs beyond a certain level will lead to increased costs which is a waste and could in some cases lead to the destruction of the crop enterprise(s) and livestock enterprise(s).

Years of farming experience (X_8) had a regression coefficient of 0.09. The positive and significant coefficient of years of farming experience had the implication that more years on the farm in terms of farming experience will enhance the food security status of the household. That is, the more the number of years of farming experience, the higher the probability of food security of the household will increase.

Number of Extension Visits made to the Household (X_9) had a regression coefficient of 0.37. The positive and significant coefficient of number of extension visits made to the household implies that the more the number of extension visits made to the household, the higher the likelihood that such a household will become more food secure. This is so because during such visits, households were trained and feedbacks received on the technology passed to the farmers during the previous visit. This allowed for positive interaction and hence the likelihood that the interaction will assist the farmers to benefit more on the technology being passed.

Membership of a cooperative group (X_{10}) had a regression coefficient of 2.04. The positive and significant coefficient of membership of a cooperative group suggest that membership of a cooperative society will increase the probability of a household being food secure. This is likely to be so because most cooperative groups would probably enhance members access to credit, modern inputs and training.

On the other hand, some of the variables were not found to be statistically significant. These include: marital status, family size, distance to source of modern farm inputs, access to credit, proportion of food sold in the household, level of education attained by the household head and primary occupation of household head. Some explanations as to why these variables might have not been found to be significant are given below including how these variables affect households' food security.

Marital Status (X_3) **-** did not matter whether the household head was married or single for as long as married, divorced/single household heads had equal access to extension agents, received similar extension messages etc. Since there was no discrimination in terms of the marital status of the household head, it was unlikely that this will affect significantly the household food security status. The regression coefficient for marital status is –0.93. The negative and non significant coefficient for marital status of the household head implies that the marital status of a head of a household i.e whether married or single did not matter in terms of whether the household is food secure or not.

Proportion of food produced and sold (x_{12}) – A situation where most of the households sold a greater proportion of the food produced by the household and was unlikely to supplement this with purchases from the market, was likely to negatively affect the food security status of the household. The regression coefficient for proportion of quantity of food sold over the food produced was found to be 0.00 and not significant even at 10% level of significance. This implies that the proportion of food sold did not negatively affect the food security status of the household. This was likely because the funds received from the sale of farm produce might have been used to purchase some food items lacking in the household.

Years of schooling (Level of education attained) (x_{13}) – Level of education attained by household head had a regression coefficient of 0.59 but which was not significant at 10% level of significance. This finding implies that the higher the level of education attained, the greater the possibility that such a household will be food secure. This is so because the level of education attained helps the household head and invariably members of the household in their understanding of extension messages passed to them. Once such messages are well understood and implemented, food production was most likely to improve. This would most likely be consumed directly or sold to enable the family purchase some other food in the market to supplement the food at home. In this way this will increase the probability of the household being food secure.

Primary Occupation (x_{14}) – Nearly 84% of PROSAB farmers and nearly 59% of non-PROSAB farmers indicated farming as their primary occupation. On the average, 71.5% of the households studied had farming as a primary occupation. The regression coefficient was found to be 0.07 and not significant at even 10% level of significance. This finding implies that the more the number of households involved in farming the greater the likelihood that they will be more food secure. Adebayo (2011) found the coefficients of farm size, number of dependents to be positive and significant at 1% level of probability. Access to UNDP credit and diversification level were found to be negative and significant at 1% level of probability. Iorlamen *et al.* (2010) found that food insecurity incidence decreased with increase in the quantity of food consumed by the household. The food insecurity incidence ranged from 0.17 for households consuming 200kg and above/month to 0.55 for households consuming 50kg or less/month. The implication being that, the greater the quantity of food consumed by a household the higher its food security status. Awotide *et al.* (2011) found that the determinants of food insecurity status to have coefficients of income (0.120), age of the respondent (0.061) and sex of the respondents (0.247) were positive and significant at 1% level of significance. Years of formal education (0.037) had a positive coefficient which was significant at 10% level of significance while farming experience in years (0.133) and household size (0.028) had a negative coefficient which was significant at 1% level of significance.

Amaza *et al.* (2009) found cost of hired labour (0.00001), and PROSAB zone (0.4903) to have positive coefficients and having statistical significance at 1%. The non-agricultural income was positive ($4.26^{e} – 06$) and statistically significant at 5% level of probability. Size of household had a negative coefficient of (-0.214) which was statiscally significant at 1% level of probability.

Table 27: Result of the Logit Regression Analysis of the Determinants of Household Food Security

Independent Variable	**Regression Coefficient**	**S.E.**	**Signif.**
Constant	-1.43	1.41	0.31
Age (X_2)	-0.01	0.02	0.00*
Marital Status(X_3)	-0.93	0.31	0.76
Family Size (X_4)	-0.02	0.06	0.73
Farm Size (X_5)	-0.09	0.12	0.48
Use of modern farm inputs(X_6)	-2.97	1.01	0.00*
Distance to source of inputs(X_7)	0.00	0.01	0.58
Farming experience (X_8)	0.07	0.03	0.01*
No. of extension visits (X_9)	0.37	0.18	0.04 **
Membership of a Coop. Society(X_{10})	2.04	0.35	0.00 *
Access to credit (X_{11})	0.32	0.52	0.55
Proportion of quantity of food sold(X_{12})	0.00	0.00	0.46
Years of schooling (X_{13})	0.59	0.43	0.17
Occupation (X_{14})	0.07	0.30	0.82

Note: * Statistically significant at 1% level of probability
* Statistically significant at 5% level of probability
SE = Standard Error
Log Likelihood function = 85.722

We reject the nullhypothesis which stated that there is no difference in the food security status of households in the project area and in the non project area because the mean kilocalories of the PROSAB farmers was 3.14 which is greater than the mean kilocalories of the non-PROSAB farmers which was found to be 2.52. In view of this, we accept the alternative hypothesis. The result is statistically significant at 0.05% level of probability.

4.3.3 Food sources and accessibility

The aim of this section is to discuss food sources and households' access to food and the implication of this on food security among PROSAB and non-PROSAB households alike.

4.3.3.1 Sources of food for the household

The result of analysis of the various sources of food for the household is presented in Table 28. The result showed that the dominant source of food for the households was own production as 71.1% of PROSAB farmers and 61.3% of non-PROSAB farmers indicated. This suggests that own production was the main source of food for majority of the households. In order to complement the food from own production, the market was the next most important source of food. This finding suggests that PROSAB farmers relied much more on their own production (71.1%) than non-PROSAB farmers (61.3%). This can be understood because most of the PROSAB respondents were farmers who spent more time on the farm. About 29% of the non-PROSAB farmers indicated that they resorted to the market to buy food as against 25.1% of PROSAB farmers. These two sources of food accounted for 96.2% for PROSAB farmers and 90.2% for non-PROSAB farmers. More non-PROSAB farmers had to rely on the market more than PROSAB farmers to source for food from the market to supplement their food requirement in their households. The implication for this finding with respect to the source of food for the household is that most PROSAB farmers were unlikely to face food security challenges than non-PROSAB farmers. Similarly, since fewer PROSAB farmers relied on the market to source for their food than the non-PROSAB farmers, they had a higher chance of being more food secure than the non-PROSAB households. This could mean that the project might have had a positive impact on food security on PROSAB farmers than on non- PROSAB farmers.

Table 28: Distribution of Respondents by Major Sources of Food for the Household in 2010

Source	PROSAB Farmers		Non-PROSAB Farmers	
	Frequency	**Percent**	**Frequency**	**Percent**
Own production	164	71.1	157	61.3
Purchased from the market	58	25.1	74	28.9
Gift from friends/relations	4	1.7	2	0.8
Exchange labor for food	4	1.7	1	0.4
Combination of sources	1	0.4	22	8.6
Total	**231**	**100.0**	**256**	**100.0**

The result of analysis of the combination of sources of food for the households in 2010 on Table 29 further shows that some of the households as indicated by 27.7% of PROSAB farmers had different combinations of food sources to feed members of their households as against 72.3% of PROSAB farmers who indicated that they relied on only one source of food to feed members of their households. On the other hand, 32.7% of non-PROSAB farmers relied on different sources of food to feed members of their households as against 67.3% of non-PROSAB farmers who indicated that they relied on only one source to feed members of their households. Though the non-PROSAB farmers relied on more diversified sources of food for their households, however, the higher reliance of PROSAB households to own production made them to be more food secure than for the non-PROSAB households.

Table 29: Distribution of Respondents by the Combination of Sources of Food for The Household in 2010

Source	PROSAB Farmers		Non-PROSAB Farmers	
	Frequency	**Percent**	**Frequency**	**Percent**
Own harvest	114	63.3	98	54.4
Purchase	9	5.0	20	11.1
Gift	3	1.7	1	0.6
Exchanged labour	3	1.7	1	0.6
Own harvest/purchase	49	27.1	38	21.1
Own harvest/gift	1	0.6	0	0.0
Own harvest/purchased/ gift/exchanged	0	0.0	1	0.6
Own harvest/purchasedexchanged	0	0.0	15	8.2
Own harvest/exchanged labour	0	0.0	5	2.8
No response	1	0.6	1	0.6
Total	**180**	**100.0**	**180**	**100.0**

The result of analysis of the sources of animal protein used by the household is on Table 30 which shows that the major ways of sourcing animal protein unlike in the case of food was the market as indicated by 71% of PROSAB farmers and 71.1% of non-PROSAB farmers. This was followed by own production as 21.5% of PROSAB farmers and 23% of non-PROSAB farmers indicated own production as the second most important means of sourcing animal protein.

Table 30:Distribution of Respondents by Major Methods of Sourcing Animal Protein for the Household in 2010

Source of protein	PROSAB Farmers		Non-PROSAB Farmers	
	Frequency	**Percent**	**Frequency**	**Percent**
Own production	46	21.5	50	23.0
Purchased from the market	152	71.0	155	71.1
Gift from friends/relations	9	4.2	4	1.8
Exchanged labour for meat	7	3.3	5	2.3
No response	0	0.0	4	1.8
Total	**214**	**100.0**	**218**	**100.0**

The result of the analysis on the combination of major methods of sourcing animal protein is on Table 31. It showed that some of the households relied on more than one means in which they obtained animal protein. These findings as presented on Table 31 show the combination of major sources of animal protein for the households in 2010. Nearly 65.5% of PROSAB farmers and 65% of non-PROSAB farmers relied on the market as the major source of animal protein.

Those farmers who had own production were only 6.7% for PROSAB farmers and non-PROSAB farmers respectively. As was the case of the different combinations of major sources of food produced by the farmers, the most popular combination was the market and own production as indicated by 18.9% of PROSAB farmers and 13.3% of non-PROSAB farmers who indicated this combination as their major source of animal protein. The implication of this finding is that since most households relied on the market to meet their animal protein requirement, they would need to have finance with which to do so. Their ability to access animal protein depended to a large extend to the finance available to them. The second implication is that for these households to meet their protein requirement as recommended by the Food and Agricultural organization (FAO) of 65grammes they had to look inwards i.e. they would have to make efforts to increase the number of livestock kept at home for home consumption. An increase in livestock keeping and consumption would enable most households to meet the FAO protein intake of 65 grammes per day per adult.

Table 31: Distribution of Respondents by the Combination of Major Methods of Sourcing of Animal Protein in the Households in 2010

Source	**PROSAB Farmers**		**Non-PROSAB Farmers**	
	Frequency	**Percent**	**Frequency**	**Percent**
Own production	12	6.7	12	6.7
Purchased	118	65.5	117	65.0
Gift	9	5.0	4	2.2
Exchanged labour for food	7	3.9	5	2.8
Combination of all sources	0	0.0	4	2.2
Own production/purchased	34	18.9	24	13.3
Own production/purchased/ Exchangelabour*	0	0.0	14	7.8
Total	**180**	**100.0**	**180**	**100.0**

Note: * Exchange labour means that the household head did not pay for the meat in cash but rather did some work equivalent to the cost of the meat given to him/her.

4.3.4 Food shortage

Food shortage is the inability of households to provide adequate food for the households which is an indication of the level of food insecurity in the household.

The result of analysis of the duration in days and frequency of food shortage in 2010 showed that PROSAB farmers and non-PROSAB farmers indicated that they experienced food shortage in 2010. It is important to note however that the households that experienced food shortage experienced it at different periods of the year. For example, the result of the analysis of food shortage on Table 32 shows that while PROSAB farmers indicated that they did not experience food shortage in the first quarter of 2010 i.e. January – March, 2010; 48.5% of non-PROSAB farmers indicated that they did experience food shortage within the first quarter of 2010 which was for 24 days out of the 90 days in the quarter. That is, they experienced food shortage for 26.8% of the quarter.

