

**ANALYSIS OF POVERTY, RISK AND COPING STRATEGIES OF IRISH
POTATO FARMERS IN SELECTED LOCAL GOVERNMENT AREAS OF
PLATEAU STATE, NIGERIA**

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DECEMBER, 2015

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(MSc /AGRIC/8829 / 2011-12)

**A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE
STUDIES, AHMADU BELLO UNIVERSITY, ZARIA, IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER
OF SCIENCE DEGREE IN AGRICULTURAL ECONOMICS**

**DEPARTMENT OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY
FACULTY OF AGRICULTURE
AHMADU BELLO UNIVERSITY
ZARIA, KADUNA STATE
NIGERIA**

DECEMBER, 2015

DECLARATION

I hereby declare that this dissertation titled “**Analysis of Poverty, Risk and Coping Strategies of Irish Potato Farmers in Selected Local Government Areas of Plateau 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 in this or any other institution. All borrowed information has been duly acknowledged in the text and a list of references provided.

Akosua OPPONG-YEBOAH
Student

Date

CERTIFICATION

This dissertation titled “**Analysis of Poverty, Risk and Coping Strategies of Irish Potato Farmers in Selected Local Government Areas of Plateau State, Nigeria**”, by Akosua **OPPONG-YEBOAH** meets the regulations governing the award of the Degree of Master of Science, Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This dissertation is dedicated to God Almighty.

ACKNOWLEDGEMENTS

My deepest thanks go to God Almighty for his mercy, care and strength during the entire period of my study. My special gratitude goes to my supervisors: Prof. Ben Ahmed and Dr. A. A. Hassan for their advice, constructive criticisms and encouragement towards the success of this project.

I thank the Head of Department of Agricultural Economics and Rural Sociology and all the academic and non-academic staff of the Department, for providing a conducive environment for learning. My appreciation goes to Dr M. W. Musa for his useful comments, assistance and guidance, Dr M. A. Damisa for his valuable inputs throughout the study, Mr. O. Oyahkilomen, for his assistance and guidance, Mr S. Oyewole and Mr. F. Siewe for helping with analysis of the data.

I extend my deepest appreciation to my parents Mr. and Mrs. K. Oppong-Yeboah for their prayers, moral and financial support. To my siblings Kweku and Kwame you have been pillars of support and source of inspiration. I am grateful to Rev. Andrew and Mrs Philadelphia Dido and members of Chapel of Grace Plateau State polytechnic, Barkin-Ladi, and Chapel of Redemption, Zaria, for their prayers and encouragement.

I am grateful to Mr Moses Thomas Dung, Mr Nicholas Kofie, Mr Hayford Gyimah, Mr and Mrs Peter Garba, Mrs Rebecca Jiya, Salihu Sulaiman for all the support, love and encouragement. I wish to express my appreciation to all my colleagues and friends during my M.Sc. programme and to everyone who has contributed towards the success of this research work. Finally, I am grateful to my friends: Ado Yakubu, Amaka Ezeonuegbu, Edoama Akpakpan, Elijah Adegbe, Grace Isuwa, Esther Eyin, Aishatu Sani, Karima Dauda, Timothy Adeyinka, John Kwaghe, Abdulrahman Sani, George Bivan, Sharon Adole, I sincerely thank all of you for your faith and support.

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ABSTRACT

This study was conducted to analyse poverty, risk and coping strategies of Irish potato farmers in selected Local Government Areas of Plateau state. A multi-stage sampling technique was used to select 150 farmers for the study. Primary data were used and these were collected with aid of structured questionnaire. Descriptive statistics, Foster Greer and Thorbeck, regression model involving Tobit, multiple regression and Logit were employed to analyze the data. The results revealed that the mean age of the farmers was 48. The average household size is 7 members and the average potato farming experience was 16 years. Only 15.3 percent do not have formal education. The average farm size was estimated to be 1.8 hectares. Majority of the farmers (82.7 percent) had no contact with extension agent. It was found that 63.3 percent had no access to credit. About 68 percent did not belong to any cooperative association. About 43, 29, 28 percent of the Irish potato farmers belong to non-poor, moderate poor and core poor poverty profile respectively. The determinants of poverty in the study area were farming experience, sex, household size, education, amount of credit received. It was found that marketing risk had the highest level of risk with a mean of 0.6. The study revealed that irrigation, spreading of sales over time period, and holding cash (savings) were the most pronounced risk-coping strategies adopted. The determinants of risk-coping strategy adopted in the study area were age, farming experience, sex, household size, dependency ratio, farm size and amount of credit received. These variables were positively related to the number of risk-coping strategies adopted. Risk-coping strategy was also found to be significantly related with the poverty status of the respondents in the study area. The estimated coefficient (-2.73) obtained for risk-coping strategy was negative and significant at 5 percent level of probability. This implied that as risk-coping strategies increase, poverty status of the respondents also decreases. Also it was found that mixed cropping contributed the most to poverty reduction. The study recommended that government and private insurance companies should develop more effective insurance product for Irish potato farmers to patronize and use as shock absorbers against risky events.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Poverty in Nigeria is a rural phenomenon. Approximately 74 % of the rural population in Nigeria are described as poor and are comprised predominantly of resource-poor peasants, cultivating an average of about two hectares of land usually on scattered holdings with low and declining productivity (National Bureau of Statistics, 2012). In Sub-Saharan Africa, the incidence of extreme poverty has actually increased in recent years, and in 2015 nearly one in every two people is expected to be poor: the incidence of poverty is projected at over 45 percent essentially unchanged from 1990. In absolute numbers, Sub-Saharan Africa is expected to have 400 million poor in 2015 (Loungani, 2003).

Since the collapse of the oil boom of the 1970s, there has been a dramatic increase in the incidence and severity of poverty in Nigeria, arising in part from dwindling performance of the agricultural sector where a preponderant majority of the poor are employed (Manyong *et al.*, 2005). For example, rural poverty increased from 28.3 % in 1980 to 73.4% in 2013-2014 and the proportion of the urban poor also rose from 17.2% in 1980 to 52.2% in 2013-2014 (World Bank, 2014).

All production implies the taking of some risks, since the cost on the effort has to be incurred in advance of the final output, which may turn out to be more or less than was expected (Upton, 1973). Crop and livestock yields are highly dependent on the weather; rains may arrive early or late or there may be too much or too little rain for normal plant growth or may cease abruptly ahead of usual period. In periods of drought the restricted

plant growth means that livestock fodder supplies and hence livestock production may also be limited. Then again, outbreaks of animal or insect pests or diseases can cause major yield losses. Apart from the risks of crop failure or losses of livestock production there are also risks of sickness, injury or death of family members (Upton, 1973).

The National Root Crop Research Institute (NRCRI), Vom and other agricultural research institutions in Nigeria and abroad have made notable achievements in increasing the yield of irish potato (Zemba *et al.*, 2013). The crop breeders have developed varieties of irish potato, which are capable of responding to improved cultural practices. They have gone a long way towards solving the problems of pests and diseases both in the field and storage (Okonkwo, 1992). However, despite the advanced techniques used in crop husbandry, the yield of irish potato is still variable over time and space in the area.

In recent times, there has been an emerging awareness in agricultural development literature that for agriculture to drive development and hence alleviate poverty in developing countries, issues bordering on effective risk management and coping strategies of smallholders to economic shocks will have to be addressed (Eriksen and Silva, 2009, Ziervogel *et al.*, 2006, O'Brien *et al.*, 2009 and Eakin, 2005).

Irish potato can be characterized as a high-input, high-output and high-risk crop. The great responsiveness of its yield to inputs such as high quality seed tubers, fertilizers, pesticides and additional labour motivates farmers to use inputs more heavily on potatoes than on other crops (Horton, 1987). Also, because of the relatively high level of potato yield, the short growing period, and high market value, the potato crop

generates larger returns per hectare and per day than most other crops grown in developing countries (Horton, 1987). However, because of the susceptibility of potato to pests, diseases, moisture loss and extremes in weather, its yield is more variable than those of many other crops (Horton, 1987). This yield variation coupled with price fluctuation and high input costs, makes potato production risky. Due to these problems, few farmers specialize in sole potato production; most grow potatoes with other crops (Horton, 1987).

1.2 Problem Statement

Nigeria suffers from high levels of poverty and rising inequality in income in spite of her enormous wealth of human and material resources. According to estimates generated by the World Bank (2014), poverty rates remain high in Nigeria. For example, poverty rate increased from 62.2% in 2009/10 to 64.2% in 2013/2014. Similarly, the rural poverty rate increased from 69% in 2009/10 to 73.4% in 2013/14 and urban poverty rate from 51.2% to 52.2%.

Many of the poor have little land on which to sustain their rapidly growing families. They also lack basic inputs and in most cases experienced declining growth in their agricultural production and productivity (Amao, Awoyemi, Omonona and Falusi, 2009). In the effort to make up for declining production, they have resorted to exploitation of generally fragile environment, leading to a cycle of low production, low income and poverty (Amao *et al.*, 2009).

Farmers and ranchers deal with a significant amount of uncertainty every day (Drollette, 2009). From not knowing what the weather will be like this year to wondering if market

prices will increase or decrease tomorrow, agricultural producers are forced to make decisions based on imperfect information (Drollette, 2009). Born out of this uncertainty is the possibility of injury or loss. For example, each time a farmer plants his fields it is possible the weather will destroy his crops, each time a feed-lot operation purchases calves, they risk a loss if market beef prices fall. And each time a dairy producer milks cows, he risks being kicked in the face (Drollette, 2009).

Plateau has a sole comparative advantage in irish potato production in Nigeria with 95% of the country's total production done in the State (Dimlong, 2012). However, inspite of the risks faced by these farmers, they still venture into the production of irish potato because, the consumption of irish potato in its fresh and processed forms between 2011-2013 increased from 4.39 to 4.63Kg/capita/year which indicates there is a demand for irish potato which motivates the farmers to produce the crop. The crop has become an integral part of the farming system of the local farmers who are responsible for producing over 1,500,000 metric tons and 92% of Nigeria's annual output (Okwonkwo *et al.*, 1995; FAO, 2012, NRCRI annual Reports, 2010). And also, considering the fact that the potato crop, which is usually harvested early, holds the key to bridging the hunger gap during the critical period between July and August (Chuwang *et al.*, 2007).The potato demand deficit in Nigeria can only be effectively supplied from the Plateau given the favorable climatic conditions.

However, research in this area of literature, for the majority focused only on the types of risk faced by farmers, determinants of poverty and therefore neglected to assess the levels of production risks faced by farmers, examine how households in these local government areas respond to these risks and linking the risk-coping strategies adopted

to the poverty status of the farmers. It is thus important to understand these risks and identify people's response strategies to these risks as to guide the formulation of interventions aimed at helping the poor.

It is against the aforementioned gaps observed in the literature and in particular in the case of Plateau State that this study, in an effort to complement literature and create more awareness in promoting national policies in transforming the stagnant agricultural sector through improving crop production and productivity sought to assess the risk, types of risk-coping strategies adopted, poverty profile, and the effect of risk-coping strategies adopted on the poverty status of the farmers in the study area.

Thus, this study seeks to provide answers to the following research questions;

- i. What are the socio-economic characteristics of Irish potato farmers in the study area?
- ii. What is the poverty level of Irish potato farmers?
- iii. What are the socio-economic and institutional factors influencing the poverty level of Irish potato farmers?
- iv. What are the various risks associated with Irish potato production?
- v. What are the coping strategies adopted by Irish potato farmers?
- vi. What are the socio-economic and institutional factors influencing the adoption of coping strategies adopted by Irish potato farmers?
- vii. What is the effect of adoption of coping strategies on the poverty level of Irish potato farmers?

1.3 Objectives of the Study

The broad objective of the study is to analyse poverty, risk and coping strategies of irish potato farmers in selected local government areas in Plateau State of Nigeria. The specific objectives are to:

- i. describe the socio-economic and institutional characteristics of irish potato farmers in the study area;
- ii. determine the poverty levels of irish potato farmers;
- iii. determine the socio-economic and institutional factors influencing the poverty level of irish potato farmers;
- iv. describe the various risks associated with irish potato production;
- v. describe the coping strategies adopted by irish potato farmers;
- vi. determine the socio-economic and institutional factors influencing the adoption of coping strategies by irish potato farmers;
- vii. determine the effect of adoption of coping strategies on poverty levels of irish potato farmers.

1.4 Justification of the Study

The quest to eradicate poverty has been identified as the most critical challenge facing the global community today; particularly for countries in the developing world (Raheem, Ayeni and Fashidemi, 2014). It is a huge task particularly in Sub-Saharan Africa where a sizeable proportion of the poor live. In Africa, about 70% of the poor live in rural areas and depend mainly on agriculture for their livelihood (Nchuchuwe, 2012).

If governments are to alleviate poverty or to assess the effectiveness of policies in alleviating poverty, they not only need to accurately measure poverty, but also to identify who the poor actually are (D'Silva and BySouth, 1992). For example, policies

targeted directly to the poor can hardly succeed unless governments know who the poor are and how they respond to policies and to the environment (World Bank, 1990).

Given the changing structure of the agricultural industry, managing risk has become vitally important to the success of agricultural operations (Drollette, 2009). The first step to successfully manage risk is to understand and recognize the sources of risk (Drollette, 2009).

The findings of this study will aid policy makers in designing appropriate policies at helping the poor, in understanding the risks and people's responses to the strategies will serve as guides for formulating interventions that help the poor.

1.5 Hypotheses of the Study

The hypotheses to be tested in this study are:

- i. There is no poverty among irish potato farmers in the study area.
- ii. There is no relationship between the socio-economic and institutional characteristics of irish potato farmers and the coping strategies adopted.
- iii. Adoption of risk-coping strategy has no effect on poverty levels of irish potato farmers.

CHAPTER TWO

LITERATURE REVIEW

2.1 Irish Potato Production in Nigeria

Irish potato was first introduced in Nigeria in the late 19th Century, through missionary activities (Obigbesan, 1976). The production was encouraged by the British Colonial Government during the Second World War as the tubers were needed to feed their armed forces in West Africa. Since then, the importance of irish potato has been widely realized such that it is now an important commodity in both local and international trade.

Irish potato is by far the most efficient tuber crop in Nigeria in terms of tuber yield and days to maturity. Thus, because of the short maturity period of the crop, it is produced almost throughout the year making it the highest yielding tuber crop in Nigeria (Okonkwo *et al.*, 1995).

In developing countries, irish potato is ranked first in energy production per hectare per day, significantly above cassava and cereals. It is a lover of cool climate and therefore requires a cool growing season, with a moderate and well distributed rainfall of about 800millimeters during growing seasons with no prolonged dry weather (Ahmed, 1980).

Although Nigeria is known to be the fourth biggest producer of potato in Sub-Saharan Africa, it is the seventh biggest producer of potato in Africa. The main potato growing area in Nigeria is the Jos Plateau, where altitudes range from 1200 to 1400 meters and summer temperatures that rarely exceed 35°C make for a temperate climate, well suited for potato production (Ugonna *et al.*, 2013).

2.2 Area, Output and Yield Trend of Irish Potato in Nigeria

The area, production and yield trend of irish potato production in Nigeria is as shown in Table 2.1. Total output of irish potato increased from 599,000 tonnes in 2000 to 838,000 tonnes in 2006, and area cultivated increased from 212,000 hectares to 269,000 hectares in 2007. The yield per hectare increased from 2,826 ton/hectare in 2000 to 3,150 ton/hectare in 2006. There was a fall in the output from 838,000 tonnes in 2006 to 662,000 tonnes in 2007 and yield of the crop also fell from 3,150 ton/hectare in 2006 to 2,461 ton/hectare in 2007, though area cultivated increased from 266,000 hectares in 2006 to 269,000 hectares in 2007. Output between 2008-2012 increased from 1,105,000 to 1,150,000 tonnes, yield of irish potato increased from 4,202 to 4,389 tonnes/hectare, but area cultivated between the time interval dropped from 263,000 to 262,000 hectares.

Table 2.1: Area, Output and Yield Trend of Irish Potato in Nigeria, 2000 to 2012

Year	Area ('000 hectare)	Output ('000 ton)	Yield (ton/hectare)
2000	212	599	2,826
2001	212	599	2,826
2002	224	637	2,844
2003	235	678	2,885
2004	246	726	2,951
2005	260	776	2,985
2006	266	838	3,150
2007	269	662	2,461
2008	263	1,105	4,202
2009	250	1,000	4,000
2010	260	1,100	4,231
2011	260	1,100	4,231
2012	262	1,150	4,389

Source: FAO (2014)

2.3 Economic Importance of Irish Potato

To underscore the importance of potato in addressing the world food crises, the United Nations officially declared 2008 as the “international year of the potato”, in order to raise its profile in developing nations, calling the crop the “Hidden Treasure” (FAO,

2008). Potatoes rank fourth in the world as a food crop after maize, rice and wheat (FAOSTAT, 2009). Potato has been recognized as one of the main crops to alleviate hunger in the world, and is also identified to be the fourth most important root crop in Nigeria, after cassava, yam and cocoyam (Okonkwo *et al.*, 2009). Irish potato is grown for food as well as a cash crop, this is because there is an economically high expected value per hectare (Anderson, 1996). Potato is a crop of major economic significance worldwide. The crop provides a reliable source of income, employment and food for many populations in the developing countries (FAO, 2008). Globally, potato provides employment and food security to an estimated 800 million people (Hoffler and Ochieng, 2009).