The result of the analysis of households that experienced food shortage in the second quarter of 2010 is on Table 32. Of the 36.7% of PROSAB farmers who indicated that they experienced food shortage in their households, they experienced food shortage on the average for 45 days out of the 90 days in the second quarter of 2010. However, in 2010; of the 365 days, they experienced food shortage on the average for 26.8 days during the year. That is, they had food shortage for 7.3% of the year. Similarly, of the 33.9% of non-PROSAB farmers who indicated that they had food shortage in 2010; the period April – June 2010 was the most difficult for them as they experienced food shortage for 41.3 days out of the 90 days in the quarter. In 2010, they experienced food shortage for an average of 32.1 days which was 8.8% of the year. One interesting finding is that PROSAB farmers did not experience food shortage between January and March 2010 as against non-PROSAB farmers who did. This could have been because of the fact that PROSAB farmers might have had access to early maturing crops than non-PROSAB farmers as the early maturing crop varieties might have been harvested for home consumption early thus enabling them to overcome food shortage. Some of the maize and sorghum varieties provided by PROSAB were early maturing. In addition, in view of the high diversification in livelihoods in favor of non-PROSAB houses with a high number having government jobs (26.7%) and private salaried jobs (6.1%) for primary occupations as against 12.8% and 0.6% for government salaried jobs and private salaried jobs (0.6%) for PROSAB households; the non- payment of salaries of workers could have affected non-PROSAB farmers than PROSAB households. In this way, the issue of food shortage would not have been there as observed.

Table 32: Duration (Days) And Frequency of Food Shortage By Households which Experienced Food Shortage.

	PROSAB Farmers			**Non-PROSAB Farmers**		
Period of the year	**Frequency**	**Percent**	**Duration (Days)**	**Frequency**	**Percent**	**Duration (days)**
Jan-March	0	0.0	0	48	48.5	24.1
April-June	4	6.6	45.0	8	8.1	41.3
July-Sept	56	91.8	34.3	43	43.3	31.0
Oct-Dec	1	1.6	1	0	0.0	0.0
Total	61	100		99	100	
Mean (days)		26.8			32.1	

In considering the analysis of the food shortage experienced by both PROSAB farmers and non-PROSAB farmers, our finding based on the result of the analysis of the duration of food shortage indicated that while PROSAB farmers did not experience any food shortage, in the period January – March 2010, non-PROSAB farmers did for the same period i.e. January – March 2010 for nearly 24days. The food shortage in days lasted between 2 days and 72 days during the quarter. Over 62.4% of the non-PROSAB farmers experienced food shortage during the quarter of between 21 – 30 days. The absence of food shortage during the first quarter of 2010 among PROSAB farmers was due to the success of the early maturing crops and their knowledge of improved production. This is because in explaining why they did not experienced food shortage in 2010, while 11.9% PROSAB farmers had good knowledge of improved technology, only 1.8% of non-PROSAB households had such knowledge. Similarly, their explanation as to why the causes of food shortage in 2010 showed that 10% of PROSAB farmers gave poor knowledge of improved technology as compared to 25% of non-PROSAB farmers who gave similar reason. Furthermore, non-

PROSAB households (16.1%) compared to 13.3% of PROSAB households had low farm production.

As a result of this finding, food shortage is most likely to affect most members of the household. For example, for children it could lead to stunted growth, kwashiorkor and where the available food lacks quality and quantity it could lead to more serious problems such as starvation and diseases for members of the household.

The result of the analysis done for first, second and third quarters of 2010 are shown in Tables 33, 34 and 35 respectively.

Table 33: Duration of Food Shortage (Days) Among Households between January and March.

Number of days	Non-PROSAB Farmers	
	Frequency	**Percent**
1-10	12	25.0
11-20	1	2.1
21-30	30	62.4
31-40	2	4.2
41-50	1	2.1
51-60	0	0.0
61-70	1	2.1
71+	1	2.1
Total	**48**	**100.0**

Note: There was no food shortage for PROSAB farmers during the period January to March, 2010

During the second quarter of 2010, the mean duration of food shortage for PROSAB farmers was 45.0 days and 41.3 days for non-PROSAB farmers. Non-PROSAB farmers were more (62.5%) affected among those who had food crisis falling between 21-30days than PROSAB farmers.

Table 34: Duration (Days) of Food Shortage Among Households Between April and June.

Number of days	**PROSAB Farmers**		**Non-PROSAB Farmers**	
	Frequency	**Percent**	**Frequency**	**Percent**
1-10	0	0.0	0	0.0
11-20	0	0.0	0	0.0
21-30	1	25.0	5	62.5
31-40	1	25.0	1	12.5
41-50	1	25.0	1	12.5
51-60	1	25.0	0	0.0
61-70	0	0.0	0	0.0
71^{+}	0	0.0	1	12.5
Total	**4**	**100.0**	**8**	**100.0**
Mean (Days)	45.0		42.3	
Minimum (Days)	30.0		30.0	
Maximum (Days)	90.0		90.0	

For the third quarter of 2010 i.e. July to September, the mean duration of food shortage was 34.3 days for PROSAB farmers and 31 days for non-PROSAB farmers. Nearly 46% of PROSAB farmers had food shortage ranging between 51-60 days followed by 21-30days for 32.1% of PROSAB farmers. In the case of non-PROSAB farmers, nearly 93% of the farmers had food shortage for 21-30days for the same period i.e. July-September, 2010 and only 4.7% of the farmers had food shortage lasting 51-60 days during the period July-September, 2010.

Table 35: Duration (Days) of Food Shortage among Households between July and September.

Number of days	PROSAB Farmers		Non-PROSAB Farmers	
	Frequency	Percent	Frequency	Percent
1-10	12	21.4	0	0.0
11-20	4	7.1	1	2.3
21-30	18	2.1	40	93.0
31-40	1	1.8	0	0.0
41-50	0	0.0	0	0.0
51-60	20	35.8	2	4.7
61-70	1	1.8	0	0.0
71+	0	0	0	0.0
Total	**56**	**100.0**	**43**	**100.0**
Mean (Days)	34.3		31.0	
Minimum (Days)	1		14	
Maximum (Days)	70		60	

4.3.5 Reasons for not experiencing food shortage.

As discussed earlier, nearly 63.3% of PROSAB farmers and 66.1% of non-PROSAB farmers did not experience any food shortage in 2010. As a result, based on the result of the analysis of the reasons given for not experiencing food shortage on Table 36, 67.2% of PROSAB farmers explained that it was due to the fact that they produced enough food/ they had sufficient food to feed members of their households while 70.7% of non-PROSAB farmers also explained that they had produced enough food/ they had sufficient food to feed members of their households.

Table 36: Reasons Given by Households For Not Experiencing Food Shortage

Reason	PROSAB Farmers		Non-PROSAB Farmers	
	Frequency	**Percent**	**Frequency**	**Percent**
Produced enough food/ have sufficient food to feed the family.	68	67.2	77	70.7
Income from trading helped	2	2.0	3	2.8
Had access to farm inputs	8	7.9	10	9.2
Had enough money to buy farm inputs	5	5.0	5	4.6
Had good knowledge of improved technology	12	11.9	2	1.8
Obtained financial assistance with which to buy food	4	4.0	1	0.9
No response	2	2.0	11	10.0
Total	**101**	**100.0**	**109**	**100.0**

4.3.6. Causes of food shortage

The result of the analysis of the causes of food shortage among households is presented on Table 37. In order of importance, nearly 23%, 19.4% and 17% of PROSAB farmers explained that the major causes of food shortage was inadequate storage facilities, inadequate farm inputs and inadequate money to buy food respectively. The reasons given by non-PROSAB farmers were different as 26.1%, 25% and 16.1% of the farmers gave inadequate storage facilities, lack of knowledge of improved technology and low production respectively as the major causes for the food shortage they experienced.

It is interesting to note that most farmers indicated lack of storage facilities. The lack of knowledge of improved technology and low production whether on account of lack of improved technology or lack of improved farm inputs are issues of concern. It is to be noted also that since the issue of storage was not directly addressed by PROSAB, it is with little surprise that non-PROSAB farmers as well as PROSAB farmers faced problems of storage.

Table 37: Causes of Food Shortage among Households.

Causes of food shortage	PROSAB Farmers		Non-PROSAB Farmers	
	Frequency	Percent	Frequency	Percent
Inadequate storage facilities	42	23.3	47	26.1
Inadequate money to buy food	31	17.2	18	10.0
Inadequate farm inputs	35	19.4	22	12.2
Poor knowledge of improved technology	18	10.0	45	25.0
Low production	24	13.3	29	16.1
Could not receive adequate remittance from relations	20	11.1	15	8.3
No response	10	5.7	4	2.4

4.3.7 Strategies adopted by household heads to solve the problems of food shortage

Faced with the challenge of food shortage, household heads had to adopt different strategies in an attempt to meet this challenge of food shortage in 2010. The result of our analysis of the strategies adopted is presented in Table 38. Therefore, based on the result of analysis, 31% of PROSAB farmers and 25.6% of non-PROSAB farmers explained that they resorted to purchases of food in the market to solve their food shortages or meet their food needs in their households. In order of importance, nearly 13% of PROSAB farmers sought assistance from relations and nearly 11 % sold their livestock to be able to buy food for members of their households. Among the non-PROSAB farmers, nearly 14% of the farmers sold livestock to enable them buy food and nearly 12% of them (non-PROSAB farmers) had to seek for assistance from relations to be able to feed members of their households. It is worthy of note that nearly 6% of PROSAB farmers resorted to borrowing money so that they could meet the challenge of food shortage in their households.

The fact that some households i.e. 10.6% of PROSAB farmers and 10.5% of non-PROSAB households had to reduce their number of meals per day is indicative of food insecurity in the household. Also, the fact that nearly 13% of PROSAB farmers and nearly 16% of non-PROSAB farmers indicated that they had to sell livestock for cash to enable them purchase food implies that households in the study area should consider the keeping of livestock serious for among other reasons, they can always resort to the cash from the sale of such livestock to supplement their food requirement in their households apart from the fact that such livestock particularly chicken, and small ruminants can sometime be used for home consumption. Yahaya (2009) found bringing out stored produce (39.2%), disposal of animals and other assets to buy food (31.7%), assistance from relatives/friends (12.5%), income from off farm activities (10%) and borrowing from credit sources (6.6%) as the coping strategies. While Yahaya (2009) found five strategies, we found seven strategies used to cope with food shortage. The two strategies not found by Yahaya (2009) were buying from the market and reduced number of meals.

According to Adebayo (2011) buying from the market, bringing out stored food, assistance from other farmers/relatives, sales of livestock/other assets, and reduce number of meals were used as coping strategies. The project beneficiaries used buying from the market (48.2%) followed by bringing out stored produce (19.6%), sale of livestock/other assets (14.3%), assistance from other farmers/relatives (12.5%) and reduce number of meals (5.4%). On the other hand, the non-project beneficiaries used buying from the market (52.4%), bringing out stored produce (25.9%), sale of livestock/other (5.4%) and reduce number of meals (3.6%). The beneficiaries and non beneficiaries used similar coping strategies and ranked them the same.

Adebayo (2011) like Yahaya (2009) also found five coping strategies for food shortage. However, unlike Yahaya (2009) and Adebayo (2011) we did not find bringing out stored produce as a coping strategy.

Table 38: Strategies Adopted by Household Heads to Cope with Food Shortages in 2010

	PROSAB Farmers		**Non-PROSAB Farmers**	
Strategy	**Frequency**	**Percent**	**Frequency**	**Percent**
Buying from the market	60	33.3	50	27.8
Sought for help from other farmers	20	11.1	21	11.7
Sold livestock for cash to buy food	23	12.8	28	15.6
Reduced number of meals per day	19	10.6	19	10.5
Used income from off farm activities	21	11.7	22	12.2
Sought for assistance from relations	26	14.4	23	12.8
Borrowed money to buy food	11	6.1	17	9.4
Total	**180**	**100.0**	**180**	**100.0**

4.3.8 Estimation of the impact of the project

The Double Difference Estimator is a tool used to estimate the impact of a project. According to Chen et al., (2006) and Nkonya et al., (2008) in Simonyan (2009), the double difference model compares changes in outcome measures (e.g change in increase before and after) and also between project participants (PROSAB farmers) and non project participants (non-PROSAB farmers), rather than on comparing outcome levels at one point in time. According to Ravallion, (2005), the advantage of using the double difference method is that it nets out the effects of additive factors that have fixed (time variant) impacts on say income indicator, or that it reflects common trends affecting project participants and non participants equally, such as changes in prices. If the difference in income, production or in number between the beneficiaries and non beneficiaries is positive it implies there was impact of the project on beneficiaries otherwise no impact.

The result of the analysis of the double difference estimator is in Table 39. The result shows that there is a positive mean income for maize, soybean, cowpea, sheep and goats. This implies that there was impact of the project on PROSAB farmers in respect of these. On the other hand, the result shows that there was a negative mean income for cattle of ₦360,667 which implies that there was no impact on PROSAB farmers. This could have been so because there was no project intervention in cattle. With respect to household items, there is a positive mean income for cars/pickups, and houses renovated or built which implies that the project made an impact on PROSAB farmers but could not with respect to land since the mean income is - ₦84.