Potatoes are a carbohydrate-rich, energy-providing food with little fat. They are particularly high in vitamin C and are a good source of several B vitamins and potassium (Camirea *et al.*, 2009). The health benefits of potatoes have been widely acknowledged and research is continuously finding new health benefits of potatoes such as flavonoid called quercetin (Suszkiw, 2009). Potato starch is also widely used by the pharmaceutical, textile, wood and paper industries as an adhesive, binder, texture agent and filler and by oil-drilling firms to wash boreholes, Potato starch is a 100% biodegradable substitute for polystyrene and other plastics (Ugonna *et al.*, 2013). It is used, for example, in disposable plates, dishes and knives while the peel and the other zero value wastes from potato processing are rich in starch that can be liquefied and fermented to produce fuel-grade ethanol (Ugonna *et al.*, 2013).

2.4 Poverty as a Concept

Poverty as a concept does not lend itself to an easy and precise definition. The analytical exploration of the concept and definition is fraught with a number of difficulties. This is because it affects many aspects of the human conditions/situations which include the physical, moral and psychological. Poverty is more easily recognized than defined. Hence, a universally acceptable definition of the term has remained elusive (Okunmadewa, 2001). According to Baulch (1996), the concept of poverty should be broadened to include lack of dignity and autonomy, following the increasingly multidimensional conceptualizations. Poverty is viewed as a process, rather than as a static concept. For instance, the poor instead of being viewed as passive victims of society in need of assistance rather should be viewed as agents who struggle to cope with poverty with whatever assets they may possess.

Poverty is largely situated in rural areas where the poorest people live. For this reason efforts to reduce poverty have largely targeted rural areas (Saheed, 2010). Poverty is a relative term in the sense that the population that will be regarded as poor in Western Europe may have level and pattern of living that would be regarded as materially well off in many of the less developed countries (Oseni *et al.*, 2012).

Poverty has increased in Sub-Saharan Africa over the past two decades, both in absolute terms and as a share of the world's total poor (World Bank, 2004; Kraybill and Bashaasha, 2006). The situation in Sub-Saharan Africa is especially desperate as nearly half of the population is poor and poverty has increased over the last decade (World Bank, 2003). Like in many developing countries, poverty in Nigeria is essentially a rural phenomenon, as most of the impoverished people live in the rural areas where they derive their livelihood from farming (Etim, 2007).

2.4.1 Definitions of poverty

There are a number of definitions of poverty that have emerged over the years. According to the 1997 Human Development Report, the general consensus is that poverty is defined mainly according to different perspectives: the income perspective, the basic needs perspective and the capacity perspective.

Income/consumption definition of poverty: This approach to the identification of poverty is the most commonly used especially in applied welfare economics. It identifies poverty as follows: A person is poor if, and only if, his/her access to economic resources is insufficient to acquire enough commodities to meet basic material needs adequately (Lipton, 1997).

Poverty according to the basic needs perspective: It defines poverty as the deprivation of material requirements for the minimally acceptable fulfillment of basic human needs. “Basic needs may be interpreted in terms of minimum specified quantities of such things as food, clothing, shelter, water and sanitation that are necessary to prevent ill health and undernourishment” (Shaffer, 2001). It is clear that this notion of deprivation goes well beyond the lack of private income, and instead includes basic needs that have to be provided by states or communities in order to prevent people from becoming poor. In addition, it also recognizes the need for employment opportunities.

Poverty according to the human capability perspective: The capability approach rejects monetary income as its measure of well-being, and instead focuses on indicators of the freedom to live a ‘valued’ life (Human Development Report, 1997). According to this framework, poverty is defined as the absence of some basic capabilities needed to

function, where ‘basic capabilities’ are “the ability to satisfy certain crucially important functioning up to certain minimally adequate levels” (Sen, 1993). The relevant functioning in this context refers to the various valuable things that a person can do or be, such as living a long life, being healthy, well-nourished, adequately clothed and sheltered and interacting well with others in the community.

World Bank (2001) and Ucha (2010), summarized the various dimensions of poverty as a lack of opportunity, lack of empowerment and a lack of security. The window of opportunity remains closed to the poor masses, and this makes them practically inactive in the society. Their lack of empowerment limits their choices in almost everything and their lack of security makes them vulnerable to diseases and violence.

Based on these different perspectives, it is clear that the concept of poverty has been extended beyond its economic domain. According to UN (1998), poverty is a denial of choices and opportunities and a violation of human dignity. It means a lack of basic capacity to participate effectively in society. It means not having enough to feed and clothe a family, not having a school or clinic to go to and not having access to credit. It means insecurity, powerlessness and exclusion of individuals, households and communities. It means susceptibility to violence, and it often implies living on marginal or fragile environments, without access to clean water or sanitation.

This research acknowledges the fact that poverty is a multidimensional phenomenon, and regards poverty as a pronounced deprivation of human wellbeing, which includes vulnerability to adverse events outside the poor’s control, being badly treated by the institutions of state and society and being excluded from having a voice and power. Any

household or individual with insufficient income or expenditure to acquire the basic necessities of life is also considered to be poor (World Bank, 2001).

2.4.2 Dimensions of poverty

2.4.2.1 Absolute poverty

Absolute poverty describes the conditions in which the basic needs cannot be met. Absolute poverty is the minimum basket of resources which one needs to survive (Schwartzman, 1998). Absolute poverty is often known as subsistence poverty since it is based on assessment of minimum subsistence requirements. In a narrow sense, it is a state which a person cannot secure his long-term physical survival (Kircher, 2002). It is usually measured by pricing the basic necessities of life, drawing a poverty line in terms of this price, and defining as poor, those whose income fall below that figure. This measure is universal and not time-bound, and has the advantage of international comparability. An example of this would be the minimum amount of calorie intake which is recommended by prominent institutions such as FAO and the World Health Organization, or the \$ 1 a day and \$ 2 a day that are used by Human development Reports when examining the extent of absolute poverty throughout the world.

2.4.2.2 Relative poverty

Relative poverty is defined in relation to the social norms and standard of living in a particular society. It can, therefore, include the individual's ability to take part in activities that a particular society values even if they are not necessary for survival. Definitions of relative poverty are based upon comparison, often with some notion of prevailing living standards in the community being researched (Ravallion, 1998). It relates to average income of the society and social exclusion (Schwartzman, 1998).

Examples of poverty definition in this category include people in the lowest 20% of the income distribution or people earning less than 50% of the mean income.

2.4.2.3 Chronic poverty

Chronic poverty is experienced by individuals and households for extended periods of time or throughout their entire lives, and it is also called ‘persistent poverty’. According to Uccelli (1997), chronic poverty is characterized by a deep-rooted, impoverished condition, which is the consequence of multiple deprivations over time, such as poor health, substandard nutrition and inadequate access to productive assets, and is often associated with persistent, intergenerational poverty. As a result, chronic poverty is usually more difficult to address as its causes are largely structural and endemic (Okunmadewa, 2001; Mafimisebi, 2002).

2.4.2.4 Transient poverty

Transient poverty is temporary, and short-term in nature (Okunmadewa, 2001; Mafimisebi, 2002). Transient poverty normally results from a one-time decline in living standards, from which a household gradually emerges. Alternatively, it may show itself in fluctuations in well-being that result in frequent declines in living standards. For example, seasonal variations in food security may result in some households periodically falling in and out of poverty, sometimes quite regularly, over time (Woolard and Leibbrandt, 2001).

2.4.3 Characteristics of rural poverty

Rural poverty has particular characteristics. The livelihoods and survival of rural people depend heavily on agriculture and other rural sectors strongly reliant on natural resources. Weather-related shocks and stresses and risks associated with seasonality are intrinsic to rural livelihoods tied intimately to agricultural production (Ravallion *et al.*, 2007). As a result, rural livelihoods tend to be characterised by risk, shocks and stresses, including economic shocks such as changing market prices and climate-related risks, which may lead to drought or repeated flooding (Ravallion *et al.*, 2007).

The poorest people are often the most vulnerable people to these shocks and stresses, though coping and risk management strategies are widespread. Poor people in rural areas also tend to suffer poverty over long time periods, with more limited income-generating opportunities compared to people in urban areas. Access to services and infrastructure is usually limited (Ravallion *et al.*, 2007).

2.4.4 Causes of poverty

Unlike the definition of poverty, which continues to conjure up different meanings for different people, general concurrence among scholars and development practitioners regarding the factors that determine and sustain poverty has been more closely approximated (Burki, 1990). There is no one cause or determinant of poverty. On the contrary, a combination of several complex factors contributes to poverty. According to Ajakaiye and Adeyeye (1999), they include low or negative economic growth, inappropriate macroeconomic policies, deficiencies in the labour market resulting in limited job growth, low productivity and low wages in the informal sector, and a lag in human resource development. Other factors according to them which have contributed

to a decline in living standards include increase in crime and violence, environmental degradation, retrenchment of workers, a fall in the real value of safety nets, and changes in family structures.

Yahie (1993), classifies the causes of poverty to be structural and transitional. Structural causes are those which are more permanent and dependent on a host of exogenous factors such as limited resources, lack of skills, location disadvantage and other social and political factors. The stratum of individuals that falls in this category include the disabled, orphans, landless farmers, households headed by females. Transitional causes, on the other hand, are those which are occasioned by structural adjustment reforms and changes in domestic economic policies that may result in price changes and unemployment. Natural calamities such as droughts and man-made disasters such as wars and environmental degradation induce transitional poverty.

Obadan (1997), argued that the main factors that cause poverty in Sub-Saharan Africa include: inadequate access to employment opportunities; inadequate physical assets such as land and capital (the poor have minimal access to credit even on a small scale); inadequate access to the means of supporting rural development in poor regions; poor access to markets where goods and services can be sold; low endowment of human capital; destruction of natural resources leading to environmental degradation and reduced productivity; inadequate access to assistance for those living at the margin and the victims of transitory poverty; and finally, failure to involve the people in the design of development programmes that affect them.

According to Ward (1999), the factors that cause poverty in most urban cities can be linked to the inner decay caused by poor public facilities that have been allowed to get run down due to lack of maintenance and investment. Insufficient resources and poor maintenance skills are often accountable for this. In addition, the available amenities are frequently inadequate to meet the increasing demands placed on them.

The Federal Office of Statistics (FOS) (1999), on their part identified several causes of poverty in Nigeria to include: (i) inadequate access to education, health, sanitation and water services. This was attributed to, inequitable social service delivery, which results in the inability of the poor to live a healthy and active life and to take advantage of employment opportunities; (ii) low level of technology; (iii) inefficient use of resources; (iv) poor macro-economic and monetary policies resulting in low economic growth rate and continuous devaluation of the Naira; (v) bad governance over the years which has deprived Nigerians of the ideals and dividends of democracy; (vi) unemployment in Nigeria which has assumed crisis level since the 1980s and early 1990s, especially among school leavers and graduates of tertiary institutions; and (vii) poor human resource development-traditional and formal education has not been integrated, and so there has been no empowerment of people with the relevant skills to improve the pace of development.

Omonona (2010), is of the opinion that the major causes of Nigeria's poverty go beyond low incomes, savings and growth, which are usually associated with a poor country. According to him causes of poverty in Nigeria include high levels of inequality attributable to unequal access to income opportunities, basic infrastructure, poor education and health status.

According to Aigbokhan (2000), the real and perceived increase in the level of poverty in Nigeria is as a result of severe economic shocks that rocked the Nigerian economy during the early 1980s. The factors that contributed to the shocks were declining prices of oil (the country's main export), and rises in real international interest rates that compounded the external debt.

2.4.5 Approaches for tackling poverty

The United Nations Economic Commission for Africa (UNECA) identified, in 1999, seven factors as being key to reducing poverty in Africa. These include the following: (i) integrating population, environment and science and technology policies into national development strategies; (ii) promoting investments in the social sectors (such as education, health and employment-generating programmes) that target and reach the poor; (iii) addressing gender inequalities; (iv) building the capacity to use information technology, so as to meet development goals; (v) Integrating regions in Africa, in order to gain a competitive edge in the global arena; (vi) improving governance; (vii) establishing measures that will halt the prevalence of the HIV/AIDS epidemic, because it has dire economic consequences both at the micro and macroeconomic levels.

The World Development Report of 2000/2001, which focuses on poverty reduction, proposed a three-pronged strategy for attacking poverty, namely: (i) promoting economic opportunities for the poor, with recommendations to encourage effective private investment by reducing risks for private investors; ensuring the rule of law, and fighting corruption, expand into international markets; build the assets of the poor; address asset inequality across gender, ethnic, racial and social divides; improve

infrastructure and increase knowledge in poor areas ; (ii) facilitating the empowerment of the poor (this includes laying the political and legal foundations for inclusive development; creating public administrations that foster growth and equity; promoting inclusive decentralization and community development; promoting gender equity; tackling social barriers such as class, race and gender stratifications; and supporting poor people's social capital, and (iii) enhancing security (this includes formulating a modular approach - that is, a mix of interventions-to help poor people manage risk; developing national programmes to prevent, prepare for and respond to macro shocks including both financial and natural disasters, designing national systems of social risk management that are also pro-growth; prevent civil conflict and tackling the HIV/AIDS epidemic) (World Bank, 2001).

2.5 Risks in Agricultural Production

Risk in agriculture is pervasive and complex, especially in agricultural production (Hardaker *et al.*, 2004), since it depends on the vagaries of nature. Poor people are typically more exposed to risks and least protected from them. They have limited assets, and are thus less able to deal with risks and absorb shocks. Risk exposure has a direct bearing on well-being, causes poverty or can increase the depth of poverty (Hoogeveen *et al.*, 2005). The direction of causation can be both ways- poverty causes exposure to risk, poor people are forced to live in an area exposed to natural hazards, and risks can cause poverty, for example, a natural hazard such as flood can destroy assets.

2.5.1 Definition of risk

Just(2003), referred to risk as situations in which the objective probability distribution of outcomes is known by the decision-maker. In other words, risk is considered as

uncertainty with consequences (Blackburn *et al.*, 1994;Cross, 2000). Risk occurs when there is a chance of something happening that will have an impact upon objectives. It is measured in terms of consequences (Australian/New Zealand Standards, 2004).

According to Harwood *et al.* (1999), agricultural risk is uncertainty that matters, and may involve the probability of losing money, possible harm to human health, repercussions that affect resources (irrigation, credit) and other types of events that affect a person's welfare.

According to the World Bank (2001), risk refers to uncertain events that can damage well-being – the risk of becoming ill, or the risk that a drought will occur. According to Cooper *et al.*, (1993), and Williams and Schroder (1999), a state of risk is considered to exist whenever knowledge of the situation enables the likelihood of the various possible events to be assessed in advance.

2.5.2 Types of agricultural risk

The risks that farmers face result from numerous sources of change. Some of these are related directly to the farm business and would not exist were it not for the farm (Miller *et al.*, 2004). Some of the risks are related to our involvement in a farm business as individuals, while others are related to the environment in which our farm business and we as human beings operate (Miller *et al.*, 2004). Sources of risk in agriculture are discussed below.

2.5.2.1 Production risk

Production as a source of risk concerns variation in output arising from weather, pests and diseases, input quality and availability, the inherent variability of biological systems, and technological change (Musser, 1998). Similarly, Goucher (1996), perceived production risk as the possibility that the level of physical output that is planned will not be achieved.

Production risk occurs because agriculture is affected by many uncontrollable events that are often related to weather, including excessive or insufficient rainfall, extreme temperatures, hail, insect pests, and diseases. Technology also plays a key role in production risk in farming (Harwood *et al.*, 1999). In fact, farming has been so successful because it has adopted new technologies like pesticides and herbicides, but this has not been achieved without a significant increase in adverse consequences.

2.5.2.2 Market risk

Price or market risk reflects the risks associated with changes in the price of outputs or of inputs that may occur after the commitment to production has been made (Harwood *et al.*, 1999). In other words, market risk covers the possibility that the price which a product ultimately realizes will differ from that which was planned.

Another kind of market risk arises in the process of delivery of production to the right market place where the producer can have reasonable price for his produce. The inability to deliver perishable products to the right market at the right time can impair the effort of producers (due to quality deterioration). The lack of basic infrastructural facilities, well-developed markets and proper market information system makes this a

significant source of risk. Farmers are exposed to unpredictable competitive markets for inputs and outputs. It includes risks that result from unpredictable exchange rates (Hardaker *et al.*, 2004).