The level of significance is given by the P values which suggest that soybean, maize and houses renovated or built were found to be statistically significant at 5% level of significance.

The consumer price index for maize, soybean and cowpea was estimated to be 124, that of cattle, sheep and goats was estimated to be 117 while that of cars/pickups, houses renovated/built and land was estimated to be 137. What this means is that the inflation rate for crops was 24%, livestock 17% and 37% for household items.

The result of analysis of the double difference estimator is on Table 39. In view of the fact that crop production had a positive DDE for all the three crops of maize, soybean and cowpea; it produced the highest impact. This is followed by the livestock sector and household items which had the lowest DDEs.

The crop subsector had soybean with the highest DDE which though a relative new crop, it was well received by the farmers. In addition, the farmers benefitted from improved prices received from animal feed producers from Jos and Kano who purchased most of the soybean produced. Cowpea could have made a higher impact if the improved brown varieties had been promoted by PROSAB rather than the improved white varieties which had been introduced. The farmers showed preference for the brown varieties.

In the livestock subsector, cattle did poorly compared to sheep and goats. This could have been because of the frequent clashes between the herdsmen and the farmers in southern Borno in 2010. Perhaps, the limited intervention by the project mostly on sheep and goats should be the explanation for their better impact than cattle.

The impact of household items was lowest. Houses built or renovated had a higher DDE than cars/pickups and lastly land. What these suggest is unlike crops and livestock, household items required far greater quantum of resources in view of the high capital requirement to be able to make some better impact particularly in respect to house construction/renovation and investments in cars/pickups. This is however not the case with respect to land as the land tenure system in southern Borno state does not lend itself so much to investments in land including purchasing land.

Our findings are similar to that of Simonyan (2009) who found a positive mean difference of about ₦243,299.61 on incomes which was realized between beneficiaries and non-beneficiaries before and after Fadama II project. The difference in income was significant at 1% level of probability. The finding implied that, there was an impact of the project on beneficiary's income in the study area. Also, our findings are similar to those obtained by Nkonya *et al.* (2008) on the project impact on pro-poor in Nigeria where they reported that Fadama II succeeded in improving the poverty level of the beneficiary communities in Nigeria.

Table 39: Double Difference Estimator For Crop Production, Livestock and Household Items.

Variables	**Mean**	**Std deviation**	**t-value**	**Std Error**
Crop Production				
Maize	373,221	10,502.43	4.08	114.38
Soybean	379,484	4,509.82	7.03	364.59
Cowpea	204,458	6,821.13	4.06	480.84
CP1	124			
Livestock				
Cattle	-360,667	21,102.34	6.37	179.70
Sheep	773,208	6,713.92	5.19	149.14
Goats	401,709	5,744.30	1.49	93.77
CP1	117			
Household items				
Cars/pickups	57	8,407.71	2.18	31.95
Houses renov./built	62	5,871.63	3.86	7.69
Land	-84	1,777.01	9.41	20.68
CP1	137			

4.4 Constraints Faced by Farmers in the Project Area.

This section aims to examine the nature of constraints faced by farmers in the project area in 2004 and invariably compare the constraints with those faced by farmers in the project area in 2010.

The result of the analysis of constraints faced by households in the study area in 2004 is in Table 40. The result showed that low yields and production of farm produce was the major challenge as indicated by 19.1% of the farmers. This was followed by lack of market for farm produce/low prices as indicated by 16.3% of the households. The least challenge was absence of buying agents as indicated by 0.9% of the farmers

Table 40: Farm Constraints Faced by Households in the Study Area in 2004.

Constraint	**Frequency**	**Percent**	**Rank**
Inadequate market for farm produce/low price	260	16.3	2nd
Inadequate seedlings/improved seeds	60	3.8	8th
Absence of farm labour	70	4.4	7th
Insect problems	25	1.6	12th
Absence of buying agents	15	0.9	13th
Problem of birds	49	3.1	10th
Inadequate capital (credit)	231	14.5	3rd
Poor soil fertility	58	3.6	9th
Low yield and production	304	19.1	1st
Absence of land	49	3.1	11th
Inadequate inorganic fertilizer	195	12.2	5th
Striga infestation	201	12.6	4th
Others	77	4.8	6th
Total	**1594**	**100.0**	

Source: PROSAB, 2004; PROSAB, 2006

The result of the analysis of constraints faced by farmers in the project area in 2010 is shown in Table 41. The results showed that absence of inorganic fertilizer had the highest rating as indicated by 12.6% of PROSAB farmers; while 17.5% of non-PROSAB farmers indicated that their major constraint was extension visits. This was closely followed by the lack of extension visits among PROSAB farmers (12.6%) and absence of inorganic fertilizer among non-PROSAB farmers (15.6%). Among both group of farmers, lack of market information was the least constraint as indicated by 2.4% of PROSAB farmers and 0.5% of non-PROSAB farmers. From the result of analysis in Table 40 and when compared with the result of analysis on Table 41, the constraints ranked 1st, 2nd, 4th, 6th, 8th, 9th, 10th, 11th, and 12th might have been solved as a result of the project intervention. The constraints ranked 3rd (lack of capital/credit), 5th (lack of inorganic fertilizer) and 13th (absence of buying agents) were not solved by the project. This may be because the lack of credit was ranked 3rd in 2010 among PROSAB farmers, lack of inorganic fertilizer was ranked 1st among PROSAB farmers in 2010 and the absence of buying agents can be seen as the inability of PROSAB farmers in 2010 to sell farm produce at high prices which was ranked 9th among PROSAB farmers in 2010.

While most of the constraints faced by the households in 2004 appeared to have been solved, however, the termination of the project intervention led to new constraints which include absence of inorganic fertilizer, lack of extension visits and so on. The implication is that while the intervention by the project solved most of the initial constraints at project inception in 2004, the termination of the project life in 2009 threw more challenges which may affect the sustainability of the project.

Adebayo (2011) found that the beneficiaries of the UNDP micro-credit faced five challenges which were credit was too small (37.5%) ranked 1st followed by interest rate too high (33.9%) ranked 2nd, repayment period too short (16.1%) ranked 3rd, time consuming/cumbersome (14.3%) ranked 4th and inappropriate time of disbursement (5.4%) ranked 5th. From these findings, it is evident that Adebayo (2011) looked at only the credit challenge and not other challenges faced by the beneficiary farmers as well as the non-beneficiary farmers.

Nasiru *et al.* (2011) identified poor road work (98.3%) as the major constraint faced by farming households in Tafawa Balewa LGA of Bauchi State. The other constraints identified were high cost of inputs (89.9%), inadequate processing facilities (78%), inadequate storage facilities (74.6%), lack of money to buy agrochemicals to treat pests and diseases (57.6%0, lack of market to sell (47.5%) and accessibility to land (39%).

Nwauwa *et al.* (2011) in their study on market participation by small-scale maize farmers in Osun State found high transportation cost (33%) as the major constraint. This was followed by bad roads (26%), lack of credit (21%), low productivity (14%), pests and diseases (3%) and lack of information (3%). The study also revealed that the farmers had the following market options to sell their farm produce: Farm gate (49%), village market (33%), city market (14%) and house (4%). Thus, the study revealed that these constraints accumulated in poor market participation by the farmers. The study also revealed that there were at least three other uses farmers could put their produce into. That is, apart from going into the market, they could store the produce and sell later or use it for the next planting season, eat it or give it out as gift

Table 41: Farm Constraints Faced by Households in 2010

	PROSAB Farmers			Non-PROSAB Farmers		
	Frequency	**Percent**	**Rank**	**Frequency**	**Percent**	**Rank**
Inadequate fertilizer	86	13.7	1st	90	15.6	2nd
Inadequate agrochemicals	65	10.4	4th	68	11.8	3rd
Extension visits	79	12.6	2nd	101	17.5	1st
Agricultural credit	75	12.0	3rd	45	7.9	7th
Inability to sell farm produce at high prices	10	5.4	8th	9	5.0	8th
Poor market information	15	2.4	12th	3	0.5	12th
Inadequate agric insurance	27	4.3	10th	10	1.7	11th
Inadequate training	51	8.1	6th	13	2.3	10th
Poor storage facilities	48	7.7	7th	47	8.1	6th
Inadequate agro-processing equipment	62	9.9	5th	29	5.0	9th
Food shortage	33	5.3	9th	67	11.6	4th
Others	23	3.6	11th	48	8.3	5th
Total	**627**	**100.0**		**577**	**100.0**	

4.5 Farmer Groups' Perception of the Impact of the Project

This section is aimed at examining farmers' perception of the assessment of impact of the project (using Focused Group Discussions) on food security, farm income, agricultural credit, fertilizer etc.

4.5.1 Impact of PROSAB on access to and use of agricultural credit

The result of the analysis on the impact of PROSAB on access to agricultural credit is on Table 42. It shows that more women (45%) than men (30%) and youth (10%) indicated that PROSAB had made some impact in their access and use of agricultural credit. This may be so because women were able to access much more credit through the Development and Exchange Centre (DEC) at Biu since the credit at DEC was limited to women only. Overall, more men, women and youth (54.7%) indicated that there was a decrease in impact of their access to credit while 49% of all men, women and youth were of the view that there was no difference in the agricultural credit situation compared to what it was at the beginning of the project. More men (30%) than women (18%) and youth (20%) were of the view that their access to agricultural credit was less which implies that the impact of the project on their access to agricultural credit had decrease. This must have been on account of the fact that access to credit was a serious constraint. The finding on Table 40 which showed that access to credit was ranked 3rd by PROSAB farmers in 2010 is worthy of note. Similarly, the finding on Table 41 which showed that access to credit to agricultural credit in 2004 was ranked 3rd too. This underscores the seriousness of the lack of access to agricultural credit in the project area.

4.5.2 Impact of PROSAB on access and use of improved seeds in the project area.

The result of analysis of the impact of PROSAB on the use of improved seeds among households in the project area is in Table 42. The result showed that more men as indicated by 85% of them believed that the project brought about the increased use of improved seeds. This was followed by 83% of women and 71% of youth. This may have been so because most men as household heads were the improved seed growers followed by women. Since most of the farm decisions like the use of improved seeds were taken by men followed by women, they were in a position to understand the extent to which the use of improved seeds in the project area impacted positively on the farmers and hence their rating of the impact of the project on access and use of improved seeds in the project area. It is not surprising therefore that fewer men (10%) than women (14%) and youth (15%) were of the view that the project impact on access and use of improved seeds was less. This finding is similar with the view expressed by all the groups as 3% women, 5% men and 14% youth were of the view that when compared to 2004, the impact of the project on access and use of improved seeds was less when compared to 2010.

4.5.3 Impact of PROSAB on crop management techniques

The result of the analysis on the impact of PROSAB on Crop Management techniques is in Table 42. It shows that more women (86%) indicated that PROSAB brought about improvement in crop management techniques than men (75%) and youth (67%). Overall, all groups indicated by 76% that PROSAB brought about improvement in the crop management practices in the project area than it was at project inception. This may have been so because most women were active participants than any other group. Also, although the youth participated in the project, however, the extent of participation was far below that of the women and men. This may have explained the reason for their rating of the impact of PROSAB on crop management techniques lowest. This may also be the explanation why the youth indicated that the impact of PROSAB on crop management techniques was worst than in 2004.

4.5.4 Impact of PROSAB on farmers' access to improved farm inputs

The result of the analysis of the impact of PROSAB on farmers' access to improved farm inputs is in Table 42. The results showed that 91% of men followed by 76% of women and 69% of youth indicated that PROSAB intervention enabled them to have greater access to improved farm inputs especially through the farm input dealers at Biu and other markets. On the other hand, more youth (30%) followed by women (14%) and men (7%) indicated that their farm input situation was not different from what it used to be.

On the average, only 2% of men, and 1% of women and youth respectively indicated that farmers' access to improved farm inputs decreased. Our finding in respect of access and use of farm inputs showed that relatively more PROSAB farmers (530) than non PROSAB farmers (355) had access and used improved farm inputs. Also, when the situation is compared between 2004 and 2010; that is before and after PROSAB, 32.1% of the farmers used improved seeds in 2010 compared to 11.2% in 2004. Similarly, 30.8% of PROSAB farmers used inorganic fertilizers in 2010 compared to 14.5% in 2004 and 30.0% of PROSAB farmers used agrochemicals in 2010 compared to 13.9% of the farmers in 2004.