2.5.2.3 Financial risk

Financial risk results from the way the firm's capital is raised and financed (Harwood *et al.*, 1999). Many agricultural production cycles stretch over long periods of time, and farmers must anticipate expenses to meet out the requirement. But they will only get well if the product is marketed well. This leads to potential cash flow problems exacerbated by lack of access to insurance services, credit and the high cost of borrowing, and also the user/beneficiary can equally divert the funds away from the primary purpose for which the loan was collected. These problems can be classified as financial risk. Interest rates on borrowed capital fluctuate and there may be cash flow difficulties if there are insufficient funds to repay creditors. The farmer also faces a probability of losing his capital (Hardaker *et al.*, 2004).

2.5.2.4 Institutional risk

These risks relate to institutional changes such as changes in government intervention in agriculture, changes in food safety requirements, increasing environmental regulations, and macro-economic settings such as interest and exchange rate policies. Musser (1998), claimed that farmers are subject to an ever-increasing array of regulations from all levels of government.

This includes political risk, which is the risk associated with unfavourable policy changes. An example is changes in tax or credit policy and restriction on the use of a

certain pesticide that alters the cost of production. Sovereign risk is the risk that foreign governments will not honor commitments such as trade agreements (Hardaker *et al.*, 2004). Also, under institutional risk, is transaction risk. This results from opportunistic behaviour and the reliability of transacting partners. It is represented by the losses incurred as a result of the failure in enforcing exclusive property rights, enforcing required attributes, in completing the intended transaction or in protecting transaction benefits from third-party predation (Dorward *et al.*, 2007).

2.5.2.5 Human risk

Human resource risk may be associated with the labour and management functions of farming and can include the vulnerability of the farm to the health and continuing ability of the sole farm operator and the availability and reliability of labour (Anderson, 1994). Disruptive changes may result from such events as death, divorce, injury, conflict or the poor health of the principal operator of the farm (Harwood *et al.*, 1999).

Risk of injury to key employees, or to the owner of an owner-operated farm, is one of the most important risks for farmers to manage. An injured farmer or manager who cannot make managerial decisions, or carry out farm operations, is likely to suffer the increased cost of employing somebody else, and even significant loss of revenue through lower production (Gaynor, 1998).

Another human resource issue is the flow of people from rural to urban areas. The continuing economic pressure on farming is making this situation worse than it once was. It is a problem facing an increasing number of rural communities worldwide, such that skilled rural labour is becoming less and less available for rural businesses.

2.5.2.6 Legal risk

Legal risks underlie all other types of risks. Production practices must conform to environmental laws and noncompliance could result in significant penalties or a lawsuit (Drollette, 2009). Many marketing and financial decisions are subject to contract law, and inability to meet the terms of any contract agreement can also have serious legal implications. Farmers are also required to meet statutory obligations relating to tax reporting and payments, labour and wage laws, safety requirements (Drollette, 2009). For example tort liability is the risk of being sued by a customer, worker or visitor, for example if there is an accident due to improper safety procedures on the farm

2.6 Risk Management in Agriculture

Risk needs to be managed to increase or stabilize the prospective returns to owners or shareholders from a particular enterprise (Stulz, 2003). The objectives to be achieved in managing risk require that the risks be identified and evaluated so that managers can be informed about which risks to hedge or to mitigate, and which risks to transfer or to sell. Thieke (2000) said that these activities are both offensive and defensive, in that good risk management is able to promote a business person's risk capacity (in this case, a farmer), as well as defend the business (farm) from unwanted risk. More generally, the goal of risk management is to obtain the best available combination of expected income and income certainty, given the individual's resources and risk preferences. Hardaker *et al.* (2004), considered risk management as the systematic application of management policies, procedures and practices to the tasks of identifying, analyzing, assessing, treating and monitoring risk.

Risk management deals with selecting the appropriate mix of alternative strategies to reduce risks within the farm's operation, transfer risks from the operator to others more capable of handling risk exposure, or build the operation's capacity to bear risks (Harwood *et al.*, 1999). The first fundamental strategy in managing risk aims at reducing the probability of a negative outcome. For example, in order to reduce the probability of a yield loss due to drought, farmers may plant drought-resilient crop varieties, or they may invest in irrigation facilities (Tangermann, 2011). A second set of options is oriented to mitigating risk. Diversification is one of the most basic and obvious approaches in this category. For example, on the farm, simultaneous production of several commodities with different risk patterns can mitigate the risk resulting from natural factors. Combining different sources of revenue, on-farm and off-farm, can smooth the development of overall household income (Tangermann, 2011). The third option for coping with risk consists mainly of financial approaches. Coping strategies refer to a set of measures adopted to attempt to meet physiological, social, economic and political needs of everyday life. Therefore short-term adjustments to a households' livelihood portfolio or drawing on available capital assets to minimize the effects of sudden shocks are put in common place. In particular, saving in good times and selling assets or borrowing from banks when a negative outcome has occurred (Tangermann, 2011).

2.6.1 Tools and strategies for managing agricultural risks

2.6.1.1 Production risk

Several strategies can be used to reduce production risk (Kalan, 2013). Farmers have three choices in dealing successfully with production risks. One, they can control or minimize risk through management practices. Two, they can reduce production

variability by making changes such as diversifying, integrating, applying technology, and three, they can transfer production risk to someone else through contracting, purchasing insurance.

(i)Controlling/minimizing risk

There are numerous examples of how risk can be minimized or controlled through improved management practices. Timelines of operations has a very large impact on most production activities. When a field operation is performed, there is normally an optimal time for this operation with respect to the value of the crop. If the operation is performed earlier or later, the value of the crop may decrease due to changes in quantity and /or quality (ASABE, 2006). Soil fertility varies considerably in Africa, leading to variable crop productivity and crop response to additions of fertilizer and inorganic nutrient resources (Zingore *et al.*, 2007).

(ii)Reducing production variability

(a) Diversification: Diversification has been one of the most common methods used to reduce risk (Miller *et al.*, 2004). By having more than one enterprise in the farm business, the chance of a large loss from a given hazard is reduced. But for diversification to be effective, enterprises included in the business should not be subject to the same hazards or at least not to the same degree (Miller *et al.*, 2004). Some techniques include generating income from off-farm activities and engaging in the same farm enterprise in different physical locations.

(b) Flexibility: Strategic risk management requires the capability to be flexible. Flexibility is the managerial/organizational capacity to change in response to changing circumstances. To be flexible, a firm must have the resources and skills to successfully change strategies regarding key strategic business choices, such as business enterprise focus, financial/organizational structure, marketing and channel linkages, and growth/downsizing (Miller *et al.*, 2013). Examples of flexibility include intensifying the farming system by increasing an already existing enterprise, and keeping land fallow (unplanted) in times of low rainfall in order not to risk unnecessary expenditure on inputs.

(c) Vertical integration: In practice, vertical integration in agriculture often involves ownership of both farm production and processing activities. Vertical integration is also common in certain specialty crops, particularly for fresh vegetable and potato operations (Harwood *et al.*, 1999). Vertical integration often encompasses not only production of the crop, but also sorting, assembling, and packaging products for retail sales. Examples of vertical integration in farming are farmers who raise corn and hay as feed for their dairy operations are vertically integrated across both crop and livestock production (Harwood *et al.*, 1999).

(d) Evaluating new technologies: There are countless opportunities to apply new technology in managing production risk on the farm. This includes the physical technology often referred to as precision agriculture. Precision agriculture takes advantage of advances in computers and mechanical engineering to make better, more efficient, machines and equipment (Crane *et al.*, 2013). As with all new technologies, farmers who adopt these new innovations try to capture a range of potential benefits,

including lower input costs and environmental quality. Benefits can also include higher crop yields due to improved pest control and more cost-effective use of crop inputs. Animal agriculture is being affected by biotechnology. Safer, more effective vaccines are already in use. Biotechnology is being used to develop diagnostic tests for a wide range of diseases and viruses.

(iii) Transferring risk to someone else

(e) Production contracting: Production contracts typically gives the contractor (the buyer of the commodity) considerable control over the production process (Perry, 1997). Contracts usually specify in detail the production inputs supplied by the contractor, the quality and quantity of a particular commodity that is to be delivered, and the compensation that is to be paid to the grower (Harwood *et al.*, 1999). Farmers enter into contracts for various reasons, including income stability, improved efficiency, market security, and access to capital.

(f) Insurance: Insurance is the means of protecting against unexpected loss. The risk can be passed off by purchasing insurance from an insurance company, or it can be self-insured. With self-insurance there are no premiums to pay, but in the event of a loss, the operator bears the full amount of the loss (Crane *et al.*, 2013). Insurance can be an effective mechanism of transferring large risks to someone else. To be insurable, an adverse event must be important enough to cause economic hardship to the insured if it occurs. Further, there must be a sufficient number of adverse events or potential quality loss to allow a reasonably close calculation of the probable loss. Also, the potential loss must be accidental and unintentional and when an adverse event occurs, the amount of loss must be observable and measurable (Crane *et al.*, 2013).

2.6.1.2 Marketing risk

Marketing risk exists because of the variability of product prices and the uncertainty of future market prices that the farmer faces when making the decision to produce a commodity. Several methods can be used to reduce price variability or to set a satisfactory price before the crops or livestock are ready for sale (Kalan, 2013).

(a) Spreading sales: This form of managing market risk is easily obtainable if a farmer is producing a crop that can be easily stored after harvest and/or parts of the crop can be sold at different times during the year. The farmer can watch for changes in the market and sell when prices are most favorable. This particularly applies to food grains and for seasonal produce that can be stored. Examples include apples, potatoes and onions (Kalan, 2013).

(b) Direct sales: Selling directly to final consumers may be a way to enhance profitability and reduce risk. Small- scale farmers near population centres may especially benefit from direct sales to final consumers. However, the farmers need to be sure that they can sell everything taken to market. Otherwise, they may end up worse off than selling to traders. They also need to be sure that the higher prices they will get from retail sales will cover the extra costs they will incur (Kalan, 2013).

(c) Market contract: Marketing contracts are either verbal or written agreements between a buyer and a producer that set a price and/or an outlet for a commodity before harvest or before the commodity is ready to be marketed (Perry, 1997). Since ownership of the commodity is generally retained by the grower while the commodity is produced, management decisions (such as varieties or breeds, or input use and timing) typically remain with the producer (Harwood *et al.*, 1996).

(d) Forward pricing: Forward pricing is a practice where the buyer and producer agree on a price for the sale of crops or livestock in advance of delivery. An agreement is reached to deliver the crop at an agreed price, quantity, quality and time. This practice enables farmers to reduce the risk that the price they receive for their output might not cover production costs (Kalan, 2013).

2.6.1.3 Financial risk

Financial risk occurs when money is borrowed to finance the operation of the farm business. This risk is caused by uncertainty about future interest rates and repayment schedules, changes in the loan collateral, and the ability of the farm to generate the cash flow necessary for credit repayments (Kalan, 2013).

(a) Credit: Many factors influence a farmer's decision to borrow money, including: attitude toward risk; the size and type of farm operation; the farmer's relationship with input suppliers and output purchasers; and the willingness of lenders to provide loans at conditions acceptable to the farmer (Kalan, 2013). Increasing the capital available to farmers through lending enables them to expand their farm businesses but this, in turn, obliges them to repay outstanding debts and creates the risk of loan default. Increased debt raises the likelihood that farmers would be unable to meet their financial obligations in a year of low returns. Highly indebted farmers operate in an environment of greater financial risk (Kalan, 2013).

(b) Off-farm employment: To reduce financial risk, in some cases, it is necessary and in other cases, it is wise to secure some type of off-farm employment. Whether it is the producer, his spouse, or another family member who finds another job, off-farm employment ensures a cash flow that is unrelated to the farm's success and that allows

the family, and sometimes the farm, to survive in difficult times (Drollette, 2009).

(c) Liquidity: Liquidity is the ability of the farmer to raise cash. What can a farmer do if an unfavorable event happens? Does the farmer have ready cash or other assets that can be easily converted to cash to cover his or her financial obligations? Assets tied up in land and machinery are the most difficult to convert to cash, while stored inputs or products are easier to convert. Cash held at home or in a bank provides the best protection (Kalan, 2013).

(d) Leasing assets: Assets are hired or rented out to another farmer for a specified period and at a specified price. The asset remains the legal property of the owner. Farmers can lease land, machinery, equipment or livestock. Leasing assets generates additional income and spreads the cost of paying for and maintaining the asset (Kalan, 2013).

2.6.1.4 Institutional risk

Institutional risk refers to unpredictable changes in the provision of services, such as the supply of credit and purchased inputs, and information from both formal and non-formal institutions. It also refers to uncertainties concerning government policies that affect farming.

(a) Producer groups: When farmers have sufficient trust in each other, there is scope for them to work together informally as a producer group in order to reduce some of the risks associated with credit mobilization, the purchase of inputs and marketing (Kalan, 2013). Groups for credit and marketing purposes can produce: (i) economies of scale in

input procurement, loan administration and marketing of produce; (ii) capital accumulation through savings and credit mobilization; and (iii) timely delivery of services.

The risk reducing function of farmer groups comes from the pooling of capital of individual farmers into a common fund, collecting and disseminating information to its members, and bulk buying and marketing (Kalan, 2013).

(b) Cooperatives: Forming and participating in more formal cooperative organizations also provides farmers the opportunity to benefit from volume sales of produce, bulk purchases of inputs and supplies, and the mobilization of credit (Kalan, 2013). Cooperative marketing involves: (i) consolidating loads to facilitate bulk buying by traders or bulk transport; (ii) sharing transport to reduce costs; and (iii) negotiating jointly with buyers.

2.6.1.5 Human and personal risk

Human risks are those risks associated with the people involved in the farm business. This refers to the risks related to human involvement and interactions that are important for business success (Crane *et al.*, 2013).

(a) Labour planning: An aspect of human risk management involves strategies to guard against unexpected changes in the availability and productivity of labour. Careful labour planning, such as using a seasonal labour calendar ensures that farmers know exactly what and how much labour is needed at various times during the production season (Kalan, 2013).

(b) Employee management: Farm employee management involves securing and retaining quality farm labour. The goal is to use labour effectively and efficiently so that the cost of labour can be justified and the risks of using labor mitigated (Crane *et al.*, 2013). By developing sound employee search and management procedures, offering appropriate fair and equitable compensation, reward systems, benefit packages, living conditions, and other employee considerations are important aspects of managing human risk (Crane *et al.*, 2013).

(c) Labour productivity: To address labour productivity risks, larger farmers may replace hand labour with animal power, tractors or motorized implements. Different production programmes including changing farm enterprises and enterprise mixes may also be looked at. Intercropping, improving farm layout, introduction of labour-saving technologies and similar actions can all contribute to a human risk management strategy (Kalan, 2013).

2.6.1.6 Legal risk

Legal risk refers to the possibility of being sued, fined or otherwise penalized for violating a law or regulatory standard (Greer, 2003).

(a) Property and liability insurance: Carefully review your farm owner's insurance policy to make sure that you are covered for events such as collapse of a barn roof, barn fire, or injury to a visitor. Many policies don't adequately cover these events. If yours doesn't, increase your liability limits or purchase additional "riders" to cover them. Make sure your animals and/or stored crops are covered. Remember that if you have a farm market the potential for tort liability increases dramatically, and you need special "riders" to cover the increase risk (Greer, 2003).

Insurance costs and company structures change frequently. It's important to make certain you are spending your insurance money wisely by getting quotes from a number of insurance sources every two or three years. This process also gives you the opportunity to get a "second opinion" on your coverage needs when you review them with different agents (Greer, 2003).

2.7 Analytical Review

2.7.1 Measurement of poverty

Poverty can be approached from an objective or subjective perspective. The objective perspective (sometimes referred to as welfare approach) involves normative judgments as to what constitutes poverty and what is required to move people out of their improvised state. The subjective approach, on the other hand, places a premium on people's preferences on how much they value goods and services hence the emphasis on individual utility (Makoka and Kaplan, 2005).

However, poverty measurement has traditionally been dominated by the objective approach. Only relatively recently, the international community as a whole has taken a serious interest in measuring subjective poverty (Dessalien, 2000). Clearly both objective and subjective perspectives bring valuable insights to the measurement and analysis of poverty. They approach the phenomenon from different angles and captures fundamentally different aspects of it, neither of which can be said to be categorically right or wrong.

(a) Dollar per day measurement: Absolute poverty refers to the minimum set of resources needed to survive. Absolute poverty then is designated as the line below

which existence becomes a matter of acute deprivation, hunger, premature death and suffering (Schwartzman, 1998). As such, it is defined by two fundamental characteristics: (i) the sharp division of the income status of poor versus non-poor, and (ii) the acceptance of income (or consumption) as central to the understanding of poverty.

To convert the \$1/day estimate into local currency, the latest purchasing power parity exchange rates for consumption are used. The purchasing power parity exchange rates reflect the average price levels for all commodities in the market (weighted by their share in international expenditure) rather than the small subset of commodities that are likely targeted by the poor for subsistence (Nye, 2002). The poverty line is then converted into local currency using consumer price indices and applied to income or consumption data made available by household surveys on the national level (Ravallion, 2002).