4.5.5 Impact of PROSAB on crop production

The result of the analysis of the impact of PROSAB on crop production is in Table 42. The result showed that more men as indicated by 83% believed PROSAB impacted positively on crop production in the project area. This was followed by 81% of women and 79% of youth. 16% of the men indicated that the crop production position had not changed. Similarly, 14% of women and youth respectively believed that the crop situation did not change as a result of PROSAB intervention. Crop production was one of the most successful interventions achieved by the project. This was because most of the improved seeds and new farm technologies introduced in the project area bordered on crop production. This explains why 83% of men, 81% of women and 79% of youth indicated that the project intervention in crop production made an impact. More youth (7%) than women (5%) and men (1%) indicated that the impact of the project on crop production was less while more men (16%) than women (14%) and youth (14%) indicated that there was no difference in the crop production in 2010 when compared to 2004.

Table 42: Percentage Change of Perception by PROSAB Farmers on Agricultural Credit, Improved Seeds, Improved Farm Inputs and Food Production in 2010

	Impact (%)		
Group	**Increase**	**Decrease**	**Same**
Agric. Credit			
Men	30.0	30.0	40.0
Women	45.0	18.0	37.0
Youth	10.0	20.0	70.0
Improved Seeds			
Men	85.0	5.0	10.0
Women	83.0	3.0	14.0
Youth	71.0	14.0	15.0
Improved Farm Inputs			
Men	91.0	2.0	7.0
Women	76.0	0.0	14.0
Youth	69.0	1.0	30.0
Crop Production			
Men	83.0	1.0	16.0
Women	81.0	5.0	14.0
Youth	79.0	7.0	14.0
Mean	81.0	4.3	14.7

4.5.6 Impact of PROSAB on livestock production

The result of the analysis of the impact of PROSAB on livestock production is in Table 43. The result showed that more women as indicated by 88% believed the project impacted positively on livestock production. This was followed by 77% of youth and 70% of men. This finding may have been so because of the Goats and Sheep Share Scheme introduced for which the women were the direct beneficiaries. Overall, all groups (78.3%) indicated that the project impacted positively on livestock production in the project area. In addition, the youth had been involved in livestock management than the men. This might have been so because the youth i.e the young men were involved in providing feeds and medication to the animals than the women and the men. More youth (6%) than women (5%) and men (3%) indicated that the impact of the project when compared to 2004 the project did not make impact on livestock production. Similarly, fewer women (7%) than youth (17%) and men (27%) indicated that there was no difference in the impact of the project compared to 2004. In other words, the impact of the project on livestock production was similar to what it was in 2004. This could have been so because most men rather than women and youth did not participate in the livestock component of the project or that they were not impressed with the extent of the intervention to have created the kind of impact that could have impressed them.

Table 43: Percentage Change of Perception by PROSAB Farmers on Livestock Production in 2010

	Impact (%)		
Group	**Increase**	**Decrease**	**Same**
Men	70.0	3.0	27.0
Women	88.0	5.0	7.0
Youth	77.0	6.0	17.0
Mean	78.3	4.7	17.0

4.5.7 Impact of PROSAB on Agro-processing

The result of the analysis of the impact of PROSAB on agro-processing is in Table 44. More women (47%) indicated that the project had impacted positively on agro-processing in the project area. This was followed by 38% of youth and 25% of men. More men (65%) felt that the situation with respect to agro-processing did not change even after project intervention. The impact of the project on agro-processing was particularly low due probably to the inability of most households to procure any agro-processing equipment for use after they were exposed to this equipment by IITA agro-processing experts.

Agro-processing as important as it is did not receive the kind of priority it deserved because most of the farmers indicated that they could not afford the agro-processing equipments for which demonstration were carried out for them. They could not either purchase any of the equipment because they could not manage such equipment(s) as a group. Overall, the impact of the project was relatively low with respect to agro-processing. Youth (15%) as well as women (15%) indicated that the impact of the project on agro-processing had decreased compared to 10% of men. However, more men (65%) than youth (47%) and women (38%) indicated that there was no difference in the impact of the project compared to pre-project implementation in 2004.

4.5.8 Impact of PROSAB on soybean utilization

The result of the analysis on the impact of PROSAB on soybean utilization is in Table 44. It shows that more women as indicated by 90% of them felt that PROSAB had made an impact in the project area on soybean utilization. This is likely so because:

a) Soybean was relatively a new crop in the project area as it was introduced and made popular during project implementation. Most beneficiaries became impressed with the benefits arising from its different uses; and

b) Most women adopted this technology because they saw advantages like it being a source of income and also the fact that it had the capacity to improve the nutrition of their households etc.

This finding can be understood if viewed from the previous finding that women fully participated in this activity than men and youth. Most men and youth saw the activity as one which was meant for women which might have affected their participation. The low participation of the youth might have been due to the fact that the youth were only the young men as the young women were classified as part of the women group. More youth (7%) than men (6%) and women (2%) were of the view that the impact of PROSAB on soybean utilization was less than it was in 2004. More men (14%) than youth (13%) and women (8%) were of the view that there was no difference in the impact of the project on soybean utilization.

Table 44: Percentage Change of Perception by PROSAB FarmersPerception Change on Agro-Processing and Soybean Utilization

Group	Impact (%)		
	Increase	Decrease	Same
Agro-processing			
Men	25.0	10.0	65.0
Women	47.0	15.0	38.0
Youth	38.0	15.0	47.0
Soybean Utilization			
Men	80.0	6.0	14.0
Women	90.0	2.0	8.0
Youth	70.0	7.0	13.0
Mean	80.0	5.0	15.0

4.5.9 Impact of PROSAB on farmers' access to output dealers

The result of the analysis on the impact of PROSAB on farmers' access to output dealers is in Table 45.The result showed that more men as indicated by 75% of them were of the opinion that the project enhanced their access to output dealers. This was followed by 60% of the women and 42% of the youth. On the other hand, more youth (55%), followed by women (38%) and men (23%) indicated that their access to output dealers did not change with PROSAB intervention. A very negligible number of men and women (2%) respectively and youth (3%) indicated that PROSAB did not enhance their access to output dealers and as a result, their access to output dealers decreased. Access to output dealers was one of the major achievements of the project as the project introduced farmers to output dealers from outside the project area. These output dealers were supported by some of the farmers who served as output agents. However, the outreach in terms of the number of farmers who had access to output dealers was relatively low. That is, only few PROSAB farmers had their farm produce especially soybean and maize purchased by output dealers directly or by their agents.

However, those farmers who had access to output dealers received prices much higher than those who sold their farm produce in the open market in the project area. Some of the farmers indicated that they "preferred to sell to the output dealers because the output dealers gave them higher prices". Similarly, some others indicated that "sale to output dealers was more profitable because their prices were higher than in the local market".

4.5.10 Impact of PROSAB on asset ownership

The result of the analysis of the impact of PROSAB on assets ownership is in Table 45. The result showed that 75% of women followed by 68% of men and 64% of youth indicated that the project impacted positively on asset ownership in the project area. On the other hand, 34% of youth, 32% of men and 23% of women indicated that PROSAB intervention did not substantially changed the asset ownership among the project beneficiaries. The perception of women (75%) on asset ownership might have been highest because in addition to income from the crop based enterprises and livestock based enterprises which was high as found in the gross margin analysis, women also earned income through the sale of the soybean recipes they had commercialized such as soybean milk, cheese (awara), dadawa, pap (Kamu) and moimoi. The additional income was applied to purchase additional assets or repair/renovate assets. This explain why the double difference estimator may have been positive for cars/pickups and houses renovated/built suggesting that the project made an impact in asset ownership.

Only 2% of women and youth respectively indicated that a decrease in asset ownership in the project area was achieved. More youth (34%) than men (32%) and women (23%) indicated that there was no difference in the asset ownership in 2010 when compared to 2004.

4.5.11 Impact of PROSAB on farm income

The result of the analysis of the impact of PROSAB on the income of farmers in the project area is in Table 45. The result shows that more youth as indicated by 33% believed that there was no difference between farmers' farm incomes before and during the project. That is, the youth were of the view that the project did not impact positively on farmers' farm incomes. However, both the women and men groups did not share similar views as the youth as 89% of the men and 92% of the women felt the project impacted positively on farmers' farm incomes compared to 60% of the youth. This finding is supported by the finding that firstly, PROSAB farmers had higher gross margins than non-PROSAB farmers. Secondly, more women earned income through the commercialization of soybean recipes such as soybean cake, cheese, dadawa and soybean milk. Thirdly, both men and women more than youth earned a lot more income from other farm sources. This explains why fewer youth (7%), women (3%) and men (2%) were of the view that the impact of the project on farmers' incomes was low.

4.5.12 Impact of PROSAB on food security

The result of the analysis of the impact of PROSAB on food security is in Table 45. Ninety three (93) percent of men, followed by 88% of women and 72% of youth indicated that PROSAB intervention led to increased food security. 27% of the youth indicated that the food situation had not changed followed by 9% women and 5% men. Overall, all the groups on the average indicated that PROSAB intervention achieved food security. Increased food production led to increased food security. Increased food production was also experienced beyond the project area. Overall, most farmers were of the view that increased food security was achieved not only in the project area but throughout the state because of the increased agricultural production. Only an insignificant few for example 3% of women, 2% of men and 1% of youth) indicated that the impact of the project on food security was less while 27% of youth, 9% of women and 5% of men indicated that the food security status of households had not changed from project inception in 2004 when compared to 2010.

This finding is supported by earlier findings that the food insecurity status in the project area fell from 58% in 2004 to 42.8% in 2010. That is, the food security status of the project households increased from 42% to 57.2%. Similarly, the double difference estimators for soybean, maize and cowpea were positive and significant at 1%, 5% and 10% level of significance respectively.

Table 45: Percentage Change of Perception by PROSAB Farmers on Farmers' Access to Output Dealers, Asset Ownership, Farm Income and Food Security

	Impact (%)		
Group	**Increase**	**Decrease**	**Same**
Output Dealers			
Men	75.0	2.0	23.0
Women	60.0	2.0	38.0
Youth	42.0	3.0	55.0
Asset Ownership			
Men	68.0	0.0	32.0
Women	75.0	2.0	23.0
Youth	64.0	2.0	34.0
Farm Income			
Men	89.0	2.0	9.0
Women	92.0	3.0	5.0
Youth	60.0	7.0	33.0
Food Security			
Men	93.0	2.0	5.0
Women	88.0	3.0	9.0
Youth	72.0	1.0	27.0
Mean	84.0	2.0	13.7

4.5.13 PROSAB households rating of how the project improved their wellbeing

This section is aimed at estimating how PROSAB households' wellbeing was improved as a result of the intervention.

The result of the analysis of PROSAB households rating of how the project improved their wellbeing is in Table 46. This finding shows how PROSAB farmers rated how their participation in the project had improved their wellbeing. Most farmers rated their ability to pay school fees of their children easily highest (22.3%). This was followed by their ability to buy inorganic fertilizer and agrochemicals (20.5%), build new houses or renovated their houses (16.3%). Based on the ranking in the improvement of the wellbeing of PROSAB households, the least perceived benefit or improvement in their wellbeing was the ability to marry an additional wife or wives. This was closely followed by other benefits they achieved which were ranked 9^{th}.

The basis of such ranking can be easily understood if we realize that most PROSAB farmers received increased farm incomes especially for those who cultivated maize, soybean and cowpea. It is likely that the increased incomes were used to pay children school fees, buy more inorganic fertilizer and agrochemicals, bought motor cycles, pickups and so on.

Table 46: PROSAB Farmers' Perception of How their Wellbeing Was Improved through their Participation in the Project.

	PROSAB Farmers		
Improvement in wellbeing	**Frequency**	**Percent**	**Rank**
Bought more land for farming	30	6.5	7th
Bought animals for rearing	54	11.6	5th
Bought a motorcycle/car/pickup van	57	12.2	4th
Build/renovated his/her house	76	16.3	3rd
Was able to pay children's school fees easily	104	22.3	1st
Bought furniture for use in the house	33	7.1	6th
Married another wife	15	3.2	8th
Bought fertilizer and agro-chemicals	96	20.5	2nd
Others	2	0.4	9th
Total	**467**	**100.0**	

Chapter 5

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Introduction

The aim in this chapter is to summarize the study, draw conclusion and make recommendations.

5.1 Summary

The main objective of the study is to evaluate the impact of Promoting Sustainable Agriculture in Southern Borno (PROSAB) State on food security, farm income and rural livelihood of households. To achieve this, three out of the four LGAs in the project area namely: Biu, Hawul and Kwaya Kusar were selected at random. Four project communities were selected each from Biu LGA and Hawul LGA at random while one project community was selected at random in Kwaya Kusar LGA. In each of the nine project communities, 20 farmers were selected at random to give equal opportunity to every member of the community. In order to cover the non project area, two adjacent LGAs namely: Bayo and Shani were selected. In each of the two LGAs, four communities/villages were selected at random. Due to the relative sizes of the communities; 25 households were selected at random in two of these and 20 households in the other two communities in each of the two LGAs.

Data was collected using a structured questionnaire (Appendix I) administered to 180 households in the project area and 180 households as non-PROSAB farmers. In addition, Focus Group Discussions were held men, women and youth groups in two different project communities each in Biu and Hawul LGAs and one in Kwaya Kusar LGA. Data was collected among the three groups using a separate questionnaire (Appendix II). Descriptive statistics, Logit regression analysis, gross margin analysis, Double Different Estimator, Consumer Price Index Computation and Focus Group Discussion were used to analyze the data.

The results of the socio-economic characteristics we found that nearly 71% of PROSAB farmers were of the male gender as against 85.6% of the non-PROSAB farmers. The mean age among PROSAB farmers was 45.4% years and 42.1 years among non-PROSAB farmers. The mean farming experience was found to be 23years among PROSAB farmers and 20years among non-PROSAB farmers. The mean family size was 7 among PROSAB and non-PROSAB farmers respectively.

The predominant land ownership tenure among PROSAB and non-PROSAB farmers was family land, the mean farm size was 2.8Ha among PROSAB farmers and 1.3Ha among non-PROSAB farmers, the major farm enterprise was staple food crops among both PROSAB and non -ROSAB farmers, maize was the major crop followed by soybean among both PROSAB and non-PROSAB farmers.

The mean off farm income was ₦87,896.75 for PROSAB farmers and ₦29,373.62 for non-PROSAB farmers. Bank of Agricultural (formerly NACRDB Ltd) was the major source of agricultural credit and also provided the highest mean loan value of ₦124,000 for PROSAB farmers and ₦100,000 for non-PROSAB farmers. The major problem experienced among PROSAB and non-PROSAB farmers was delay in obtaining credit.

The major source of food was own production among PROSAB farmers and also among non-PROSAB farmers. In 2010, PROSAB farmers experienced food crisis for 26.8 days while it was 32.1 days among non-PROSAB farmers. The severity of food shortage was highest in July – September among PROSAB farmers and January – March among non-PROSAB farmers. The main cause of food shortage was inadequate storage facilities among PROSAB farmers and non-PROSAB farmers respectively. Buying from the market was the main strategy adopted by PROSAB farmers and non-PROSAB farmers as a means to cope with food shortages in 2010.

Our findings on food security status of households showed that among PROSAB farmers, 103 households were food secure (57.2%) while 77 households (42.8%) were food insecure while among non-PROSAB farmers, 64 households (35.6%) were food secure while 116 households (64.4%) were food insecure. The food security index was 1.43 among PROSAB households and 1.10 among non-PROSAB households.

The result of the Logit regression analysis showed that the determinants of food security were found to be gender, age, years of farming experience, use of modern farm inputs, number of extension visits and membership of a cooperative society. Gender, years of farming experience, number of extension visits and membership of a cooperative society had a positive coefficient while age and use of modern farm inputs had negative coefficients. Five determinants in the model, were found to be significant at 1% while one i.e number of extension visits made was significant at 5%.

The mean Double Difference Estimator was found to be positive for maize, soybean, cowpea, sheep, goats, cars/pickups and houses renovated/built. The Double Difference Estimator was found to be negative for cattle and land. A positive mean suggest impact.

The gross margin for crop based enterprises was found to be ₦111,495.63 for PROSAB farmers and ₦88,006.96 for non-PROSAB farmers. The average return per naira outlay was ₦1.94 and ₦1.82 for PROSAB and non-PROSAB farmers respectively. The gross margin for livestock based enterprises was ₦81,108.89 among PROSAB farmers and ₦91,736.76 for non-PROSAB farmers while average return per naira outlay was found to be ₦22.38 among PROSAB farmers and ₦23.24 among non-PROSAB farmers.

Farmers faced a number of constraints. These constraints include inadequate fertilizer, inadequate extension visits, poor access to agricultural credit which were ranked highest among PROSAB farmers while inadequate extension visits, inadequate fertilizer and inadequate agrochemicals were also ranked highest among non-PROSAB farmers.
These issues pose very serious sustainability challenges to the project benefits to the farmers in the project area.

The Focused Group Discussions (FGDs) among women, men and youth farmer groups showed that the project impacted positively on the farmers which have increased the chances of the project being sustained over time. Similarly, PROSAB farmers indicated that their wellbeing was improved as a result of the intervention of PROSAB. They ranked ability to pay their children's fees at school easily first followed by their ability to purchase inorganic fertilizer and agrochemicals for their farm work etc.

5.2 Conclusion

Empirically, the PROSAB project impacted positively on the project beneficiaries (PROSAB farmers) most especially in crop production and household assets ownership.

Similarly, PROSAB farmers had more food secure households than non-PROSAB farmers. In addition, PROSAB farmers had higher gross margin in crop based enterprises than in the livestock based enterprises while non-PROSAB farmers had higher gross margin in livestock based enterprises than in crop based enterprises.

Reduced extension visits, the continuous loss of vigor by improved seeds, the non patronage by output dealers and absence of market information, continuous absence of agricultural credit and the delay in providing same, the absence of functional farmer groups and the lack of government buy-in of the project pose a very serious sustainability challenge to the project benefits.

Overall it can be inferred that the goal of the intervention which was to improve the food security, farm income and livelihoods of rural communities in southern Borno State was achieved by and large through the implementation of the PROSAB in the project area of southern Borno State.

5.3 Contribution to Knowledge

The study has been able to contribute to existing knowledge in the following ways:

1. The project created an impact as a result of the increased number of households that were found to be food secure, achieved positive mean incomes and higher gross margins.
2. The farm constraints experienced by farmers in 2004 were solved at the end of project implementation in 2009.

5.4 Recommendations

Based on the findings of this study, we would like to make the following recommendations:

1. Since education has direct impact on occupation and enhances the learning capacity of individuals and hence food security, farm income and livelihoods, more attention should be placed on the conventional western education of households in both the project area and non project area.
2. In view of the fact that access and use of farm credit was found to be quite inadequate; inadequate linkages to output dealers and input dealers, farmers in the project and non project areas should establish functional community based organizations to handle such issues.
3. The commercialization of the knowledge gained on some of the soybean recipes like cheese, soybean cake, dadawa (local seasoning), soybean milk and ‘tom-brown’ should be encouraged as this has great potentials to improve food security, household income and the livelihoods of the women not only in the project area but also in the non project area.

REFERENCES

Adato, M and R. Meinzen–Dick (2002). Assessing The Impact of Agricultural Research on Poverty Using The Sustainable Livelihoods Framework. Food Consumption and Nutrition Division Discussion Paper No. 128 and Environment Paper No. 89. International Food Policy Research Institute, Washington, DC, USA.

Adebayo, O.O (2011). The Impact of the United Nation Development Programmes' (UNDP) Micro Credit Scheme on the Food Security Status of Farm Households, Kaduna State. A Ph.D Agricultural Economics Thesis, Ahmadu Bello University, Zaria, Nigeria.

Adubi, A.A. (1992). An Empirical Analysis of Production Risks and Attitudes of Small Farmers in Oyo State, Nigeria. Ph.D Thesis, University of Ibadan, Nigeria. K.P.

Afrifalo,S.F.and Ayilaran,C.I.(2011).Economic Analysis of the Effecte of Micro-credit Scheme Among Members of Farmers Development Union in Oyo State,Nigeria.Pages 213-221.Edited by Odedina,S.A,Osuntade,O.B.,Adebayo,K,Awodu,M.O. and Fapohunda,O.O. Proceedings of Farm Management of Nigeria(FAMAN) Conference(Akure 2011) Held at the Federal College of Agriculture,Akure,Nigeria 5th-8th September,2011.

Aigbokhan,B.C.(2001).Resuscitating Agricultural Production for Export:A paper presented at the 10th Conference of Zonal Research of Nigeria on the Resource Endowment,Growth and Macro-economic Management in Nigeria held in Owerri. June.130 pp.

Ala, A.L.; Musa, I.M.; and Mohammed, I. (2010). Credit Administration Acquisition and Utilization Among Crop Farmers in Zamfara State, Nigeria in Proceedings of the 24th National Conference of Farm Management of Nigeria, Mubi, Nigeria. 11th – 14th October, 2010. Pp. 334 – 337. Edited by Neils, J.S.; Khobe, D,; Ja'afar-Furo, M.R.; and Futuless, K.N.

Alene, A.D, V.M. Manyong, J. Gockowsky, O. Coulibaly, and S. Abele (2004). A Framework for Conceptualizing Impact Assessment and Promoting Impact Culture in Agricultural Research.

Amaza, P.S (2000). Resource-use Efficiency in Food Crop Production in Gombe State, Nigeria. Ph.D Thesis, Department of Agricultural Economics, University of Ibadan.

Amaza, P.S. (2006). Food consumption pattern in Borno State, Nigeria. International Institute for Tropical Agriculture, Ibadan, Nigeria. October 2006.

Amaza, P.S, J.K. Olayemi, A.O Adejobi, Y. Billa and A. Iheanacho (2004). Baseline Socioeconomic Survey Report: Agriculture in Borno State, Nigeria.

Amaza, P.S., Olayemi A.O.; Bila; and Iheanacho, S. (2007). Baseline Socioeconomic Survey Report: Agriculture in Borno State, Nigeria. International Institute for Tropical Agriculture, Ibadan, Nigeria 84pp.

Amaza, P,T. Abdoulaye, P. Kwaghe and A. Tegbasu (2009). Changes in Household Food Security and Poverty Status in PROSAB Area of Southern Borno State, Nigeria. International Institute for Tropical Agriculture/Canadian International Development Agency .

Avery,S.(2011).Types of Rural Livelihood System.http://www.ehow.com

Awotide, D.O.; Aderinto, A.; and Ogunwale, B. (2011). Food Insecurity and Coping Strategies Among Peri-Urban Farming Households in Iwo LGA of Osun State, Nigeria in the Proceedings of the 25th Farm Management Association of Nigeria (FAMAN) Conference (Akure 2011), held at the Federal College of Agriculture, Akure. 5th – 8th September, 2011. Pp. 154 – 159

Babatunde, R.O; Omotosho,O.A. and Sholotan,O.S (2007). Socio-Economic Characteristics and Food Security Status of Farming Households in Kwara State, North Central Nigeria. Pakistan Journal of Nutrition 6(1): 49-58.

Baker, J. (2000). Evaluating the Impact of Development Projects on Poverty: A Handbook for Practitioners. Directions in Development, World Bank, Washington, D.C. 20pp

Barney C. and William J.H (1994). Demographical Behaviour and poverty: Micro-level Evidence from Southern-Sudan. World Development 22 (7) pp 1031-1044.

Barres, A.J.D., and Hirakata, V.N. (2003). Alternatives for Logistic regression in cross Sectional Studies: An Empirical Comparison of Models that Directly Estimate the Prevalence Ratio. http://www.biomedcentral.com/1471 - 2288/3/21.

Bender, W. and Hunt, S. (1991). Poverty and Food Insecurity in Luanda. Food Studies Group Working Paper No.1, University of Oxford, London.

Casley, D.J. and Lury D.A, (1985) Monitoring and Evaluation of Agriculture and Rural Development Projects. A World Bank Publication. The Hopkins University Press, Baltimore, Maryland, USA.

Central Bank Nigeria (2011[a]). Annual Report, Abuja, Nigeria. 31st December, 2011 pp. 120 – 127

Central Bank Nigeria (2011[b]). Statistical Bulletin, Abuja, Nigeria. (22) December, 2011 pp. 97 -170

Chamber,R.(2008).Sustainable Rural Livelihood. Washington D.C. McMilan Press.

Chen, S.; Ren, M.; and Martin, R. (2006). Are There Lasting Impact of Aid to Poor Areas. Evidence from Rural China Development Research Group, World Bank Policy Working Paper 4084, December, 2006. Pp.12 – 23.

Canadian International Development Agency (2003). Promoting Sustainable Rural Development Through Agriculture: Canada Making a Difference in the World. PP. 8-18.

Canadian International Development Agency (2006). Mid-term Evaluation (Final Report) of Promoting Sustainable Agriculture in Borno State (PROSAB). June 2006 pp.48

Daris, J.R. (2008). The Rural Non-Farm Economy and Livelihood. Development and Comprehensive System “0510016 Econ WPA”.

De Janvry, A. and Sadoulet, E. (2002). World Poverty and the Role of Agricultural Technology: Direct and Indirect Effects. Journal of Development Studies 38(4): 1-26.

Dercon,S.and Krishnan,P.(1996).” Income Portfolio in Rural Ethiopia and Tanzania:Choices and Constraints”. *Journal of Development Studies* 32(6)

Department For International Development (1997). The UK White Paper on International Development-and Beyond. London, UK.

Diouf, J. (1997). Investing in Food Security. Proceedings of Food and Agricultural Organization Conference held in Rome, 4th – 6th March, pp.6 – 8.

European Evaluation Society (EES) (2007). EES Statement: The Importance of a Methodologically Diverse approach to Impact Evaluation-Specifically with Respect to Development Aid and Development Interventions. EES Secretariat. BB Nijkerk, The Netherlands.