The Bank's \$1/day definition is conceived as an absolute poverty line based on international standard. It has been met with much controversy in recent years by those who question not only the methodology utilized to obtain such a standard, but also the adequacy of the standard itself (Mowafi, 2004).

There is significant confusion about the interpretation of the Bank's definition, with many believing that \$1/day is measured in nominal exchange rate terms (Nye, 2002). In actuality, however, the \$1/day definition reflects what is known as "purchasing power parities," or PPPs, essentially basing the poverty line as the equivalent of what a person could buy with one dollar in the United States. It is important to note, therefore, that the

\$1/day definition does not reflect “how far a dollar could go” in local currency, but rather is an indication of what a dollar could purchase in the United States adjusted for differences in domestic price levels by what is known as the World Penn Tables (Lipton, 1996). The dollar per day measurement refers to the World Bank’s purchasing power parity (PPP) index, which defines poverty as the proportion of those living on less than US\$1 per day poverty line.

(b) Direct calorie intake method:With this measure, poor households are defined as poor if their per capita energy intake is less than the standard per capita requirement of energy. It is concluded that the direct calorie intake results in a consistent poverty line in the way that it reflects the same nutrient intake (Ahmed, 2004). Therefore, any household whose calculated kilocalorie intake per capita is less than a predetermined threshold is considered poor (David, 2000).

(c) Food energy intake method:This method sets the poverty line at the income or consumption level where the basic needs are met. Here, the poverty line is estimated on the basis of the relation between food energy intake and expenditures for consumption (Ahmed 2004). More precisely, the “daily per capita kilocalories intake (X) and monthly per capita expenditure (Y) are calculated from each sample household. A simple linear regression at the natural log of Y on X, $\ln Y = a + bX + r$, with r as residual is fitted to the household values. The poverty line is estimated by substituting the calculated kilocalorie intake per capita in place of X in the fitted equation. Households, or more precisely members of households whose monthly per capita expenditures are less than the estimated poverty line are considered poor” (David, 2000). In this poverty line, non-food items are also included as long as the total expenditures for consumption

are taken as reference (Ravallion, 1992). When it is converted into expenditures levels, inconsistency problems can occur due to different preferences for calorie sources, which differ with price levels and market conditions (Ahmed, 2004).

(d) Cost of basic needs method: The cost of basic needs method was introduced in the 1990s. Computing the costs of food and non-foods basket establish the poverty line, so that the predetermined requirements concerning the nutrition and also the basic non-food consumption are included (Ahmed, 2004). David (2000) describes the method as follows: “A food bundle is chosen on actual consumption pattern, for example, from a consumption or expenditure survey. The bundle values $F_1, F_2 \dots F_n$ are expressed as per capita quantities that collectively provide the calculated kilocalories per day. The unit price of these food items are not used directly to estimate the food poverty line, but are first adjusted through regression, controlling for total consumption, education and occupation in such a manner that the resulting prices $P_1 P_2 \dots P_n$ are supposed to represent the prices paid by the poor. The food poverty line is $F_1P_1 + F_2P_2 + \dots + F_nP_n$ The next step is to compute a cost of non-food basic needs which when added to the corresponding food poverty line gives a (total) poverty line” (David, 2002). The non-food components generally are estimated through regressions or non-parametric techniques (David, 2002). The cost of basic needs method is consistent in terms of an assumed living standard.

(e) Foster-Greer-Thorbecke (FGT) measurements: The most popular measurements of poverty, which are often used, are the so-called Foster-Greer-Thorbecke (FGT) poverty indices. Foster *et al.* (1984) developed the following decomposable poverty index:

$$P_\alpha = \frac{1}{n} \sum_{i=1}^q \left[\left(\frac{Z-y_i}{Z} \right)^\alpha I(y_i < Z) \right] \dots\dots\dots (1)$$

Where:

P_α = Poverty index

α = Degree of poverty aversion

n = Total number of observations

q = Number of people with per capita expenditure/income below Z

Z = Poverty line = $\frac{2}{3}$ of the mean annual per capita expenditure/income.

y_i = Annual per capita expenditure/income

$I ()$ = Indicator function taking 1 if $y_i < Z$ and 0 if $y_i > Z$

$$\alpha = 0, P_\alpha = P_0 = \text{Headcount index} = \frac{q}{n}$$

$$\alpha = 1, P_\alpha = P_1 = \text{Poverty gap index} = \frac{1}{n} \sum_{i=1}^q \left[\left(\frac{Z-y_i}{Z} \right)^1 I(y_i < Z) \right] \dots\dots\dots (2)$$

$$\alpha = 2, P_\alpha = P_2 = \text{Poverty severity index} = \frac{1}{n} \sum_{i=1}^q \left[\left(\frac{Z-y_i}{Z} \right)^2 I(y_i < Z) \right] \dots\dots\dots (3)$$

Headcount index is a measure of the prevalence of poverty (Ahmed, 2004). It is the proportion of the population of whom consumption (or another suitable measure of living standard) y is less than the poverty line z . Thus the headcount index shows the percentage of the population below a certain threshold/poverty line (Lok, 1995). For some purposes the headcount index is a good measurement. It is definitely easy to understand and, therefore, also easy to communicate.

Poverty gap index is a measure of the depth of poverty (Ravallion, 1992). It refers to the amount of income/expenditure that would be necessary to make a person identified as poor to become non-poor (Schubert, 1994). In other words, the poverty gap index is based on aggregate poverty deficit of the poor relative to the poverty lines. Therefore, it

depends on the distance of the poor below the poverty line (Ravallion, 1992). Poverty severity index is a measure of inequality among the poor. It is a good measurement to compare policies that are aimed at reaching the poorest.

The Foster- Greer-Thorbecke poverty index employed in this study for measuring poverty requires the definition of a poverty line. This is a pre-determined and well defined standard of income or value of consumption (expenditure). The one-third (which defines the core poverty line) and two-third (which defines the moderate poverty line) of mean per capita household expenditure/income have been commonly used (Baiyegunhi and Fraser, 2010). Ruben and Van den Berg (2001), Yunez-Nuade and Taylor (2001), used the income approach. The mean per capita income will be estimated as the average of the per capita incomes of the irish potato farmers in the sample. Thus, any irish potato farm household whose income falls below $1/3$ or $2/3$ of the mean annual per capita income will be considered poor. Hence, extremely (core) poor, moderately poor and non-poor irish potato farmers will be identified. The irish potato farmers with less than $1/3$ of mean annual per capita income will be classified as extremely poor, while those households with incomes greater than $1/3$ of total expenditure but less than $2/3$ income are moderate poor, while the non-poor will be those who spend $2/3$ or more of mean annual per capita income.

(f) Relative poverty measurement:Relative poverty is defined by reference to the living standards of majority in a given society and separates the poor from the non-poor. Households with expenditure greater than two-thirds of the total household per capita expenditure are non-poor whereas those below it are poor (NBS, 2012). Further desegregation shows that households with less than one-third of total household per

capita expenditure are core-poor (extreme poor) while those households with expenditures greater than one-third of total expenditure but less than two-thirds of the total expenditure are moderate poor. Accordingly, the poor category is sub-divided into those in extreme poverty and those in moderate poverty, where extreme poverty is more severe than moderate poor. Similarly, the non-poor are divided into the fairly rich and the very rich (NBS, 2012).

(g) Absolute poverty measurement approach: Poverty is defined in terms of the minimal requirements necessary to afford minimal standards of food, clothing, healthcare and shelter. This method considers both food expenditure and non- food expenditure using the per capita expenditure approach (NBS, 2012). The most important issue of measuring poverty in an absolute way is defining an existing minimum or minimum standard of basic needs *ex ante* (Witt, 1998). Absolute poverty is often known as subsistence poverty since it is based on assessment of minimum subsistence requirement.

Absolute-poverty is an approach which identifies a certain number of basic needs that must be completely satisfied in order for people not to be found poor: food, clothing, and housing. It is claimed that these needs are the same everywhere, even if the way in which they are satisfied varies from one county to another according to climate, the culture and the economic situation” (Larivière *et al.*, 1998).

(h) Subjective measurement of poverty: Poverty is associated not only with insufficient income or consumption, but also with insufficient outcomes with respect to health, nutrition, literacy, deficient social relations, insecurity and low self-confidence

and powerlessness. This form of poverty is usually called subjective poverty. It is based on self-assessment and “sentiments” from respondents interviewed. It considers the respondents’ opinion on whether or not they consider themselves to be poor (NBS, 2012). Subjective poverty is defined as a considerably low level of satisfaction with one’s life situation or with particular life domains such as income, health, leisure time, environment or social integration (Van Praag and Ferrer-i-Carbonell, 2005; Böhnke, 2008). Subjective relative poverty can be measured by interviews on how a person ranks herself in relation to others.

2.7.2 Advantages and disadvantages of various measures of poverty

(a) Advantages of the dollar per day measurement: The method is simple, easy to remember, and applies to all countries. It establishes a common measure to evaluate consumption poverty across countries, rather than accepting national poverty lines that would treat poverty as a relative concept. The World Bank adopted this method whereby all persons could be evaluated equally based on a single threshold of real consumption (Ravallion, 2002).

(b) Disadvantages of the dollar per day measurement: Reddy and Pogge (2002), argue that the World Bank’s figures are so flawed that they can neither be considered accurate nor relevant. Specifically, they named three methodological deficiencies as rationale to support this conclusion. Firstly, the poverty line was chosen arbitrarily and corresponds to no clear and meaningful underlying conception of poverty. In other words, the \$1/day definition has no specific interpretation in relation to the resource that is needed by the poor to meet basic requirements such as nutrition or shelter. In their view, defining the poor as those living under a dollar a day has neither practical

significance nor application for poverty policies and programmes. It cannot be interpreted as a line below which basic needs have not been met. Secondly, they noted the failure of Purchasing Power Parity (PPP) estimates to accurately describe national currency equivalents through space or time. Lacking inter-spatial and inter-temporal comparability, the calculation of global poverty estimates based on current PPP exchange rates becomes an annual exercise in futility and imprecision. Thirdly, they equally noted that the Bank's method of extrapolating and imputing data that is not available to describe national income/consumption levels when conducting calculations was not appropriate due to the limited data which leads to mistaken inferences and conclusions about the level and severity of global poverty.

(c) Advantages of the direct calorie intake method: The method is easy to compute, and measures poverty based on the quantity of food consumed by each household, it considers as poor any household not meeting the nutritional requirement. The threshold is consistent for monitoring calorie intake.

(d) Disadvantages of the direct calorie intake method: A weakness of this simple and easy to implement tool is that it only measures under-nourishment and not poverty as a multidimensional phenomenon (Ahmed, 2004; David, 2000).

(e) Advantages of the food energy intake method: In using this method, there is no need to adjust the poverty line for inflation. Ravallion (1992), concludes that this method is fine for setting a single poverty line. In a way, it also considers local tastes and prices and avoids the need for price data. One thus circumvents the difficult task of valuing non-market goods. All one needs, in principle, is data on total expenditure, household characteristics and total calorie intake.

(f) Disadvantages of the food energy intake method: The disadvantage lies on choosing an adequate level of food energy intake. Food energy requirements vary across adult individuals because of differences in stature and activity levels and even more variables have to be considered when it comes to determining requirements for children, adolescents, pregnant and lactating women. Another problem is that it varies a lot between regions, sectors and times. Different tastes, activity levels, relative prices, and public provided goods can also influence the shift of this kind of poverty line (Edig, 2006).

(g) Advantages of the cost of basic need method: The CBN approach has the advantage of ensuring consistency by treating individuals with the same living standards equally (Thorbecke, 2003).

(h) Disadvantages of the cost of basic need method: For this method, more data is required than for the direct calorie intake and food energy intake methods. Possible problems could occur with the welfare-maximizing behavior of the consumer. Another problem could be that a fixed consumption bundle might not be representative for the poor. Also the consumption between urban and rural areas differs and this difference is not taken into consideration (Ahmed, 2004).

(i) Advantages of FGT measurement of poverty: The FGT measure has an advantage of being a decomposable poverty measure. A poverty measure is said to be decomposable if the poverty measure of a group is a weighted average of the poverty measures of the individuals in a group (Aguirregabiria, 2003).

(j) Disadvantages of FGT measurement of poverty: Although these measures illustrate the incidence and average depth of poverty, they cannot reveal whether deprivation differs substantially among poor people. Further, the average poverty gap ratios are not sensitive to whether poverty alleviation targets the poorest of the poor and those who are only marginally poor (Osberg and Xu, 2005).

(k) Advantages of the relative measurement of poverty: The calculation of poverty rates based on this kind of threshold has the advantage of automatically reflecting differences in the income distribution between different regions and in time. Poverty is basically a phenomenon of inequality (Bellù and Liberati, 2005).

(l) Disadvantages of the relative measurement of poverty: Relative measures are explicitly based on the notion that poverty is relative to a society's existing level of economic, social, and cultural development. Implicit is the fact that people are social beings who operate within relationships. People whose resources are significantly below the resources of others, even if they are physically able to survive, may not be able to participate adequately in social organizations and relationships (Sen, 1992; Townsend, 1993), and also the measurement of relative poverty always needs a reference person, group or country.

(m) Advantages of the absolute poverty measurement: In the concept of absolute poverty, poverty does not vary with the overall living standards. This is especially relevant for the low-income countries (Ravallion 1992). This approach is really useful for the identification of those who need the most in emergency situations like environmental catastrophes or wars (Hatzius *et al.*, 1994).

(n) Disadvantages of the absolute poverty measurement: Problems with this method can exist with the cultural value level. Goods which are considered as necessary for physical existence might be considered differently in different societies (Edig, 2006). The valuation of the components of the basket is done through prices. Distortions occur when the prices do not reflect the real relations in shortage of goods (Edig, 2006). The preferences of consumption change in time and evaluating a new 'basket' is always costly (Schubert, 1994).

(o) Advantages of the subjective measurement of poverty: An advantage of the subjective approach to measurement of poverty is that researchers don't have to list basic needs or types of deprivation in order to assess what poverty is; people tell you what poverty is. There is also no need for researchers to specify regionally or socially undifferentiated and general cut-off levels of income or consumption below which people are considered to be poor (Spagnoli, 2010).

(p) Disadvantages of the subjective measurement of poverty: A disadvantage of the subjective approach to measurement of poverty is the well-known effect that people's income levels affect their judgments about income adequacy. In short, relatively rich people over-estimate the level of income inadequacy. A solution to this would be to ask only poor respondents about poverty, on the reasonable assumption that poor people are the best experts on poverty. But that's a circular reasoning, because focusing only on the poor, poverty has already been decided. It is also difficult to interpret the results (Spagnoli, 2010).

2.7.3 Studies that used FGT to measure the poverty profile among farming households

Adekoya(2014), studied the analysis of farm households' poverty status in Ogun state, Nigeria. The FGT poverty incidence, poverty gap and severity of poverty were estimated to be 78.1%, 55.8% and 43.0% respectively.

Baiyegunhi and Fraser (2014), employed the use of FGT to analyze the extent and severity of poverty. The results revealed that about 44 percent of the sampled households live below the poverty line with an average poverty gap of 0.097.

Obisesan (2013), employed FGT to analyze the poverty level of cassava farming households in South-West, Nigeria. The result revealed that 66.7% of all the households were poor which indicated a high rate of poverty among cassava farmers in the State.

2.7.4 Tobit model

Continuous dependent variables can sometimes take on only a limited range of values. This may happen because they have been censored or truncated in some way. A sample is said to be truncated if some observations have been excluded systematically from the sample. On the other hand, in a censored sample, although, observations have not been excluded systematically, some of the information contained in them has been suppressed (Davidson and Mackinnon, 1993).

Any dependent variable that has either been truncated or censored is said to be a limited dependent variable. In such situation, special methods are required for the estimation of the parameters because the consequence of truncation or censoring can be severe.

Let's consider the regression model;

$$Y_i^0 = \beta_1 + \beta_2 X_i + U, \quad u_i \sim NID(0, \sigma^2) \dots\dots\dots (4)$$

Where y_i^0 is a latent variable, we actually observe y_i , which differs from y_i^0 because it is either truncated or censored. For simplicity, suppose that censorship or truncation whenever $y_i^0 < 0$. It is proven that u_i in the above equation is non-normal and correlated with x_i . In other words, two key assumptions of the classical linear regression model are violated. The severity of truncation or censorship will depend on whether the discarded observations are large or small and also whether the size of the disturbance term variance relative to the variation in the fitted values is high or low.

The Tobit model based on the previous discussion can be presented as follows

$$y_i^0 = \beta_1 + \beta_2 x_i + u_i, \quad u_i \sim NID(0, \sigma^2) \dots\dots\dots (5)$$

$$y_i = y_i^0 \text{ if } y_i^0 > 0 \text{ and } y_i = 0 \text{ otherwise}$$

Here, the latent variable y_i^0 is observed whenever it is positive. However, when $y_i^0 < 0$, the observation is censored and we only observed $y_i = 0$.