Effiong, J.B and Etim, D.O. (2012). Concept of Rural livelihood and Food Security for Growth and Development in Nigeria in Proceedings of 26th Annual Conference of Farm Management Association of Nigeria, October 15th – 19th, 2012 pp.287 – 290.

Ellis, F. (1998). Sustainable Livelihoods Guidance Sheets, London: DFID

Ellis,F.(2000). *Rural Livelihoods and Diversity in Developing Countries*. Oxford University Press,Oxford,UK.

Ellis-Jones and Amaza, P.S. (2007). An Adoption and Impact Assessment of PROSAB Activities over Three Cropping Seasons (2004 – 2006). Promoting Sustainable Agriculture in Borno State (PROSAB). PP.42.

En.wikipedia.org/wiki/randomized-controlled Trial. Accessed 07th April, 2014 at 9.20pm.

Falake, S., R.L Kilmer, and N. Gladwin (2003). Determinants of Food Security in Southern Ethiopia. A Selected Paper Presented at the 2003 American Agricultural Economics Association Meeting in Montréal, Canada.

Falusi, A.O. (1985). Socio-economic Factors Influencing Food Nutrient Consumption of Urban and Rural Households (A Study of Ondo State of Nigeria). Nigeria Journal of Nutritional Sciences 6 (2). 52 Federal Agriculture Coordinating Unit (1992). Sustainability of the Unified Agriculture Extension System in ADPs. National M & E Seminar, APMEU (Kaduna) 28th – 29th October, 1992.

Food and Agriculture Organization (1996). World Food Summit: Draft Rome Declaration on World Food Security, Rome, August 2nd, 1996. Para 3

Food and Agriculture Organization (2007). Food Security Assessment (Document WFS 96/Tech/7), Rome, 1996 Pp.5

Frank, H. and S.C. Althoen, (1994). Statistics, Concept and Application PP. 439-440.

Folorunso, S.T., (2009). Socio-economic Analysis of the Effect of World Bank Root and Tuber Expansion Programme on Productivity and Poverty Alleviation of Farmers in Plateau State, Nigeria. An M.Sc Agric. Economics Research Proposal Presented at the Dept. of Agric. Economics & Rural Sociology, Ahmadu Bello University, Zaria, Nigeria. on 25th November, 2009.

Gohl,B.(1981).Tropical Feeds:Feed Information Summaries and Furtive Values. Pages485-489 in FAO Animal Production & Health Series,No.12 FAO,Rome,Italy.

Green,D.A.G.and Ng’ong’ola,D.A.(1993).Factors Affecting Fertilizer Adoption in Less Developed Countries: An Application of Multivariate Logistic Analysis in Malawi. *Journal of Agricultural Economics*44(1):611-625.

Grosskurth, H.; Mosha, F.; and Todd, J. (1995). Impact of improved treatment of sexually transmitted Diseases on HIV Infection in Rural Tanzania: Randomized Controlled Trial. *Lancet* 346:530 – 536.

Gujarati, D.N. and Sangeetha (2007). *BasicEcoonometris.* Tata McGraw-Hill Publishing Company Ltd. New Delhi. Special Indian Edition – Forth Edition. Pp.608-620.

Haggblade, S. and Hazell, P.B.R. (1989). Agricultural Technology and Farm/Non-Farm Growth Linkages. *Agricultural Economics*, 3:345 – 364

Hartmann, A.B. (2004). An approach to Hunger and Poverty Reduction for Sub-Saharan Africa. IITA Ibadan, Nigeria.

Hassan, R.M and Babu, S.C (1991). Measurement and Determinants of Rural Poverty: Household Consumption Patterns and Food Poverty in Rural Sudan. Food policy. Vol.1b, No.6, December, 1991.

Headslip, J.; Shannon, D.; and Casement, D. (2013). *Farm Gross Margin and Guide.* A Gross Margin Template for Crop and Livestock Enterprises.

Hewitt, C. and Togerson, D. (2009). Randomization: What is it and how to do it. In Domanski, M., McKinlay, S., editors. Successful Randomized Trials. Chapter 3. Wolters Kluwes Philadelphia, PA, USA: 2009 p.27.

Imonikhe, G.A. (2004). Impact of Katsina State Agricultural and Community Development Project On Income and Productivity of Farmers. Ph.D Thesis, Ahmadu Bello University, Zaria, Nigeria. Pp.59.

Iornhamen, T.R.; Akande, O.R.; and Tsue, P.T. (2010). Empirical Analysis of Food Security Situation Among Urban households in Benue State, Nigeria in Proceedings of the 24th Nationa Conference of Farm Management Association of Nigeria, Mubi, Nigeria 11th – 14th October, 2010 pp203 – 207, edited by Neils, J.S.; Khobe, D.; Ja'afar-Furo, M.R.; and Fatuless, K.N.

Kalirajan, and Shad, R.T. (1985). Types of Education and Agricultural Productivity: A Quantitative Analysis of Tamil Nadu Rice Farming. *Journal of Development Studies* 21: 232 – 243.

Keer, J. and S. Kolavalli (1999). Impact of Agricultural Research on Poverty: A Conceptual Framework with Instruction from the Literature. Environment and Production Technology Division Discussion paper No. 56. International Food Policy Research Institute, Washington, DC, USA.

Khandker, S.R; Koolwal, G.B., and Samad, H.A. (2010). Handbook on Impact Evaluation: Quantitative Methods and Practices. The World Bank, Washington, D.C.

Kwaghe, P.V. (2006). Poverty profile and its Determinants among Farming Households in Borno State, Nigeria. Unpublished PhD thesis. Dept of Agricultural Economics, University of Maiduguri.

Lawal, A.M. (2006). Issues of Food Security among Rural Households in Kwara State. Unpublished PhD Pre-field Seminar Paper. Dept of Agric. Economics and Farm Management, Faculty of Agriculture, University of Ilorin, Ilorin, Nigeria.

Makinde, O.K (2001). Determinants of Food Security in Bauchi Area of Northern Guinea Savanna of Nigeria. Unpublished PhD thesis, University of Ibadan, Nigeria.

Manza, E.A.G. (1988). An Evaluation of the Performance of Kaduna State Agricultural Development. Project 1985-1987: A Case Study of Zone IV. M.Sc Agric Economics thesis, Ahmadu Bello Univeristy, Zaria, Nigeria.

Maredia,M.Byerlee,D.,and Anderson,J.(2003)Ex-Post Evaluation of Economic Impacts of Agricultural ResearchProgramme. A Tour of Good Practice. Paper presented at the Workshop on the Future of Impact Assessment in CGIAR: Needs Constraints and Options,Standing Panel on Impact Assessment of the Technical Advisory Committee.May 3-5. Rome,Italy.Pp.12-16.

Morgan, P.E. (1985). Social Impact Analysis and the Dynamics of Advocacy in Development Assistance. Pp.21-31 in Social Impact Analysis and Development Planning in the Third World, edited by W. Derman and S. Whiteford. Westview Press. Social Impact Assessment series No.12, Boulder, Colorado, USA.

Musa,J.D.(2006).*Effect of Irrigation Practices on the Rural Life*. Dobby Publishers,Lagos,Nigeria.Pp.122-136.

Musa, R.S. (2009). Impact of Fadama II Development Project on the Income of Benefited Marginalized and Vulnerable Groups in Kaduna State. PhD Agricultural Economics Thesis. Department of Agric Economics & R.S., Faculty of Agriculture; ABU, Zaria.

Nasai, D.H. (2008). Factors Influencing Livelihood Diversification among Rural Farmers in Giwa LGA of Kaduna State. M.Sc Agric Extension and Rural Sociology Thesis. Dept of Agric. Economics & R.S., ABU, Zaria.

Nasiru, M.; Haruna, U.; and Halilu, R. (2011). The Role of Women Farmers in Attaining Sustainable Food Security in Tafawa Balewa Area of Bauchi State, Nigeria in The Proceedings of the 25th Farm Management association of Nigeria (FAMAN) Conference. Held 5th – 8th September, 2011. Pp.298 -305.

National Population Commission(2006).National Population Census 2006.

Nkonya, E. and Davis, K. (2008). The Statistical Challenges of Attributing Impacts of Demand – Driven Advisory service Programmes and Farmer Field Schools in Africa. International Food Research Institute.

Nkonya, E; Philip, D; Mongues, T; Pender, J; Yahaya, M; Adebowale, G.J and Arokoyo, T (2008). Impact of a pro-poor Community-driven Development Project in Nigeria. A Report Submitted to International Food Policy Research Institute on Sustainable Solutions for Ending Hunger and Poverty. March, 2008. Pp 10-36.

Nwauwa, L.O.E.; Ogunyika, A.I.; and Akintunde, K.O. (2011). Market Participation of Small-Scale Maize Farmers in Osun State, Nigeria. Application of Household Commercialization Index. In the Proceedings of the 25th Farm management

Association of Nigeria (FAMAN) Conference. Held 5th – 8th September, 2011. Pp.325 – 335.

Oakley, P. (1983). The Monitoring and Evaluation of Participation in Rural Development. Food and Agriculture Organization of the United Nations. Rome, November 1983, P.52.

Obamiso, E.O.W., Doppler and P.M. Kormawa, (2003). "Pillars of Food Security in Rural Areas of Nigeria". Food Africa Forum 31st March-11th April. http;//food Africa. nig. Org. Accessed on the 10th May, 2010.

Obiechina, M.E. (2007). Improving the Agricultural Sector toward Economic Development and Poverty Reduction in Nigeria in Bullion, Vol. 31 No.4 October – December, 2007. Pp.66 – 88.

OECD (1988). Sustainability in Development Programmes: "Compedium of Donor Experience", Expert Group on Aid Evaluation of OECD Development Assistance Committee (DAC), Paris, June 1988. 57pp. English

Oguntona, E.B. and Akinyele, I.O. (1995). Nutrients Composition of Commonly Eaten Foods in Nigeria – Raw, Processed and Prepared. Food Basket Foundation Series.

Olukosi, J.O and Erhabor, P.O (2004). Introduction to Farm Management Economics. Principles and Application. Agitab Publicshers, Zaria. 114pp.

Olayemi, J.K. (1998). Food Security in Nigeria. Research Report No.2. Development Policy Centre, Kaduna, Nigeria. 85pp.

Omonona, B.T. and Agoi, G. (2007). An analysis of food security situation among Nigeria Urban households: Evidence from Lagos State, Nigeria. Journal of Central European Agriculture 8(3).

Omotosho, O.A., M.O. Adewumi, A. Mohammad-Lawal and O.E. Ayinde (2006). Determinants of Food Security Among Rural Farming Households.

Osinubi, T.S. (2003). "Macroeconomic Policies and Proper Growth in Nigeria." Proceedings of Conference on Inequality & Human wellbeing. Wider Helsinki, Finland 30-31 May.

Panwal,E.F. and Patrobas, N.B.G.(2011). Agricultural Development Policies in Nigeria: The implementation Strategies and Problems. Pages190-194. Edited by Odedina, S.A., Osuntade, O.B., Adebayo, K.,A.O. and Fapohunda, O.O. Proceedings of the 25th Farm Management Association of Nigeria(FAMAN) Conference (Akure 2011) Held at the Federal College of Agriculture, Akure, Nigeria. 5th-8th September.

Promoting Sustainable Agriculture in Southern Borno State (2004). Baseline Socio-Economic Survey Report of Agriculture in Borno State. November, 2004.

Promoting Sustainable Agriculture in Southern Borno State (2005). Report of visit by Jim Ellis-Jones October 23 to November 2005.

Promoting Sustainable Agriculture in Southern Borno State (2006). Annual Report. April 2005-March 2006.

Ravallion,M.(2001).The Mystery of the Vanishing Benefits:An Introduction to Impact Evaluation. *The World Bank Economic Review.*Vol.15,No.1 115-140.

Ravallion, M. (2003). Making Impact Evaluations More Useful. Development Research Group, World Bank, Washington DC, USA.

Ravallion, M (2005). Evaluating Anti-Poverty Programs. Development Research Group, World Bank Forthcoming in Handbook of Development Economics Vol.4.

Rena, R. (2002). Eritean Agriculture: Prospects and Challenges. Eritea. New Africa Press

Robson, M. (2010). United Nations Food and Agriculture Organization: Statistics in Sustainable Crop Production Intensification. FAO Rome.

Rougoor, C.W.; Ruud, G.T.; Huime, B.M.; and Renkema, J.A. (1998). How to Define and Study Farmers' Management Capacity: Theory and Use in Agricultural Economics. *Agricultural Economics* 18: 261 – 272

Rusike, J., N.M. Mahungu, S. Jumbo, (2008). Estimating Impact of Cassava Research for Development Program on Productivity, Uptake and Food Security in Malawi.