The log-likelihood function for the Tobit model is

$$\sum_{y_i=0} \ln \Phi \left(-X_i \beta / \sigma \right) + \sum_{y_i>0} \ln \Phi \left(\frac{1}{\sigma} \phi \left((y_i - X_i \beta) / \sigma \right) \right) \dots\dots\dots (6)$$

β_1 and β_2 will be estimated by maximizing the above log likelihood function

2.7.5 Empirical studies on the determinants of poverty

Oladimeji *et al.* (2014), studied the determinants of poverty among rural artisanal fishery households in Kwara state. Tobit regression model was employed to analyse the

data. Evidence from the regression estimates showed that eight of the nine variables included in the model had the expected apriori expectations and were statistically significant ($0.001 > P > 0.01$).

Asogwa *et al.* (2012a), analyzed the determinants of poverty severity among rural farmers in Nigeria: A censored regression model approach. Their results revealed that 87.63% variation in poverty severity was explained by variations in the specified explanatory variables.

Asogwa *et al.* (2012b), estimated the determinants of poverty depth among the peri-urban farmers in Nigeria using farm level data, their result revealed that farm total economic efficiency, household size, age, education, farming experience, access to credit, gainful employment for household members, membership of farmer association, extension contact and valuable farm asset significantly influenced poverty depth among the respondents.

2.7.6 Multiple regression model

Multiple regression is a statistical measure that attempts to determine the strength of the relationship between one dependent variable (usually denoted by Y) and a series of other changing variables (known as independent variables). The two basic types of regression are linear regression and multiple regression. Linear regression uses one independent variable to explain and/or predict the outcome of Y, while multiple regression uses two or more independent variables to predict the outcome. The general form of each type of regression is:

Linear regression: $Y = a + bX + u$ (7)

Multiple regression: $Y = a + b_1X_1 + b_2X_2 + B_3X_3 + \dots + B_tX_t + U$ (8)

Where:

Y= the variable that we are trying to predict

X= the variable that we are using to predict Y

a= the intercept

b= the slope

u= the regression residual.

In multiple regression, the separate variables are differentiated by using subscripted numbers. Regression takes a group of random variables, thought to be predicting Y, and tries to find a mathematical relationship between them. This relationship is typically in the form of a straight line (linear regression) that best approximates all the individual data points.

Important assumptions

1. The first assumption is that the dependent variable can be calculated as a linear function of the covariates, plus an error term.
2. The second assumption is that the expected value of the error term is zero, which can be expressed mathematically as $E[e] = 0$. An estimator with the expected value of zero is called unbiased.
3. The third assumption is that the error terms all have the same variance and are not correlated with one another.
4. The fourth assumption is that the covariates can be considered fixed in repeated samples, which means it is possible to redraw the sample with the same values for the covariates. This can be expressed mathematically as $E[ee^T] = \sigma I$.

5. The fifth assumption is that the number of dependent variables is greater than the number of covariates and that there are no exact linear relationship between the covariates. (Kennedy, 2008).

2.7.7 Empirical studies on the determinants of coping strategies adopted by farmers

Ike and Ezeafulukwe (2015), analyzed the coping strategies adopted against climate change by small-scale farmers in Delta State, Nigeria. The findings using the Ordinary Least Square Regression Analysis (OLS) revealed that farm size, farming experience, education and income have a significant positive effect on the number of strategies adopted.

Regassa (2011), studied smallholder farmers coping strategies to household food insecurity and hunger in Southern Ethiopia. The findings of the multivariate analysis using multiple regression technique revealed that age of the household head, educational status, and access to main social service have associations with the number of coping strategies practiced by the households.

Namwata *et al.* (2010), studied the adoption of improved agricultural technologies for irish potatoes (*Solanum tuberosum*) among farmers in Mbeya rural district, Tanzania: A case of Ilungu ward. A multiple linear regression analysis for isolating factors influencing adoption of improved agricultural technologies for irish potato farmers in the study area. In the regression analysis, number of technologies adopted by the farmers was used as the dependent variable against the independent variables.

2.7.8 Logistic regression model

In literature, several binary choice models can be identified depending on the type of link function considered. Although the normal and logistic are the most commonly used link functions, others can be found in the literature namely: log-log, complementary log, Cauchy (Williams, 2006)

Logistic or Logit regression model as mentioned is a particular class of binary choice models where the error term is assumed to follow a logistic distribution. Let i indexing a farmer out of N farmers sample randomly within a given region. If y_i is a discrete random variable taking 1 when the characteristic of interest is observed and 0 otherwise, then the model can be written as follows:

$$L_i = \ln \left(\frac{p(y_i=1|X_i)}{1-p(y_i=1|X_i)} \right) = \beta_0 + \sum_{j=1}^N \beta_j x_{ij} + \mu_i \dots \dots \dots (9)$$

Where:

$L_i = \frac{p(y_i=1|X_i)}{1-p(y_i=1|X_i)}$ = Odds that the i^{th} farmer will be observed with the characteristic of interest

$$p(y_i = 1|X_i) = \frac{e^{\sum_{j=1}^N \beta_j x_{ij} + \mu_i}}{1 + e^{\sum_{j=1}^N \beta_j x_{ij} + \mu_i}} \dots \dots \dots (10)$$

Where:

$p(y_i = 1|X_i)$ = Probability that the i^{th} farmer will be observed with the characteristic of interest

$$1 - p(y_i = 1|X_i) \dots \dots \dots (11)$$

Where:

$1 - p(y_i = 1|X_i)$ = Probability that the i^{th} farmer will not be observed with the characteristic of interest.

Estimation of Logistic regression model

Two methods are considered in estimating the model namely Ordinary Least Square-based (OLS) method and Maximum Likelihood-based (ML) method.

Ordinary least square method

OLS method assumes that the expected value of the regressand or the probability that the regressand takes on the value 1 is a linear function of the observed characteristics of the observations. The model encompasses a number of lapses in the sense that the assumptions underlying a probabilistic model are not satisfied. For instance when OLS technique is employed $\hat{p}(y_i = 1|X_i)$ does not always fall between 0 and 1. Secondly, when the values of the covariates increase $\hat{p}(y_i = 1|X_i)$ does not always increase suggesting that $\hat{p}(y_i = 1|X_i)$ is not always an increasing function of X_i . Thirdly, because X_i may be non-linearly related to $\hat{p}(y_i = 1|X_i)$ the error term ε_i is heteroscedastic, suggesting the parameters are inconsistent and thus inference is deceptive (Gujarati, 2004). In order to correct for the inconsistency of OLS method based on Log-likelihood function are adopted.

Maximum likelihood method

As mentioned previously, in order to estimate the regression coefficients, the following log-likelihood function is maximized:

$$\ln L(\beta_0, \beta_j) = \sum_{i=1}^N y_i (\beta_0 + \sum_{j=1}^N \beta_j x_i) - \sum_{i=1}^N \ln [1 + e^{-(\beta_0 + \sum_{j=1}^N \beta_j x_i)}] \dots \dots \dots (12)$$

The advantage of this method is that key probability models' assumptions are satisfied:

$p(y_i = 1|X_i)$ increases with X_i and it is limited within 0 and 1.

2.7.9 Empirical studies that used logit regression model

Abimbola and Oluwakemi (2013), studied livelihood diversification and welfare of rural households in Ondo State, Nigeria. Using the poverty status of the farmers as the dependent variable, their findings of the effect of livelihood diversification on household welfare using Logit regression model showed that a combination of farm and non-farm activities were pursued as strategies to increase household welfare in the study area.

Agada and Igbokwe (2014), employed Logistic regression for analyzing the determinants of household food security and coping strategies among ethnic groups in North-Central Nigeria. The results of the logistic regression for analyzing the determinants of household food security revealed that own production, farm income, annual income and household size were significant in explaining the variation in the food security status of the households.

Leekoi *et al.*(2014), employed logistic regression model to determine the socio-economic factors of a households' exposure to risk in Thailand, using exposure to risk(1 or 0) as the determinant variable. The findings of the study revealed that gender, location of houses and household size significantly affect a household's exposure to risk.

CHAPTER THREE

METHODOLOGY

3.1 The Study Area

The study was conducted in selected local government areas of Plateau State, of Nigeria. The State is located between longitudes 8° 40' and 9° 50'E latitudes 9° and 10° 45'N of the Greenwich meridian and an altitude of 1293.2 metres above sea level (Zemba *et al.*, 2013). It has a land mass of 26,899 square kilometres and a projected population of 3,983,258 in 2014 using a population growth rate of 3.2% from 2006 population census (NPC, 2006).

Plateau State has a near temperate climate with an average temperature of between 18° and 22°C. Mean annual rainfall in the State varies from 131.75cm in the Southern part to 146cm in the north. The rainy season starts from April to October and the dry season from November to March. High temperatures are recorded in the months of March to May which ranges from 28.2° C to 30.4°C while harmattan winds cause the coldest weather between December and January which ranges from 12.7°C to 13.1°C. These seasons are suitable for Irish potato production because they meet the required 15°C for tuber formation.

The form of farming system in Plateau state is mostly intercropping, monocropping and mixed farming. However, most of the Irish potato produced (70%) on the Jos Plateau is through intercropping with tropical cereals like maize, sorghum and millet by small-scale farmers (Okonkwo *et al.*, 1995). However the most predominant crop mixture seems to be potato/maize considering the wide spread cultivation. The advantages of maize/potato intercropping is highlighted to include security against total crop yield loss,

diversity of nutrition options, environmental management, higher nitrogen use efficiency, higher land/other resources use efficiencies, creating artificial/physical barriers for pests and diseases (Chuwang, 2006; Bouws and Finckh, 2007; Chuwang and Odion, 2010).

However, in recent times there appears to be a concerted effort by some key players in the potato industry of Nigeria most especially multinational seed companies, agro based/potato processing companies and some scientists to encourage mono cropping to the detriment of intercropping. The reasons for this paradigm shift includes the production of clean and attractive tubers for 'seed' and for the market as well as reported apparent high levels of returns on investment with sole cropping (Chuwang, 2010). The other major crops grown in the state include tomato, cabbage, carrot, lettuce, and cucumber. Cereal crops such as maize, millet, soybeans, acha and sorghum are also grown, alongside cattle, small ruminant and poultry production. Some of the indigenous tribes in the State are the Berom, Afizere, Ngas, Anaguta, Chip, Goemai, Irigwe, Jarawa, Mupun, and Mwaghavu.

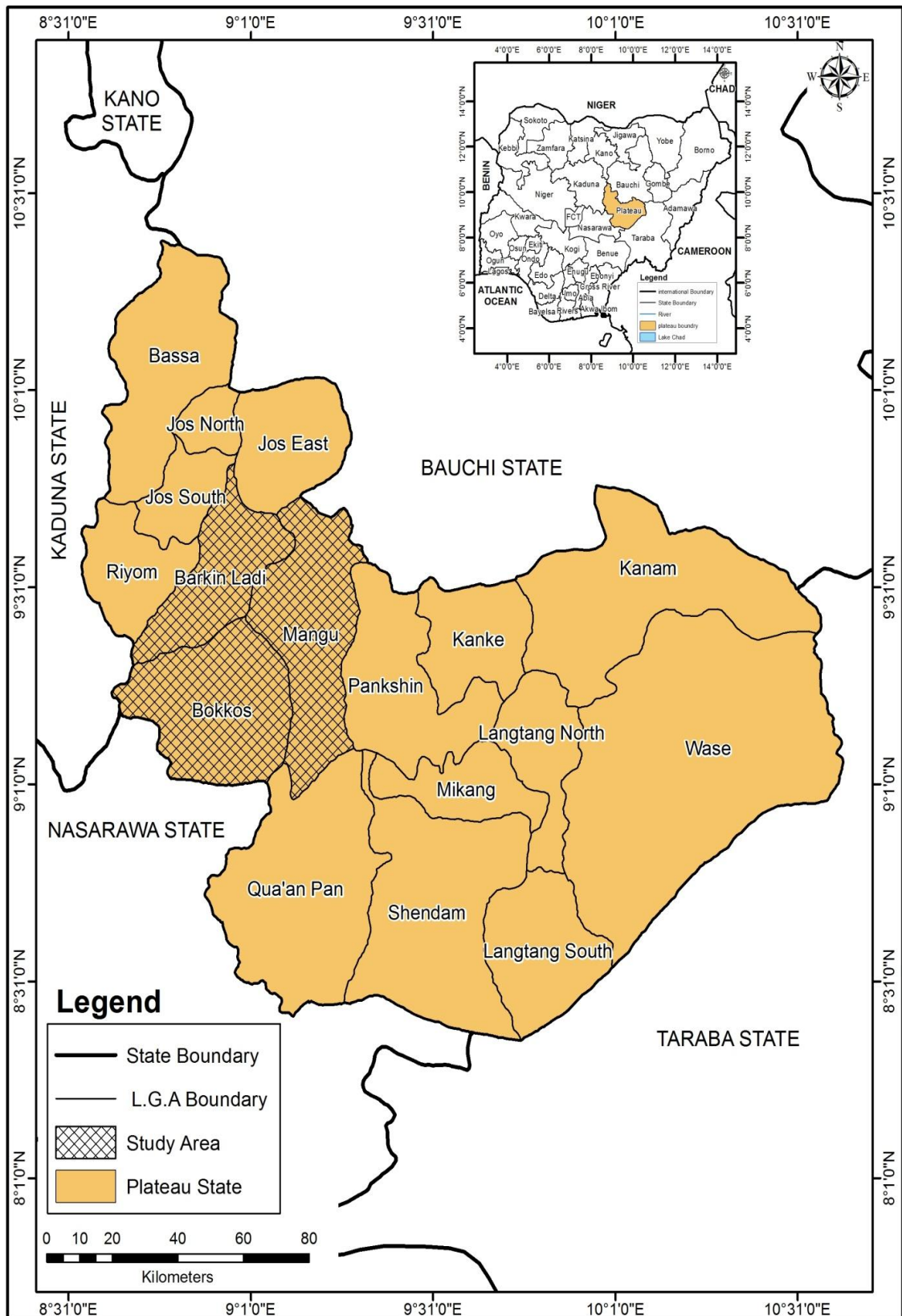


Figure 1: Map of Plateau State Showing the Study Area
 Source: Adapted from the Administrative Map of Plateau State

3.2 Sample Size and Sampling Technique

A multi-stage sampling technique was employed in selecting the irish potato farmers. The first stage involved a purposive selection of 3 Local Government Areas (Bokkos, Mangu, and Barkin-Ladi). The choice of these areas was based on the fact that they are the prominent irish potato-producing areas in Plateau State (Jwanya *et al.*,2014). The second stage involved a random selection of nine villages from the 30 villages in the three LGAs, using probability proportional to size method (Jirgi, 2013). This is given by;

$$N_i = \frac{ni}{N} * 9 \dots\dots\dots (13)$$

Where:

N_i = the number of villages to be selected from LGA i, $i= 1$ to 3

ni = the number of villages in LGA i (Barkin-Ladi=12, Bokkos=10, Mangu=8)

N = total number of villages in all the three LGAs = (30)

9 = this is the desired number of villages to be selected from the three LGAs.

This led to a selection of 4 villages from Barkin-Ladi LGA, 2 villages from Mangu LGA and 3 villages from Bokkos LGA. In the third stage, 10 % of the irish potato farmers were selected from the sample frame of irish potato farmers in each of the 9 villages obtained during the reconnaissance survey. Finally, systematic random sampling based on the formula below was used in determining the specified interval at which the irish potato farmers in each village was selected and interviewed. Thus, a total of 150 irish potato farmers were selected using the following equation (Table 3.1).

The formula for the systematic random sampling method is:

$$K = \frac{N}{n} \dots\dots\dots (14)$$

Where:

K = specified interval for choosing individuals rounded down to a whole number, N =is the number in the proportion being sampled, and n =is the required sample size (Amir and Knipscheer, 1989).

Table 3.1: Distribution of irish potato farmers in the selected LGAs

LGAs	Villages	Sample Frame	Number of irish potato farmers selected
BarkinLadi	Heipang	175	17
	Pwomol	180	18
	Ban	135	14
	Chik	145	15
Bokkos	Tangur	190	19
	Chenget	160	16
	Kunet	145	14
Mangu	Gangshir	170	17
	Perka	200	20
Total		1500	150

3.3 Data Collection

Primary data was used for this study. The data was collected for the 2014 cropping season during the rainy season with the use of structured questionnaire. The questionnaire was administered by trained enumerators in the languages spoken by the respondents so as to ensure that the right responses were obtained. Information was collected on: (a) household's socio-economic characteristics such as gender, age, household size, farming experience, educational level, farm size, extension contact,

membership of cooperatives, amount of credit received; (b) types of risks such as production, marketing, financial, human and institutional risks; (c) risk-coping strategies adopted.

3.4 Method of Data Analysis

3.4.1 Descriptive statistics

Descriptive statistics such as frequency distributions, percentages and means were used to achieve objectives i, iv and v.

3.4.2 Foster-Greer-Thorbecke (FGT) poverty model

Foster Greer and Thorbecke (1984), was adopted to measure the extent of poverty among irish potato farmers to achieve objective ii. The model is specified as:

$$P_{\alpha(y,z)} = \frac{1}{n} \sum_{i=1}^q \left[\left(\frac{z-y_i}{z} \right)^\alpha \right] \dots\dots\dots (15)$$

Where:

P_α = Poverty parameter index

P_0 =Headcount, P_1 = poverty gap, P_2 = poverty severity

n = Total number of small-scale irish potato farmers in the study area

q = Number of irish potato farmers below the poverty line (Z)

Z = Poverty line = $\frac{2}{3}$ of the mean annual per capita income of the irish potato farmers

y_i = Household income (€)

3.4.3 Tobit regression model

This was used to achieve objective iii. The Tobit regression, a hybrid of the discrete and continuous dependent variables will be used to determine the impact of the explanatory variables on the probability of being poor. The empirical model is specified as follows:

$$Y_i = 0 \text{ if } Y_i^* < 0$$

$$Y_i = Y_i^* \text{ if } Y_i^* \geq 0$$

$$Y_i^* = \beta_0 X_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + e_i \dots \dots \dots (16)$$

Where:

Y_i = Poverty gap

Y_i^* = Unobserved poverty severity ($[(Z - I_i)/Z]$)

Z = Poverty line

I_i = Mean per capita household income

e_i = Truncated error term

β_0 = Intercept term

$\beta_1 \dots \beta_{11}$ = Slope coefficients

$i = 1, 2 \dots 11$

x_{1i} = Age of household head

x_{2i} = Farming experience in irish potato production

x_{3i} = Gender of household head

x_{4i} = Household size

x_{5i} = Dependency ratio

x_{6i} = Educational level

x_{7i} = Number of contact with extension agent

x_{8i} = Membership of cooperative

x_{9i} = Farm size used for irish potato production

x_{10i} = Amount of credit obtained

x_{11i} = Off-farm income

3.4.4 Multiple regression model

This was used to achieve objective vi. The empirical multiple regression model is specified as follows:

$$Y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \beta_4 x_{4i} + \beta_5 x_{5i} + \beta_6 x_{6i} + \beta_7 x_{7i} + \beta_8 x_{8i} + \beta_9 x_{9i} + \beta_{10} x_{10i} + u_i \dots \dots \dots (17)$$

Where:

Y_i = Number of coping strategies adopted by the i^{th} farmer

x_{1i} = Age of household head

x_{2i} = Farming experience in irish potato production

x_{3i} = Gender of household head

x_{4i} = Household size

x_{5i} = Dependency ratio

x_{6i} = Educational level

x_{7i} = Extension contact

x_{8i} = Membership of cooperative

x_{9i} = Farm size used for irish potato production

x_{10i} = Amount of credit obtained

u_i = Stochastic error term which is assumed to be normally distributed

3.4.5 Logit regression model

This was used to achieve objective vii. The empirical model is specified as follows

$$Y = \beta_0 + \beta X_i + \varepsilon \dots \dots \dots (18)$$

Where:

Y_i = Poverty status (1=poor and 0 = non-poor)

X_i = risk – coping strategy index (Ratio of number of production risk-coping strategies adopted to total number of risk-coping strategies under consideration).

β_0 = Constant

β = Regression coefficient

ε_i = Stochastic error term which is assumed to be normally distributed

$$i = 1 \dots 150$$

The coefficient of risk-coping strategy (X_i) is expected to be negatively related to poverty status (Y_i). If the coefficient of X_i is negative and statistically significant at a specified level of significance, then the adoption of risk-coping strategies can be interpreted as having had a significant effect on poverty level of the farmers.

3.4.6 Definition and operationalization of variables used in the multiple regression model

(i) Age of household head (X_1): It was measured in years. It is expected to be negatively related with adoption of risk-coping strategies. The reason is that old people tend to be more risk averse than young people and are, therefore, less likely to adopt risk-coping strategies (Njoku, 1991).

(ii) Farming experience (X_2): It was measured by the number of years the household head has been involved in Irish potato production. It is expected to be positively related with adoption of risk-coping strategies. The reason is that the more years of experience farmers have in farming, the more conversant they are with the reality that Irish potato production is a very risky business, hence they are expectedly more willing to adopt risk-coping strategies than new entrants into the business (Agada *et al.*, 1997).

(iii) Gender of household head (X_3): A qualitative variable was created for the gender of household head which takes the value of 2 if the household head is a male and 1 if a female. It is expected to be positively related with adoption of risk-coping strategies. The reason is that male household heads have relatively more access to information, land, technology, inputs and credit than female-headed households (Saito and Weidemann, 1991).

(iv) Household size(X_4): It was measured by the number of family members living together and eating from the same pot. It is expected to be negatively related with adoption of risk-coping strategies. The reason is that households with large family sizes would tend to devote more resources to meet food security needs, health, education and other related expenditure than small households and are, therefore, less likely to adopt risk-coping strategies (Voh, 1979).

(v) Dependency ratio(X_5): It was measured as the ratio of the number of members below 15 years and over 65 years of age to other household members. It is expected to be negatively related with adoption of risk-coping strategies. The reason is that owing to the scarcity of resources, an increase in household size especially the non-working members put pressure on consumption than production and, therefore, the greater the food requirements to meet the needs of the unproductive group (the young and the old), therefore, less likely to adopt risk-coping strategies (Feleke *et al.*, 2003).

(vi) Educational status(X_6): The educational level of household head was measured as the total number of years of formal schooling. It is expected to be positively related with adoption of risk-coping strategies. The reason is that better educated and literate farmers are significantly more disposed to accept new techniques in agriculture than the less educated and less literate ones, thus increasing their adoption of risk-coping strategies (Voh, 1979).

(vii) Extension contact(X_7): It was measured by the number of times of contact between the extension agent and the farmer. It is expected to be positively related with adoption of risk-coping strategies. The reason is that constant meeting between the

extension personnel and the farmer would create greater awareness of the potential gains of adoption of improved agricultural innovations which increases farmers' ability to adopt risk-coping strategies (Obeta and Nwagbo, 1990).

(viii) Membership of farmers' groups/cooperatives(X_8): It was measured by the number of years in a cooperative organization. It is expected to be positively related with adoption of risk-coping strategies. The reason is that membership of cooperatives gives members more access to inputs and information on how to improve farm management practices which increases farmers' ability to adopt risk-coping strategies (Obare *et al.*, 2010; Nyagaka *et al.*, 2010).

(ix) Farm size(X_9): This variable was measured as the hectares of irish potato farmland cultivated by the farmers. It is expected to be positively related with adoption of risk-coping strategies. The reason is that the large-scale farmers are usually high capital base farmers and, therefore, can easily purchase and use improved inputs and practices than small-scale farmers thus, increasing the adoption of risk-coping strategies (Njoku, 1991).

(x) Amount of credit(X_{10}): It was measured as the amount of credit received both in cash and kind and it will be measured in Naira. It is expected to be positively related with adoption of risk-coping strategies. The reason is that the availability of credit enhances farmers' ability to purchase the inputs embodied in a new technology and also pay hired labour needed for the use of these inputs and improved management practices which increases the adoption of risk-coping strategies (Njoku, 1991).

3.4.7 Operationalization of variables used in the Tobit regression model

(i) Age of household head(X_1): It is expected to be positively correlated with poverty status. The reason is that as the household head grows older, his productivity decreases (Gang *et al.*, 2002). Because farmers are dependent on agriculture for their livelihood, reduced productivity means reduced employment and incomes and, therefore, increased poverty.

(ii) Farming experience(X_2): It was measured by the number of years the household head is involved in Irish potato production. It is expected to be negatively related with poverty status. The reason is that more experienced farmers are more likely to adjust to changing economic conditions and to adopt the most efficient agricultural production practices which will ultimately reduce their poverty (Yusuf, 2007).

(iii) Gender of household head(X_3): The expected effect of gender on poverty is negative. The reason is that men have higher levels of physical and human capital than women and, therefore, lower levels of poverty than women.

(iv) Household size(X_4): It is expected to be positively related with poverty status. The reason is that large households devote more resources on food consumption, health, education and other related expenditure than small households and are, therefore, more likely to be poorer than small households (Voh, 1979).

(v) Dependency ratio(X_5): It is expected to be positively related with poverty status. The reason is that the larger the dependency ratio, the lower the volume of net production (output of goods and services), and hence income and the greater the poverty level (Akande, 2011).

(vi) Educational status of household head(X_6): The expected effect of educational status of household head on poverty is negative. Education equips the people with information and new technologies that are necessary for enhancing economic activities and reducing poverty (Ruel *et al.*, 1998; Oniang'o and Mukudi, 2002).

(vii) Extension contact(X_7): It is expected to be negatively related with poverty status. The reason is that extension services teach farmers proper use of improved agricultural production technologies. The greater the extension contact, the larger the volume of agricultural production and, therefore, the lower the level of poverty (Njoku, 1991).

(viii) Membership of cooperative(X_8): Membership of cooperative is expected to be negatively related with poverty status. This means that a farmer's membership in a cooperative lowers the farmer's poverty status. The reason is that cooperative membership enhances access to information on improved technologies, material inputs of the technologies such as fertilizers, and chemicals, and credit for the purchase of inputs and payment of hired labour which reduces poverty (Njoku, 1991).

(xi) Farm size(X_9): It is expected to be negatively related to poverty status. The reason is that households with larger farm holdings are more likely to generate larger farm incomes than those with smaller farm holdings, which reduces their poverty (FOS, 1999).

(x) Amount of credit(X_{10}): The expected effect of access to credit on poverty is negative. The reason is that credit assists the farm households in the purchase of farm inputs such as fertilizer, herbicides, improved seeds and investment demand, pay for hired labour needed for the use of these inputs and improved management practices which will ultimately increase their productivity and reduce poverty (Njoku, 1991).

(xi) Off-farm income(X_{11}): It is expected to be negatively related with poverty status. The reason is that additional sources of income other than farming brings in more income to meet both farm and family needs and, therefore, reduces poverty (Voh, 1979).

CHAPTER FOUR

RESULTS AND DISCUSSION

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

This section described the results of socio-economic characteristics assessment for the farmers because of their perceived effect on the types of risk-coping strategies adopted and poverty status, these are; age, sex, household size, dependency ratio, farm size, years of farming experience, educational level, membership of cooperative, extension contact, access to credit and marital status.

4.1.1 Sex of the respondents

The distribution of the respondents based on sex in Table 4.1 showed that both male and female were represented in the sample, with male farmers being 83.30 percent and females 16.70 percent. In other words, potato production in the study area is stereotyped to sex. The predominance of male farmers in the study area could be attributed to the labour intensive nature of Irish potato production which could be very tedious, hectic and time consuming especially for females who have to combine this farming activity with their domestic chores. The finding corroborates the study of Jwanya *et al.* (2014), who observed that males constituted the majority of Irish potato farmers in Plateau State with 84.17 percent of the total respondents. The finding goes with literature that shows males dominate the farming population of most tropical agriculture. Patriarchy system and male dominance in decision making for many African societies have resulted into most of households being led by men (Duzé and Mohammed, 2006).

Table 4.1: Distribution of the respondents based on sex

Sex	Frequency	Percentage
Female	25	16.70
Male	125	83.30
Total	150	100.00

4.1.2 Age of the respondents

The results presented in Table 4.2 represent the distribution of the respondents by their age. About 34 percent of the farmers were within 41-50 years, 24.7 percent were between 31-40 years while 24 percent were between 51-60 years. Only 4 percent were below 30 years of age. The mean age of the farmers was 48 years and only 13.3percent of the heads were above 60 years of age. This result shows that majority (62 percent) of the farming population were young and in the active age group implying that the farmers can make positive contribution to agricultural production as well as serve as agents of innovation transfer. Nonetheless, this was not reflected in the average farm size cultivated as 71.3 percent of the farmers cultivated between 0.1 and 2.0 hectares of land. Only 28.7 percent cultivated more than 2 hectares. According to the farmers, they cultivated small hectares of land because of the frequent outbreak of conflict, use of traditional farming implements for irish potato production and the existence of a stiff land ownership system that hinders farmers from acquiring larger farm lands. Age has been reported by Hamidu *et al.* (2006), that age factor in traditional agriculture significantly influences productivity and increased rate of adoption, hence, these youths are dynamic and willing to take such risk connected with adoption of new agricultural technology. This result is similar to the results obtained by Jwanya *et al.* (2014), in their work on economic analysis of irrigated irish potato production in Plateau State, that a

good majority, 58.33 percent of the farmers were between 41-50 years old.

Table 4.2: Distribution of the respondents based on age

Age	Frequency	Percentage
21-30	6	4.00
31-40	37	24.70
41-50	51	34.00
51-60	36	24.00
61-70	18	12.00
>70	2	1.30
Total	150	100.00
Average age	48	

4.1.3 Marital status

The distribution of the respondents by their marital status is shown in Table 4.3. More than three quarters (80 percent) of the respondents were married, and 20 percent were unmarried. The population of unmarried household consists of widowed (8 percent), single (6.7 percent), separated (2 percent), and divorced (3.3 percent). The high proportion of the respondents who are married is an indication that family labour could be available for Irish potato farmers in the study area. The marital status of households is usually used to determine the stability of a household in African families. It is normally believed that married household heads tend to be more stable in farming activities than unmarried heads. If this holds true, the marital status of household heads will affect agricultural production (Randela, 2005). The result agrees with Ojo and Jibowo (2008), who reported that married people were responsible and their views are likely to be respected within rural communities as they take decision on the use of agricultural inputs.

Table 4.3: Distribution of the respondents based on marital status

Marital status	Frequency	Percentage
Single	10	6.70
Married	120	80.00
Separated	3	2.00
Divorced	5	3.30
Widowed	12	8.00
Total	150	100.00

4.1.4 Household size

The distribution of the respondents by household size is shown in Table 4.4. From the table, 37.33 percent had 4-6 members, followed by 7-9 members which constituted 34 percent. Only 12 percent had household size which ranged between 10-12 members. The average household size was 7 members. This implies that family labour would be readily available when needed for irish potato farming operation considering the percentage of males (83.3%) in the study area. Household size influences the availability of family labour for agricultural operations, since the main source of labour for a typical traditional farmer is his immediate dependents, it is therefore expected that, household size would influence the adoption of agricultural technologies, especially where joint labour is needed, implying that they have enough unpaid labour for farm activities (Okoedo-Okojie and Onemolease, 2009). The result is also in line with the findings of Orojobi and Damisa (2007), that household size is crucial to traditional agriculture where the main source of labour is the family particularly in Nigeria. The results corroborate the findings of Menza *et al.* (2014), who observed that irish potato farmers in Gamo highlands of southern Ethiopia had an average household size of 7.

Table 4.4: Distribution of the respondents based on household size

Household size	Frequency	Percentage
1-3	17	11.33
4-6	56	37.33
7-9	51	34.00
10-12	18	12.00
13-15	7	4.67
>15	1	0.67
Total	150	100.00
Average	7	
Min	1	
Max	16	

4.1.5 Dependency ratio

The results presented in Table 4.5 show the distribution of respondents by their dependency ratio. It was found that 27.33 percent had dependency ratio of between 0.1 – 0.2, 57.34 percent had between 0.21-0.6, 11.33 percent had between 0.61-0.80 and 2.67 percent had between 0.81- 1.00. Only 1.33 percent had dependency ratio greater than 1. The mean dependency ratio of the sampled Irish potato farmers was 0.81. According to Rios *et al.* (2009), the demographic composition of a household will matter in that, labour of children and the elderly may be less productive than members in the productive age range. This implies that more available family labour for farming activities and hence, increases labour force for crop production. A high dependency ratio in farming communities implies limited labour force for agricultural production.

Table 4.5: Distribution of the respondents based on dependency ratio

Dependency ratio	Frequency	Percentage
0.1 - 0.20	41	27.33
0.21 - 0.40	43	28.67
0.41 - 0.60	43	28.67
0.61- 0.80	17	11.33
0.81- 1.00	4	2.67
>1	2	1.33
Total	150	100.00
Average	0.81	
Max	3.00	

4.1.6 Educational level of the respondents

Distribution of the respondents by their educational level in Table 4.6 indicates that 15.33 percent had no formal education, 18.67 percent had primary education, 27.33 percent had secondary education, 36 percent had tertiary education and 2.67 percent had adult education. This result showed that majority of the respondents (84.67 percent) in the study area had one form of formal education or the other implying that there is potential for increased irish potato production since education will enable farmers to have access to information on new agricultural innovation which can be adopted to enhance their productivity. According to Abdullahi and Abdullahi (2011), western education facilitates the adoption of modern technologies and improved farm practices. Notably, formal education is an essential tool for the adoption of modern production technologies and effective communication system that encourage increase in the productivity of any agricultural venture (Nwaru, 2004; Akanni, 2007; Albert and Okidhum, 2012; Nenna and Ugwumba, 2012). The result conforms to the findings of Jwanya *et al.* (2014), in Plateau State who observed that 89.17 percent of the sampled size of irish potato farmers had formal education.