Sanginga, P.C, A.A. Adesina, V.M. Manyong, O. Otite, and K.E. Dashiell (1999). Social Impact of Soybean in Nigeria's Southern Guinea Savanna.

Sani, M. H. (2010). Priorities and Challenges of Agricultural Food Security in Nigeria in Proceedings of the 24th Annual National Conference of Farm Management Association of Nigeria, 11th – 14thOctober, 2010 pp.237 – 241.

Sen, A.K. (1982). Poverty and famines: An essay on Entitlement and Deprivation, New York: Clarendon Press, 1982.

Siamawalla, A. and Valdes, A. (1994). Food security in developing countries: International Issues IFPRI Washington DC.

Simonyan, J.B. (2009). An Impact Assessment of Fadama II Project on Income and Productivity of Beneficiary Farmers in Kaduna State. Ph.D Thesis, Department of Agricultural Economics and Rural Sociology, ABU, Zaria.

Stefanou, S.E. and Sexena, S. (1988). Education, Experience and Allocative Efficiency: A Dual Approach. *American Journal of Agricultural Economics* 70: 338 – 345.

Suchman, E.A. (1967). Evaluative Research: Principles and Practice in Public Service and Social Action Programmes. Russel Sage Foundation, New York. Pp. 73

United Nations Development Programme (1989). Evaluation: Report of the Administrator. UNDP document DP/1987/21. March 1987. Pp7-10

United States Department of Agriculture (2009). Food Security Resources, United States Department of Agriculture & Food and Nutrition Service. Washington D.C, USA. On line at **http://www.fns.usd.gov./fsec/**

Valentine,T.(1993).”Drought, Transfer Entilments and Income Distribution”. The Bostwan Experience. *World Development* 21(1).

Venner,D. and Venner,M.(2005).Economic Impact of Professional Training in the Informal Sector:The Case of the Labour Force Training Programme in Cote Dvoire. *World Bank Policy Research Working Paper* 3625,July 2005.pp.5-14.

Wikipedia on Farm income accessed on 4/03/2014 at 2.59pm.

Wikipedia (2013[a]). Consumer Price Index – Frequently asked Questions (FAQS). Accessed on 23/1/2013 at 3.56pm.

Wikipedia (2013[b]). Consumer Price Index – Frequently asked Questions (FAQS). Accessed on 23/1/2013 at 4.58pm.

Wikipedia (2013[c]). Consumer Price Index – Frequently asked Questions (FAQS). Accessed on 23/1/2013 at 5.53m.

Wikipedia (2014[a]). PPA 696 Research Methods. Accessed on the 11/04/2014 at 12.00pm.

Wikipedia (2014[b]). Econometrics. Accessed on the 11/04/2014 at 12.43pm.

World Bank (1986). Poverty and Hunger: Issues and Options for Food Security in Developing Countries. World Bank Policy Study, Washington DC, USA. Pp.1-6

World Bank (1994). Agriculture for Development. World Development Report 1995. Washington D.C World Bank

World Bank(1996).Nigeria’s Poverty in the Midst of Plenty: The Challenge of Growth with Inclusion. Report Number 147333 .UNI. The World Bank, Washington D.C.USA.

World Bank (2001). Nigeria: Strategy for Food and Nutrition Security. World Bank Document Report No.9040 – UNI

World Bank (2006). Nigeria: Strategy for Food and Nutrition Security. World Bank Document Report No.9040 – UNI

Yahaya, A.U., (2009). Analysis of Food and Nutrition Security among Rural Households in Soba LGA of Kaduna State, Nigeria. Unpublished M.Sc Agricultural Economics Thesis, Department of Agricultural Economics & R.S., ABU, Zaria.

APPENDIX I: FARMER QUESTIONAIRE

A. Background information on the household head

A1. Name: A2. Village:

A3. LGA: A4. Date of interview:

A5. What is your highest educational qualification?

1) None	( )	2) Quaranic	( )
3) Adult Education	( )	4) Primary Certificate	( )
5) SSCE/GCE/Grade II	( )	6) OND/NCE	( )
7) Nursing	( )	8) University Degree	( )
9) HND	( )	10) Master’s Degree	( )
11) Ph.D.	( )	12) Others ………………….	

B. Demographic characteristics of the household head

B1. Sex (1) Male ( ) (2) Female ( )

B2. Age in years:---

B3. Marital status: (1) Married ( ) (2) Single ( )

B4. If single, tick the one that best describes your condition

1) Divorced	( )	2) Widowed	( )
3) Separated	( )	4) Single parent	( )

5) Others, specify: ………………………………………………………...

B5. How many are members of your household?

B6. Give the following information on members of your household.

Name	Age (in years)	Sex (1=male, 2= female)

C. Social Factors

C1. How long have you been farming? Years

C2. Did an extension staff visit you last growing season i.e 2010 …advice?

1) Yes ( ) 2) No ( )

C3. If yes , how regular were these visits?

1) Weekly ( ) 2) Monthly ( )

3) Quarterly ( ) 4) Yearly ( )

How many times were these visits in a week?

C4. If yes, how many times were these visits in a week?

Times a week	Times a month	Times a quarter	Times a year

C5. Do you belong to any cooperative society?

1) Yes ( ) 2) No ( )

C6. If yes, what is the name of the cooperative society?

C7. If yes, what benefits did you derive from your membership of the cooperative society?

S/No	Cooperative society benefits	Benefit? (1/0)
1	None	
2	To have prompt access to farm inputs	
3	To be able to sell produce with good prices	
4	To obtain loan/credit	
5	To be able to process farm produce with minimum cost	
6		

C8. If No, why?

C9. Do you belong to any other group?

1) Yes ( ) 2) No ( )

S/No	Other group membership	Membership? (1/0)
1	Fadama user Association	
2	Livestock farmers group	
3	Processors	
4	Marketers	
5		

C10. What was your purpose for joining the group?

S/No	Purpose for group membership	Membership? (1/0)
1	To have prompt access to farm inputs	
2	To be able to sell produce with good prices	
3	To obtain loan/credit	
4	To be able to process farm produce with minimum cost	
5		

C11. If No, why

D. **Health – Related Factors**

First place of contact when sick

D1. If anybody in your household is sick, do you first contact for a solution?

S/No	Places of contact when sick	Contact? (1/0)
1	Clinic/Hospital	
2	Dispensary	
3	Native doctor/traditional healer	
4	Spiritualist	
5	Patent medicine store	

E. **Economic Factor**

Primary and Secondary occupations

E1. What is your primary and secondary occupation as? …

S/No	Occupation	Primary (1/0)	Secondary (1/0)
1	None		
2	Farming		
3	Government salaried job		
4	Private salaried job		
5	Crafts and artisans		
6	Trading		
7			

E2. How much did you earn per week in 2010 from your…

Week	Month	Quarter	Annum

E3. Are there other working members?

1) Yes ( ) 2) No ( )

E4. If yes, how much did your household earned from…

S/No	Income source	Amount in Naira per week or per month or per quarter or per year
1	Self-employment (trading, tailoring, carpentry, crafts etc	
2	Government employment (salary)	
3	Private employment (salary)	
4	Money earned from interest n capital lent out and rent on etc	
5	Remittances (money sent by children & relatives)	

E5. How many enterprises is your household into?

S/No	Household enterprises	Enterprises (1/0)
1	Sample food crops	
2	Livestock	
3	Cash crops	
4	Tree crops	
5		

E6. How many plots of land do you have?

Plot No.	Size of plot (Ha)	Crop combination(s)	How it was acquired	If purchased or rents amount (N)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

1. = Inherited 2. = Purchased 3. = Gift 4. = Rented 5.= Community land

E7. What was the average crop output last season i.e 2010?

Cropping system	Crops	Output (kg)	Quantity sold (kg)	Quantity given out (kg)	Quantity reserved for planting (kg)	Quantity consumed (kg)
A. Sole crops						
1.						
2.						
3.						
4.						
5.						
B. Mixed crops						
6.						
7.						
8.						
9.						
10.						
11.						

E8. Do you work off-farm? 1) Yes ( ) 2) No ( )

E9. If yes, what type of activities do you engage in during this off-farm time?

S/No	Off-farm season activities	Activities (1/0)
1	Achaba (motor cycle operator)	
2	Trading	
3	Milling machine operator	
4	Hunting	
5	Artisan/Tailoring	

E10. How much did you earn from this off-farm activity during 2010?

Week	Month	Quarter	Annum

E11. Did you benefit from any credit during the 2010?

1) Yes ( ) 2) No ( )

E12. If yes, kindly indicate from which source and … (if kind, give the value)

S/No	Source of credit	Amount (N)
1	Agric Bank (NACRDB)	
2	Commercial banks	
3	Cooperatives society	
4	Friends/relatives	
5	Money lenders	
6	Self savings	
7		

E13. What problems did you encounter in obtaining credit?

S/No	Problems association with credit	Problem (1/0)
1	Delay in getting the credit	
2	High interest rate	
3	Insufficient credit	
4	Lack of collateral	
5		

E14. Kindly indicate if you own any of the following assets.

Item	No.	Sole owner = 1 or own with someone =2	How many years ago did you acquire this item?	Did you purchase this item or did you receive it as a gift? Purchase = 1, gift = 2	If purchased, amount (N)	No. of years of expected life	Salvage value
1	Maize grain						
2	Maize flour						
3	Sorghum grain						
4	Sorghum flour						

5	Millet grain						
6	Millet flour						
7	Rice Imported						
8	Rice Local						
9	Cassava Tubers						
10	Cassava Gari						
11	Cassava Chips						
12	Yam Tuber						
13	Yam flour						
14	Cocoyam						
15	Corns						
16	Groundnut shelled						
17	Groundnut unshelled						
18	Soybean Grain						
19	Soybean Flour						
20	Cowpea						
21	Okra						
22	Tomato						
23	Onion						
24	Pepper						
25	Egg plant						
26	Carrot						
27	Pumpkin						
28	Green leaves						
29	Guava						
30	Citrus						
31	Mango						
	Others, specify						
32							
33							
34							

Units refer to local measures (e.g Mudu, Shakade, Tiya, Baskets, etc). The average weight for example of one basket in Kg should be obtained.

E16. What are your major sources of food crops?

S/No	Sources of food crops	Sources of food (1/0)
1	Own harvest	

2	Purchase from the market	
3	Gift from friends/relatives	
4	Exchange labour for food	
5		

E17. Kindly indicate how many livestock you owned and also….

Livestock	Number of livestock presently owned	How many did you own last year i.e 2010?	How many did sold this year?	How many have you consumed this year?	Quantity of animal products consumed last week (quantity/unit)	Quantity of animal products sold last week (quantity/unit)
Cattle						
Cattle Meat						
Cattle Skin						
Cattle Intestine						
Cattle Head/Leg						
Sheep						
Sheep Meat						
Sheep Skin						
Goats						
Goats Meat						
Goats Skin						
Pigs						
Chickens						
Ducks						
Guinea fowls						
Others, specify						

E18. Number of animals sold and amount realized in 2011.

Livestock	Number of livestock	Number sold	Amount Realized (₦)
Cattle			
Sheep			
Goats			
Pigs			
Chickens			
Ducks			
Guinea fowls			
Others, specify			

E19. What are your major sources of animal protein?

S/No	Sources of animal protein	Animal protein? (1/0)
1	Own production	
2	Purchase from the market	
3	Gifts from friends/relatives	
4	Exchanged labour for meat	
5		

E20. Kindly indicate how many tools you own or hired for use…

	Owned (No.)							Hired (No.)
Item	Qty	Date of purchase	Age (Years)	Purchase price (N)	Years of useful life	Salvage value	Hired Qty	Amount (N)
Cutlass								
Hand hoe (fantaya)								
Sickle								
Farm rake								

Hoe (garma)								
Ox-drawn plogh								
Ox-drawn harrow								
Ox-drawn ridger								
Others, specify								

F. Household Expenditure

F1. Indicate the quantity purchased and amount (N) spent on…

		Item purchased per week for household consumption			
S/No	Item	Quantity	Unit (1=bags, 2=kg, 3=bottles, 4=gallons, 5=cartons, 6=liter, 7=others	Purchased value (N)	Total purchased value (N) for the year
1	Salt/Potash/Maggi				
2	Groundnut oil				
3	Palm oil				
4					
5					
6	Fish (fresh/dried/smoked)				
7	Meat (beef/mutton, etc)				
8	Sugar				
9	Bread				
10	Cigarettes, tobacco, kola nuts				
11	Drinks (beer, etc)				

12	Shoes (leather, plastic, slippers)				
13	Clothing (fabric and clothing)				
14	Purchase of motor vehicle(s)				
15	Purchase of motor cycle(s)				
16	Purchase of bicycle(s)				
17	Repairs of vehicles/bicycle(s)and other maintenance				
18	Home repairs (painting, roofs, plastering)				
19	Kitchen utensils, (pots, cups, cutlery, plates, spoons, etc)				
20	Furniture (beds, tables, chairs, cartons etc)				
21	Petrol for vehicles				
22	Kerosene				
23	Detergents and soaps				
24	Pomades				
25	Toothpaste				
26	Remittances/Gifts/Donations				
27	Festivals				
28	Funerals				
29	Agroservices (tractor hiring, spraying, threshing etc)				
30	Electricity bills				
31	Transportation (money spent on transport)				
32	Agrochemicals (herbicides, pesticides etc)				
33	Fertilizer				

34	Debts				
35	Fuel wool/charcoal				
36	Educational expenses				
37	Health expenses (modern)				
38	Health expenses (traditional)				
39	Others non food expenses (specify)				
40	Taxes/levies				
41	Donations				
42	Group contribution				
43	Wedding expenses				
44	Farm tools/equipments				
45	Others, specify				
46					
47					

G. Farm specific factors

Ownership type of land you cultivate

G1. Kindly indicate the ownership type of land you cultivate.

S/No	Type of ownership	Ownership (1/0)
1	Individual	
2	Family	
3	Community	
4	Rented	
5	Purchase	
6		

G2. Kindly give a rough estimate of the total size of land …(Ha)

G3. State the labour … family members and hired.

Operation	Family labour			Hired labour		
Operation	Days used (No.)	Adult members (No.)	Children (N0.)	Days (No.)	Persons hired (No.)	Amount Paid (N)
Land clearing						
Land preparation						
Planting						
Weeding						
Fertilizing						
Spraying						
Harvesting						
Threshing						
Transportation						
Caring for livestock						

G4. State the labour contribution from farm machinery …field by field

Operation	Ox-drawn Days (No.)	Amount (if hired) (N)	Farm tractors Days (No.)	Amount (N)
Land clearing				
Planting				
Spraying				
Harvesting				
Transportation				

G5. Do you use modern farm inputs on your farm?

G6. If yes, which among the following farm inputs did you use on…..

S/No	Farm inputs used last cropping season	Used (1/0)
1	Improved seeds	
2	Fertilizer	
3	Agrochemicals	
4	Veterinary drugs	
5	Livestock feed	
6		

G7. If no, why?

G8. What is the distance between your village and the source of inputs? Km

Item	2003	2004-2009	2010
Land (Ha)			
Car/pickup (No.)			
Motorcycle (No.)			
Ox-plow, ox-ridger, ox-harrow (No.)			
Work bull (No.)			
Sewing machine (No.)			
Bank Account (N)			
Livestock (No.)			
(1) Cattle			
(2)Sheep			
(3)Goats			
(4)Chickens			
(5)Ducks			
(6)Guinea fowls			
Others, specify			

H. Food Security Status of Households

H1. Have you ever experienced food shortage … Yes ( )

No ( )

H2. If yes, which month(s) of the year dies this usually occur?

Period	Duration (Days)	Reasons
January – March		
April – June		
July – September		
October - December		

H3. If no, why?

H4. What do you think is the cause of the food shortage?

S/No	Reasons for food shortages	Food shortages
1	Inadequate food storage facilities	
2	Inadequate money to buy during those periods	
3	Inadequate farm inputs such as fertilizers, pesticides, improved sees	
4	Lack of knowledge of innovations such as improves technology	
5	Low production	
6	I could not receive the usual remittances from the town	

H5. How did you fend for the household during these period/periods of food shortages?

S/No	Copping strategies	Strategy
1	Buying from the market	
2	Tool from the store/reserved food	
3	Going to other farmers for help	
4	Sale of livestock	
5	Reduced meals	
6	Income from off-farm activities	
7	Assistance received from relatives in the town	
8	Borrowed money to buy food	

H6. What do you think can be done to avoid food shortages?

S/No	Thinks that can be done to avod food shortages?	Avoid food shortages
1	Increase loans to farmers	
2	Government should intervene in food production	
3	Provision of improved technology at affordable prices	
4	Provision of more storage facilities	
5	Extension services should be improved	
6	Government should increase prices of farm products	

H7. What is the average number of meals per day by family members?

S/No	Period	No of meals
1	During time of food shortages	
2	During time of surplus	

H8. How do you cope with surpluses?

S/No	Copping with surplus	Copping (1/0)
1	Store for future use	
2	Give excess out as gift	
3	Most times excess waste away	
4	Sell in the market at give away prices	

H9. On the average how much do you spend on feeding …daily? N

SECTION I FOR PROSAB FARMERS ONLY

I. Sustainable Factors

Crops you grow

I1. Which of the following crops did you grow in the following years?

Crop	2003	2004-2009	2010
Maize			
Sorghum			
Millet			
Groundnut			
Cotton			
Soybeans			
Cowpea			
Rice			
Pepper			
Tomato			
Others			

I2. In which of these crops did you experience increased yields …2004 and 2009 if any?

Crop	2004 – 2009
Maize	
Sorghum	
Millet	
Groundnut	
Cotton	
Soybeans	
Cowpea	
Rice	
Pepper	
Tomato	
Others	

I3. If yes, what …the reasons for the increase in the case of each crop?

S/No	Reasons for increase in 2004 – 2009
1	
2	
3	

I4. Did you experience similar increase yields/production in 2010 for these crops?

(1) Yes ( ) (2) No ( )

I5. If yes, what in your opinion were the reasons…

S/No	Reasons for increase in 2010
1	
2	
3	

I6. If no, what in your opinion were the reasons for the decrease

S/No	Reasons for increase in 2010
1	
2	
3	

I7. Which of the following animals did you keep in the …

Animal/Year	2003	2004 – 2009	2010
Cattle			
Goats			
Sheep			
Pigs			
Chicken			
Guinea fowls			
Ducks			
Others			

I8. Did you receive any training from PROSAB on …

(1)Yes ( ) (2) No ( )

I9. If yes, how regular on the average…

(1)Weekly ( ) (2) Monthly ( ) (3) Once every quarter ( )
(4) Once every six months ( ) (5) Once every year ( )

I10. In your opinion did you benefit…

(1)Yes ( ) (2) No ( )

I11. If yes, did the training lead to increased production of…

(1)Yes ( ) (2) No ( )

I12. Did you benefit from similar training in 2010?

(1)Yes ( ) (2) No ( )

I13. What benefits did you receive from PROSAB…

S/No	Benefits received from PROSAB	2003	2004 – 2009	2010
1	Training on livestock			
2	Training on herbicides and pesticides application			
3	Training on soybean uses			
4	Increased visits by extension agents			
5	Gained knowledge on improved crop management practices			
6	Gained access to improved crop technologies			
7	Had access to micro credit			
8	Had access to input dealers/farm inputs			
9	Had access to an output dealer/sold my farm…			
10	Had access to market information			
11	Gained access to crop processing equipment			

I14. Compare extension agent visits during the following periods

Extension visits	2003	2004 – 2009	2010
No visits			
Fewer visits (1-2 visits/week)			
Regular visits (3 times/week)			

I15. Source of improved seeds during the following years

Sources of improved seeds	2003	2004 – 2009	2010
Own production			
Market			

Friend/neighbor			
PROSAB			
Seed Growers Association			
Cooperative Society			

I16. Compare your yields in the following crops in the following years

Crops	2003	2004 – 2009 (Average)	2010
Maize			
Sorghum			
Millet			
Groundnut			
Cotton			
Soybeans			
Cowpea			
Rice			
Pepper			
Tomato			
Others			

I17. What in your opinion …changes observed …and 2004-2009?

S/No	Reasons for the changes …and 2004-2009
1	
2	
3	
4	

I18. What in your opinion …changes observed between 2004-2009 and 2010?

S/No	Reasons for the changes …2004-2009 and 2010
1	
2	
3	
4	

I19. In your opinion, …PROSAB improved your livelihood

S/No	Improved livelihood	Improved
1	Bought more land for farming	
2	Bought animals for rearing	
3	Bought a bicycle …for personal use or for commercial use	
4	Was able to build a house/rooms and or carryout improvement	
5	I was able to pay my children's school fees easily	
6	Bought furniture for use in the house	
7	Was able to marry a second or third wife	
8	I could buy farm inputs of fertilizers agrochemicals	
9	Any other	

I20. In your opinion, would you say that PROSAB…

(1)Yes ( ) (2) No ( )

I21. If yes, in what ways?

I22. If no, why?

I23. In your opinion, would you say that PROSAB…

(1)Yes ( ) (2) No ( )

I24. If yes, in what ways?

I25. If no, why?

APPENDIX II: GROUP QUESTIONAIRE

1. How would you assess the impact of the PROSAB project on access to and use of agricultural credit?
   a) Increase (%) i.e whether there was impact on the people ( )
   b) Decrease (%) i.e there was a decrease in the impact ( )
   c) Same (%) i.e there was no impact – same as 2004 ( )
2. How would you assess the impact of the PROSAB project on Crop management techniques?
   a) Increase (%) i.e whether there was impact on the people ( )
   b) Decrease (%) i.e there was a decrease in the impact ( )
   c) Same (%) i.e there was no impact – same as 2004 ( )
3. How would you assess the impact of the PROSAB project on soybean utilization?
   a) Increase (%) i.e whether there was impact on the people ( )
   b) Decrease (%) i.e there was a decrease in the impact ( )
   c) Same (%) i.e there was no impact – same as 2004 ( )
4. How would you assess the impact of the PROSAB project on farmers' access to and use of improved seed varieties?
   a) Increase (%) i.e whether there was impact on the people ( )
   b) Decrease (%) i.e there was a decrease in the impact ( )
   c) Same (%) i.e there was no impact – same as 2004 ( )
5. How would you assess the impact of the PROSAB project on farm income?
   a) Increase (%) i.e whether there was impact on the people ( )
   b) Decrease (%) i.e there was a decrease in the impact ( )
   c) Same (%) i.e there was no impact – same as 2004 ( )
6. How would you assess the impact of the PROSAB project on livestock production?
   a) Increase (%) i.e whether there was impact on the people ( )
   b) Decrease (%) i.e there was a decrease in the impact ( )
   c) Same (%) i.e there was no impact – same as 2004 ( )
7. How would you assess the impact of the PROSAB project on agro processing?
   a) Increase (%) i.e whether there was impact on the people ( )

b) Decrease (%) i.e there was a decrease in the impact ( )

c) Same (%) i.e there was no impact – same as 2004 ( )

8. How would you assess the impact of the PROSAB project on crop production?

a) Increase (%) i.e whether there was impact on the people ( )

b) Decrease (%) i.e there was a decrease in the impact ( )

c) Same (%) i.e there was no impact – same as 2004 ( )

9. How would you assess the impact of the PROSAB project on Food security?

a) Increase (%) i.e whether there was impact on the people ( )

b) Decrease (%) i.e there was a decrease in the impact ( )

c) Same (%) i.e there was no impact – same as 2004 ( )

10. How would you assess the impact of the PROSAB project on Asset ownership?

a) Increase (%) i.e whether there was impact on the people ( )

b) Decrease (%) i.e there was a decrease in the impact ( )

c) Same (%) i.e there was no impact – same as 2004 ( )

11. How would you assess the impact of the PROSAB project on farmers' access to improved inputs?

a) Increase (%) i.e whether there was impact on the people ( )

b) Decrease (%) i.e there was a decrease in the impact ( )

c) Same (%) i.e there was no impact – same as 2004 ( )

12. How would you assess the impact of the PROSAB project on farmers' access to output dealers?

a) Increase (%) i.e whether there was impact on the people ( )

b) Decrease (%) i.e there was a decrease in the impact ( )

c) Same (%) i.e there was no impact – same as 2004 ( )

13. In what way(s) did the PROSAB project improved your wellbeing as a farmer?

a) Bought more land for farming ( )
b) Bought animals for rearing ( )
c) Bought a motor cycle/car/pickup van for use ( )
d) Built a new house/room or renovated the house we are in ( )
e) Was able to pay my children school fees easily ( )
f) Bought furniture for use in the house ( )
g) Married another wife ( )
h) Bought inorganic fertilizer and agrochemicals ( )
i) Other ( )

APPENDIX III

Nutrients Composition of Commonly Eaten Foods in Nigeria – Raw, Processed and Prepared.

Food Item	Composition energy (Kcal/kg)	Protein (g)
Maize	3600	90
Rice	3500	60
Millet & Sorghum	3500	100
Cowpea	3300	210
Groundnut	5300	230
Soybean	4000	330
Cassava fresh	1500	10
Cassava flour	3400	20
Yam fresh	1100	20
Yam flour	5200	40
Beef	2250	147.29
Fish	1320	87.98
Egg	938	110

Source: Oguntona and Akinyele (1995)

APPENDIX IV

Equivalent Male Adult Weight to Determine Adjusted Household Size

Age Category (years)	Male	Female
Under 1	0.00	0.00
1-4	0.25	0.20
5-9.9	0.60	0.60
10-14.9	0.75	0.75
15-59.9	1.00	0.90
60 and above	0.80	0.65

Source: Falusi (1985)