Table 4.6: Distribution of the respondents based on their level of education

Educational status	Frequency	Percentage
No formal education	23	15.33
Primary	28	18.67
Secondary	41	27.33
Tertiary	54	36.00
Adult education	4	2.67
Total	150	100.00

4.1.7 Farming experience

Respondents' distribution by their farming experience in Table 4.7 showed that 47.33 percent had between 1-10 years of farming experience, 28.0 percent had 11-20 years and 16.67 percent had 21-30 years of farming experience. Only 0.67 percent had farming experience greater than 50 years. Average farming experience was 16 years. This result shows that sixteen years average farming experience of the farmers is appreciable for the development of farming technique that is technically feasible and economically worthwhile. Farming experience is a vital instrument that influences the farmers' production efficiency, this may be due to farmers knowledge of local condition (Ogunnmola, 1988). Nonetheless, this was not reflected in the age and farm size cultivated, as the mean age of the household head was 48 years and average farm size was 1.8 hectares. 71.3 percent of the respondents cultivated between 0.1-2.0 hectares. The result shows that even though the farmers were well experienced and in their active age groups, most of them still cultivated small farm sizes. This may be as a result of the frequent outbreak of conflict, use of traditional farming implements for Irish potato production and the existence of a stiff land ownership system that hinders farmers from acquiring larger farm lands. Ani (1998) and Iheanacho (2000), had

indicated that farming experience to a large extent affects farmers' managerial know-how and decision making. Besides, it influences the farmers' understanding of climatic and weather conditions as well as socio-economic policies and factors affecting farming. The finding corroborates with Danwanka and Ggala (2007), whose result revealed 14 years as average farming experience among potato farmers.

Table 4.7: Distribution of the respondents based on their farming experience

Farming Experience	Frequency	Percentage
1-10	71	47.33
11-20	42	28.00
21-30	25	16.67
31-40	8	5.33
41-50	3	2.00
51-60	1	0.67
Total	150	100.00
Average	16	
Min	3	
Max	48	

4.1.8 Farm size

The distribution of the respondents by their farm size is shown in Table 4.8. The results revealed that 30.67 percent had farm size of between 0.1-1.0 hectares, 40.67 percent had between 1.1-2.0 hectare and 12.67 percent had between 2.1-3.0 hectares. Only 16 percent had farm size greater than 3 hectares. Average farm size is 1.8 hectares. From the results, majority of the farmers in the study area had small farm sizes and could be classified as subsistence farmers and it could mean that there was room for improvement when farmlands are increased in order to tap the benefits of economics of

scale. According to the farmers, they operated on small-scale production because they lack capital to buy inputs and the outbreak of conflicts which made them abandon some of their agricultural activities. The finding supports the result of Menza *et al.* (2014), who observed that small farm size used by Irish potato farmers in Gamo highlands of southern Ethiopia was probably due to erosion, soil fertility status, fluctuation of rain fall and shortage of land.

Table 4.8: Distribution of the respondents based on their farm size

Farm size	Frequency	Percentage
0.1-1.0	46	30.67
1.1-2.0	61	40.67
2.1-3.0	19	12.67
3.1-4.0	12	8.00
4.1-5.0	12	8.00
Total	150	100.0
Average	1.8	
Min	0.2	
Max	4.5	

4.1.9 Mode of land acquisition

The result of mode of land acquisition in Table 4.9 showed that (74.0 percent) of the respondents in the study area obtained their farm land through inheritance, 11.33 percent rented their farm land, 11.33 percent obtained their land through purchase and 3.33 percent through gift indicating that no change has taken place in the method of land acquisition over the years. The high proportion of the respondents who own land by inheritance is an indication that land is sub-divided and shared among the children of deceased parents. Respondents indicated that the male inheritance system does not

allow females to inherit land because these lands may be transferred to other families on the death of a husband or when the female goes out to marry from another family. This is however reflected in the population of male respondents in the study area (83.3percent). This was confirmed by Quisumbing and Pandolfelli (2010), that men are given preference over women in accessing land in such patrilineal systems. Land is the basis for every form of physical development and constitutes the primary medium for food production, for the provision of shelter and utilities (Lasun, 2006). Hence it's the farmer's most important asset and plays essential role in increasing as well as sustaining agricultural production. Ukaejiofo (2007), noted that land is the source of livelihood in the rural areas.

Table 4.9: Distribution of the respondents based on land tenure system

Land ownership method	Frequency	Percentage
Inheritance	111	74.00
Purchase	17	11.30
Rentage	17	11.30
Gift	5	3.30
Total	150	100.0

4.1.10 Membership of cooperatives/associations

The results in Table 4.10 show the distribution of the respondents by their years of membership of cooperatives. It was found that 68 percent did not belong to any cooperatives, 14.67 percent had between 1-5 years of cooperative membership, 10 percent had between 6-10 years of membership and 3.34 percent had more than 15 years of membership. These observations indicate low membership of cooperatives by a significant proportion of farmers in the area, which implies that farmers had less access to resources and information that will improve their production practices, highlighting

the importance of some social capital in improving productivity (Shehu *et al.*, 2010). A study by the Natural Resources Institute and Concern Worldwide in 2012 indicated that for smallholder farmers to increase productivity for their income and food security to be enhanced, among other things, they should be encouraged to form cooperatives, this they said will support them in the provision of training on savings and loans based on rotation credit of small groups and harnessed production of key crops that would otherwise not be produced by a single farmer. The findings are in agreement with the results of Nyagaka *et al.* (2009), who found out that only 42 percent of irish potato farmers in Kenya belonged to farmers' association.

Table 4.10: Distribution of the respondents based on their membership of cooperatives

Years of membership	Frequency	Percentage
Non members	102	68.00
1-5	22	14.67
6-10	15	10.00
11-15	6	4.00
16-20	4	2.67
21-25	1	0.67
Total	150	100.0

4.1.11 Access to credit services

The results in Table 4.11 show the distribution of the respondents by their access to credit services and the amount of credit received. About 36.67percent of the respondents indicated to have ready access to credit services, while 63.33 percent said that they had no access to both formal and informal credit services. In other words, the level of access to credit was low among irish potato farmers in the study area. It could be the challenge of lack of collaterals by the farmers to secure credit. These observations indicate low

accessibility to credit services by a significant proportion of farmers in the area. Lack of accessibility to credit services have been reported in many parts of Sub-Saharan Africa as well as other developing countries as the limiting factor for increased agricultural productivity (Eze *et al.*, 2006; Junge *et al.*, 2009; Okoedo-Okojie and Onemolease, 2009). This finding is in concordance with the results of Nyagaka *et al.* (2009) who observed that only 35 percent of irish potato farmers in Nyandarua North District of Kenya had access to credit.

Based on the amount of credit received, the results reveal that 63.33 percent had no access to credit, 8 percent received between ~~₱~~₱30001-60000 and 0.67 percent received between ~~₱~~₱90001-120000. Only 5.33 percent received above 180000. The implication is that the size of irish potato production will be low and other inputs will be affected since capital is not available to enhance production.

Table 4.11: Distribution of the respondents based on their access to credit

Variable	Frequency	Percentage
Access to credit		
No	95	63.33
Yes	55	36.67
Source of credit		
Formal	23	15.33
Non-formal	127	84.67
Invested credit in irish potato production		
No	51	34
Yes	99	66
Amount of credit obtained (₦)		
No access	95	63.33
1 – 30,000	31	20.67
30,001 – 60,000	12	8
60,001 – 90,000	2	1.33
90,001 – 120,000	1	0.67
120,001 – 150,000	1	0.67
150,001 – 180,000	0	0
>180,000	8	5.33

4.1.12 Number of extension visits

As shown in Table 4.12, majority of the farmers (82.67 percent) in the study area had no contact with extension agent over the farming season while 11.33 percent had between 1-2 contacts, 4.67 percent had between 3-4 contacts and 1.33 percent had more than 4 contacts over the cropping period. The implication of the findings is that the poor extension contact would deprive the farmers information on the availability of seeds, agronomic practices such as fertilizer application and spacing as well as availability of markets which will increase their exposure to risks. This low frequency of contact with extension agents can be attributed to the limited number of extension agents (1: 4000 farmers) in Nigeria which makes it impossible to reach all farmers by interpersonal means (Baruwa, 2013). Low access to extension has been noted to be a limiting factor to increasing agricultural productivity in Sub-Saharan Africa and in many developing

countries (Okoedo-Okojie and Onemolease, 2009). Nompozolo (2000), has also suggested that for good performance, a reasonable access to extension services and information is necessary to back up agricultural productivity and output hence extension officers must be trained in indigenous knowledge relevant to the farming communities they serve whether an individual farmer has contact with the extension service or not. This implies that effective extension visits and supervision will go a long way to improve farmers' production level and performance and hence should be taken seriously. This finding is in concordance with the result of Njuguna *et al.* (2015), who observed that only 17 percent of Irish potato farmers in Mumberes Division, Baringo County, Kenya, had contact with extension agents.

Table 4.12: Distribution of the respondents based on number of extension visit

Number of extension visit	Frequency	Percentage
No contact	124	82.67
1-2	17	11.33
3-4	7	4.67
>5	2	1.33
Total	150	100.0

4.2 Income Sources and Poverty Pattern of Irish Potato Farmers

4.2.1 Farmers' sources of income

The results in Table 4.13 show the distribution of farmers based on their different income sources (primary and secondary occupation) over the farming period. It was found that 49.02 percent derived their main income from crop farming, 22.22 percent from livestock sales. Only 6.86 percent obtained their income from non-farm employment, 7.84 percent obtained their income from agricultural wages employment,

2.94 percent obtained income from remittances and 11.11 percent obtained income from non-agricultural wage employment. Non-farm employment refers to all income-generating activities except crop and livestock production, fishing and hunting, located in areas that are mainly servicing agricultural activities (Barrett *et al.*, 2001; Lanjouw and Lanjouw, 2001). Agricultural wage employment represents earning from supplying agricultural wage labour to other farms. Remittance income includes money sent by children and relatives. Non-agricultural wage employment includes formal and informal jobs in education, construction, commerce, health and administration. Babatunde (2008), in his study on income portfolios in rural Nigeria: composition and determinants, confirmed that farmers derive their income from both on-farm and off-farm activities.

Table 4.13: Distribution of the farmers according to their seasonal income sources

Source of income	Number of farmers	Percentage of farmers	Average income(₦)	Income share in total income (%)
Farm income				
Crop farming	150	49.02	116756	58.82
Livestock sales	68	22.22	52900	26.65
Non-farm income				
Non-agricultural wage employment	34	11.11	11536	5.81
Agricultural wage employment	24	7.84	10094	5.08
Non-farm employment	21	6.86	2884	1.45
Remittance income	9	2.94	4326	2.18
Total	306	100.00	198496	100.00

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

4.2.2 Per capita income and poverty line construction

Table 4.14 presents the distribution of per capita income per season across the Irish potato farmers. The results revealed that 12.67 percent of the respondents earned per capita income of between ₦1 and ₦5000 per season, 17.3 percent earned per capita income of between ₦10001 and ₦15000. About 24.7 percent of the Irish potato farmers earned per capita income above ₦25000. The implication of per capita income in poverty analysis is that it serves as a proxy for wellbeing on which the poverty line is drawn and from which further poverty analysis can be formed.

Table 4.14: Distribution of per capita income of Irish potato farmers

Per capita income(₦)	Frequency	Percentage
1 – 5000	19	12.67
5001 – 10000	30	20.00
10001 – 15000	26	17.33
150001 – 20000	20	13.33
20001 – 25000	18	12.00
>25000	37	24.67
Total	150	100.00
Average	25,300	
Min	667	
Max	311500	

4.2.3 Poverty profile analysis

Based on the established 2/3 mean per capita income poverty line, Irish potato farm households whose per capita income per season fall below or equal to ₦8431 were considered to be core poor, whereas those whose income per capita fall between ₦8431 and ₦16861 were moderate poor. Irish potato farmers with per capita income on or above ₦16861 per season were non-poor.

Table 4.15, presents the poverty profile of the households. Results from the table

revealed that 43,29,28 percent of the irish potato farmers belong to non-poor, moderate poor and core poor poverty profile respectively. The table further showed that the headcount measure indicated that 57 percent of irish potato farmers were poor. The poverty depth analysis showed a poverty depth of 0.46. It simply means that 46% of the poverty line was required to bring individuals within the poor households up to the poverty, hence it requires mean income per capita improvement of about ₦7756. The poverty severity index result showed that the average gap from one poor household to another stood at 48 percent. This implies that poverty is well spread and severe among the poor irish potato farmers.

Table 4.15: Household poverty profile and indices among the respondents

Poverty Profile	Frequency	Percentage
Non-poor	65	43.33
Moderate-poor	43	28.67
Core-poor	42	28.00
FGT poverty indices		
Poverty incidence(head count)	85	57.33
Poverty depth(gap)	0.46	
Poverty severity	0.48	
Mean Per Capita Income	25291.70	
Min Per Capita Income	666.67	
Max Per Capita Income	311500.00	
SD		39951.74
CV (%)		157.97
2/3 of MPCI= ₦16861		

Hypothesis 1:Hypothesis Testing for Poverty

The result of the test is presented in Table 4.16. The test was significant and therefore hypothesis 1 was rejected. This implies that there was poverty among irish potato farmers.

Table 4.16: There is no poverty among small scale irish potato farmers

Hypothesis	Test-statistic	T-test statistic	Decision
Ho1	85	2.17**	Rejected
Ho2	0.46	5.8***	Rejected
Ho3	0.48	3.2***	Rejected

Note: ** = Significant at 5% level of probability. Ho1 = there is no significant poverty incidence, Ho2 = there is no significant poverty gap and Ho3 = there is no significant poverty severity

4.2.4 Factors influencing the poverty status of the farmers

The result in Table4.17 shows the Tobit regression estimates of factors influencing the poverty status of the respondents in the study area.

$$Y_i^* = \beta_0 X_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + e_i \dots\dots\dots (17)$$

Basing all discussions at 5% level of probability. The result of the maximum likelihood estimates (MLE) of the Tobit estimation presented in Table 4.17 shows that sigma was 2.1 with a Z-value of 17.2 and was significant at 1% level of probability. Therefore, the model has a good fit to the data and that the model as specified explained significant non-zero variation in factors influencing poverty.

Farming experience is negative and significant at 1 percent. This implies that as farming experience increases, the poverty status of the farmers reduces. This is in line with the apriori expectation. More experienced farmers are more likely to adjust to changing economic conditions and to adopt the most efficient agricultural production practices which will ultimately reduce their poverty (Yusuf, 2007).

The expected sign of the coefficient of household size is hypothesized to be positive, implying that large households devote more resources on food consumption, health, education and other related expenditure than small households and are, therefore, more likely to be poorer than small households (Voh, 1979). The result from the study, however, reveals that household size is negative and significant at 1 percent. Thus, as the household size of the farmers increases, their poverty status reduces which, however is contrary to expectation. Family size affects the ability of a household to supply labour to the farm. In a large family, some members could remain engaged in traditional farming while others could opt for non-farm activities and which also reduces the risk of livelihood failure (Reardon, 1997).

Education is negative and significant at 5 percent. This implies that the more educated a farmer is, the less the likelihood of being poor. This is in line with the apriori expectation. Education equips the people with information and new technologies that are necessary for enhancing economic activities and reducing poverty (Ruel *et al.*, 1998; Oniang'o and Mukudi, 2002).

Credit is negative and significant at 1 percent. This implies that the more access to credit that a farmer has, the less the likelihood of being poor. This is in line with the

apriori expectation. Credit assists the farm households in the purchase of farm inputs such as fertilizer, herbicides, improved seeds and investment demand, pay for hired labour needed for the use of these inputs and improved management practices which will ultimately increase their productivity and reduce poverty (Njoku, 1991).

Table 4.17: Regression coefficients of factors influencing the poverty status of the farmers

Variables	Coefficient	Standard Error	T-value
Age(X1)	0.02	0.01	2.00
Farming exp. (X2)	-0.07	0.02	-3.50**
Gender (X3)	0.81	0.45	1.825
Household size (X4)	-0.33	0.07	-4.844**
Dependency ratio (X5)	0.08	0.53	0.151
Educational level (X6)	-0.29	0.14	-2.071**
Extension (X7)	-9.65E-04	0.00	-0.455
Cooperative (X8)	-2.74E-04	0.04	-0.008
Farm size (X9)	0.67	0.05	1.235
Amount of credit (X10)	-0.33309E-05	0.10233D-05	-3.257**
Amount of off-farm income	0.23	0.67	0.34

** = P < 0.05

4.3 Sources of Risk

4.3.1 Production risk

From Table 4.18, as high as 89.3 percent of the farmers rate disease incidence as an important source of risk owing to the fact that disease control through the use of agrochemicals increases the cost of crop production. Most (70 percent) of irish potato farmers rate rise in input prices as a source of risk. Unavailability of improved inputs is one of the major constraints faced by farmers in Nigeria and this obliges them to rely heavily on seed stored at harvest, which losses its viability over time, thus producing

low yields (Jirgi, 2002). This finding concurs with Zivenge and Karavina (2012), who observed limited access to inputs to be a major bottleneck confronting smallholder farmers in developing countries. Also, about 45.3 percent and 21.3 percent of the farmers respectively rate erratic rainfall as a source of risk. In recent times, irregular rainfall has been experienced by farmers in Nigeria, especially in the Northern parts of the country (Hassan, 2010). The consequent effect of erratic rainfall is delay in planting dates and death of plants when dry spell periods are prolonged. About 43.3 percent of the farmers perceive lack of access to labour as a source of risk. Farmers in the study area face labour constraints, especially during peak labour demand periods, because some youths migrate from the state in search of employment.

Table 4.18: Distribution of production risk among the farmers in the study area

Production risk	Frequency	Percentage	Ranking
Pest and diseases	134	89.3	1 st
Rise in input prices	105	70	2 nd
High rainfall	68	45.3	3 rd
Lack of access to labour	65	43.3	4 th
Low rainfall	32	21.3	5 th

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

4.3.2 Marketing risk

It can be seen from the result in Table 4.19, that 68.7 percent of the farmers perceive low price due to output quality as an important source of risk. Mangisoni (2006), explained that smallholders usually accept low prices for their crops when the broker informs them that their produce is of poor quality. Smallholder farmers accept these low prices mainly because they are unable to negotiate from a well-informed position, and the low quality of the potato produce is also attributed to the use of retained seed which is prone

to attack by diseases in the field and during storage (Makoni *et al.*, 2014). Again, 60.7 percent experienced problems in transporting output to the market. Agricultural commodities must move from the farms where they are grown to the retail outlets where they are bought. Owing to the bulky nature of the commodity, bigger trucks are required, but the cost associated with such transportation has a negative bearing on the profitability of Irish potato and farmers too cannot afford to hire trucks to transport the potato commodity to more lucrative and high value markets (Makoni *et al.*, 2014). The consequent effect of bad road conditions which are often impassable during the rainy season also does not help matters: the travelling time is long implying that it will be difficult to sell fresh produce within the required time limit (Dijkstra *et al.*, 2001). This situation confirms the farmers' heavy reliance on middlemen who come and procure the commodity from the farm, albeit at a lower price than what the market is offering (Makoni *et al.*, 2014). Again, the result shows that 58 percent of the farmer's rate output loss due to inadequate storage as a source of risk. Due to lack of storage facilities, most smallholder producers are keen to sell produce almost immediately after harvest in order to ease congestion, leading them to sell their produce at lower prices (Wilson *et al.*, 1995). About 54 percent of the farmers revealed that there was absence of market for the output. Delgado (1999), suggests infrastructure is typically poor, markets for agricultural inputs and outputs are often missing and unreliable for smallholder farmers, which makes the acquisition of agricultural resources difficult and the supply of market services also becomes limited.

Table 4.19: Distribution of marketing risk among the farmers in the study area

Marketing risk	Frequency	Percentage	Rank
Low price due to output quality	103	68.7	1 st
Problem in transporting output to the market	91	60.7	2 nd
Output loss due to inadequate storage	87	58	3 rd
Absence of a market	81	54	4 th

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

4.3.3 Financial risk

From the result in Table 4.20, 58 percent of the farmers ranked difficulty in securing loans due to high interest rates as a source of risk. Inadequate loan amounts, collateral requirements by the banks, and high interest rates charged by the banks are some of the major constraints on farm credit in Nigeria (Philip and Adetmirin, 2001). Again, 39 percent of the farmers perceived difficulty in repayment of money as a source of risk. Famoriyo (1980), observed that lack of information and uncertainty in the supervision and repayment of loans are the major constraints faced by financial institutions with respect to giving loans to the farmers. 100% of the farmers had difficulty in securing an insurance policy to deal with production risk. Most of the farmers explained that they did not know of any insurance package from any source which they could patronize to assist them in situation of “bad” uncertain occurrence such as adverse weather effects, incidence of pests and diseases, communal conflict. The confidence which farmers could have gained to invest in production through insurance policy to cushion their financial position in case of “bad” happening might be lacked (Harwood *et al.*, 1999).

Table 4.20: Distribution of financial risk among the farmers in the study area

Financial risk	Frequency	Percentage	Rank
Difficulty in having a form of insurance for the farm	142	94	1 st
Difficulty in securing loan due to high interest rate	87	58	2 nd
Difficulty in repayment of borrowed money	59	39	3 rd

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

4.3.4 Institutional risk

From the results (Table 4.21), 54.6% of the farmers perceived loss of output due to wrong information disseminated from a group they belonged to. Farmers relying on informal networks for market information are at risk of getting biased information due to opportunistic behaviour of the more informed group. For instance, Mangisoni (2006), explained that smallholders usually accept low prices for their crops when the broker informs them that their produce is of poor quality. Of equal importance is the source of market information because it determines accuracy of the information. Again, 37.3% of the farmers had a delay in service delivery by a group they belonged to. Highly productive farmers require the right inputs, in the correct quantities, at the right time and at affordable prices (Tladi-Sekgwama and Tselaesele, 2010). About 34% of the respondents had difficulty in getting money from a group they belonged to.

Table 4.21: Distribution of institutional risk among the farmers in the study area

Institutional risk	Frequency	Percentage	Rank
Loss of output due to wrong information disseminated from a group you belonged	82	54.6	1 st
A delay in service delivery by a group you belonged to	56	37.3	2 nd
Difficulty in getting money from a cooperative you belonged to	51	34	3 rd

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

4.3.5 Human risk

From the results (Table 4.22), 44.7% of the farmers ranked loss of assets due to conflict/theft as a source of risk. Violent conflict engenders destruction of human life, livelihood support systems, the environment, physical and economic infrastructure. The destruction of recognized landmarks leads to sustained uncertainty and low motivation to invest in agrarian economic activities. Also, about 32% and 49.3% of the farmers respectively rate loss of members that used to help in farm activities and household member been sick during the last cropping season as a source of risk. Major life predicaments, such as death of the owner, prolonged illness of the principals may lead to significant losses in the farm business (Drollette, 2009). 40.7% and 21.3% of the farmers perceive loss of asset due to vandalism and destruction of houses due to rain or fire as a source of risk. Asset depletion due to destruction makes access to land, water, pasture and forest to no longer be guaranteed

Table 4.22: Distribution of human risk among the farmers in the study area

Human risk	Frequency	Percentage	Rank
Loss of asset due to vandalism	61	40.7	1 st
Loss of household member that used to help in farm activities	48	32	2 nd
Destruction of homes due to rain or fire	32	21.3	3 rd
Loss of assets due to conflict/theft	27	44.7	4 th
Household member is sick	14	49.3	5 th

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

4.4 Level of Risk faced by Irish Potato Farmers

The distribution of farmers by their levels of risk is based on the sources of risk they were exposed to in 2014 rainy farming season is shown in Tables4.23-4.27. This is achieved using an index for all the different sources of risks encountered by the farmers.

The index is calculated by dividing the number of agricultural risk encountered by the farmers over the total number of agricultural risks under consideration. Specifically, five categories of risks were considered and within each category, a list of risks was identified and farmers were asked whether they encountered the risks during the farming season. A positive response implied that the farmer encountered the risk while a negative response implied the farmer did not encounter the risk. A farmer whose responses were all negative was expected to have a risk index of zero while a farmer with all responses being positive was expected to have a risk index of one.

4.4.1 Production risk

The distribution of the respondents by their level of production risk is shown in Table 4.23. From the table, the modal class of production risk was found to be between 0.51-0.75 levels of risk, accounting for 40.7. The mean level of production risk was 0.51.

Table 4.23: Distribution of the respondents based on their level of production risk

Production risk	Frequency	Percentage
0-0.25	26	17.33
0.26-0.5	35	23.33
0.51-0.75	61	40.67
0.76-1.0	28	18.67
Total	150	100.0
Mean	0.51	
Standard Dev.	0.22	
Max	0.8	

4.4.2 Marketing risk

The distribution of the respondents by their level of marketing risk is shown in Table 4.24. From the table, the modal class of marketing risk was found to be between 0.51-0.75 levels of risk, accounting for 41.33 percent. The mean level of marketing risk was 0.60.

Table 4.24: Distribution of the respondents based on their level of marketing risk

Marketing risk	Frequency	Percentage
0-0.25	27	18
0.26-0.5	46	30.67
0.51-0.75	62	41.33
0.76-1	15	10
Total	150	100
Mean	0.60	
Standard Dev.	0.24	
Max	1	

4.4.3 Financial risk

The distribution of the respondents by their level of financial risk is shown in Table 4.25. From the table, the modal class of financial risk was found to be between 0.26-0.5 levels of risk, accounting for 27.3 percent. The mean level of financial risk was 0.53.

Table 4.25: Distribution of the respondents based on their level of financial risk

Financial risk	Frequency	Percentage
0-0.25	30	20
0.26-0.5	41	27.33
0.51-0.75	39	26
0.76-1	40	26.67
Total	150	100
Mean	0.53	
Standard Dev.	0.36	
Max	1	

4.4.4 Institutional risk

The distribution of the respondents by their level of institutional risk is shown in Table 4.26. From the table, the modal class of institutional risk was found to be between 0-0.25 levels of risk, accounting for 36.7 percent. The mean level of institutional risk was 0.36.

Table 4.26: Distribution of the respondents based on their level of institutional risk

Institutional risk	Frequency	Percentage
0-0.25	55	36.67
0.26-0.5	39	26
0.51-0.75	43	28.67
0.76-1	13	8.67
Total	150	100
Mean	0.36	
Standard Dev.	0.33	
Max	1	

4.4.5 Human risk

The distribution of the respondents by their level of human risk is shown in Table 4.27.

From the table, the modal class of human risk was found to be between 0-0.25 levels of risk, accounting for 41.3 percent. The mean level of human risk was 0.38.

Table 4.27: Distribution of the respondents based on their level of human risk

Human risk	Frequency	Percentage
0-0.25	62	41.33
0.26-0.5	38	25.33
0.51-0.75	30	20
0.76-1	20	13.33
Total	150	99.99
Mean	0.38	
Standard Dev.	0.27	
Max	1	

The results show that the average level of risk among irish potato farmers is highest for marketing risk. The importance of this risk sources can be explained by the fact that irish potato farmers in Plateau state had experienced these last year some important failure in yield due to diseases like potato late blight disease and bacterial wilt, which resulted in low yield of the crop, relatively small tubers which led to low prices due to output quality. This result is similar to the results obtained by Meuwissen *et al.* (2001), who revealed that the farmers perceive price and production risk as the important sources of risk. According to Alimi and Ayanwale (2005), who investigated the risk and risk management strategies in onion production in Kebbi State of Nigeria, revealed that output price was the most important risk source with seventy percent of the respondents putting it first and having the highest index.

4.5 Risk-Coping Strategies Adopted by Irish Potato Farmers in the Study Area

Farm households have developed various mechanisms for coping with risk. Most of these mechanisms offer short-term protection. Irish potato farmers in the study area managed risk by implementing practices that would reduce their exposure to risk. Various risk management practices were identified with the farmers; and further investigation was done to find out those adopted by the farmers. These strategies generally act to reduce variability of output in Irish potato farming business.

4.5.1 Production risk-coping strategies

The results in Table 4.28, shows the coping strategies used to deal with production, marketing and financial risks among the farmers in the study area. The result shows that (74 percent) of the farmers use irrigation as a management strategy to deal with risk of drought, erratic rainfall, and insufficient amount of rainfall and flood. It was realized that most of the farmers had the technical know-how in using the simplest irrigation system. Irrigation is not just a risk management strategy but also has a major impact on output through complementing it with multiple cropping and improved seeds during cultivation. Majority of Irish potato farmers used enterprise diversification in the form of mixed cropping (62 percent). Also (as much as) 44.7 percent and 39.3 percent of the farmers used occupational diversification (i.e. supply of labour for non-farm wage income) and geographical diversification respectively as risk coping mechanisms. Family members working off-farm is seen as an important management strategy by the farmers because working off-farm boosts household income. This result is consistent with the findings of Beyena (2008) for Ethiopian farmers, and of Babatunde and Qaim (2009) and Salimonu and Falusi (2009), for Nigerian farmers. However, 15.3 percent of the farmers had a reduction in the size of meals and consumption of less preferred food.

Reduced consumption was seen as relatively the least important coping strategy, probably because farmers can borrow grains or cash from their relatives.

4.5.2 Marketing risk-coping strategies

From Table 4.28, it can be seen that about 40.7 percent of the farmers in the study area did not sell all the farm produce at the same time because farm produce is associated with seasonal price variation. Farmers try to take advantage of periods when supply is low and the demand is high so as to get good prices, thereby maximizing profit. Again, 38.7 percent of the farmers used selling their produce to the final consumer to manage risk in marketing. This is because smallholder farmers tend to prefer farm gate sales because they receive immediate payments and do not incur marketing costs such as transportation costs and tax payments (Shiferaw *et al.*, 2006).

4.5.3 Financial risk-coping strategies

The results in Table 4.28 revealed that 59.3 percent of the households spent their savings in order to protect their consumption and sharp decline in income. 42.7 percent of the farmers used selling of assets to manage financial risk. Most farmers in the study area have livestock enterprises which serve as liquid assets, livestock and livestock products are sold when there is food shortage or when there are other needs to be met by the household. The result is comparable with those of Salimonu and Falusi (2009) and Korir (2011), who reported that farmers sell liquid assets as a means of managing risk. About 40.7 percent of the farmers borrowed (cash or grains) as an important risk coping strategy. Borrowing has a cushion effect on farmers' finances during periods of scarcity and borrowing of grains helps to reduce hunger, especially towards the period of harvest. From the results, all the farmers interviewed did not receive any relief from

Government/ NGO to assist them in situation of bad uncertain occurrence such as adverse weather effects, pest infestation, and drastic low price hicks. About 38 percent and 16.7 percent of the farmers used receiving remittances from friends and family and withdrawing children from school as a coping mechanism. Remittances by the migrant labour can help households overcome credit shortage and market imperfection, and help to ensure the steady development of family production and maximize utility (Zhao, 2003). Some households think that school cost is so high and they want to cut the expenditure as a means to cope with financial risk.

Table4.28: Irish potato farmers' coping strategies to deal with risk in the study area

Coping strategies	Use		Do not use	
	Frequency	Percentage	Frequency	Percentage
Strategies for production risk				
Irrigation	111	74.00	39	26.00
Mixed cropping	93	62.00	57	38.00
Migration(geographical diversification)	59	39.30	91	60.70
Reduction in food intake	23	15.30	127	84.70
Engagement in non-farm activities	27	44.70	83	55.30
Strategies for marketing risk				
Spreading sales over several time period	61	40.70	89	59.30
Selling to the final consumer	58	38.70	92	61.20
Strategies for financial risk				
Holding cash(savings)	89	59.30	61	40.70
Selling of assets	64	42.70	86	57.30
Receiving remittances from friends and family	57	38.00	93	62.00
Borrowing money or grains	61	40.70	89	59.30
Relief from government/NGO	-	-	150	100.00
Withdrawing children from school	25	16.70	125	83.00

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

4.6 Factors Influencing the Adoption of Risk-Coping Strategies

The results in Table 4.29, show the multiple regression estimates of factors influencing the adoption of risk-coping strategies with some selected socio-economic variables.

$$Y_i = \beta_0 + \beta_1x_{1i} + \beta_2x_{2i} + \beta_3x_{3i} + \beta_4x_{4i} + \beta_5x_{5i} + \beta_6x_{6i} + \beta_7x_{7i} + \beta_8x_{8i} + \beta_9x_{9i} + \beta_{10}x_{10i} + u_i \dots \dots \dots (18)$$

Basing all discussions at 5% level of probability. From the table, the expected sign of the coefficient of age is hypothesized to be negative, implying that old people tend to be more risk averse than young people and are, therefore, less likely to adopt risk-coping strategies (Njoku, 1991). The result from the study reveals that age is positive and significant at 5 percent level. Thus, as the age of the farmer increases, the tendency to adopt risk-coping strategies increases which, however is contrary to expectation. The probable reason for this is that older people may tend to adopt better coping strategies especially in the areas of remittance, borrowing and sale of valuable assets because they have more experience in farming and are better able to assess the characteristics of modern technology than younger farmers (Bayard *et al.*,2007; Derassa *et al.*,2005).

Gender of the household head is positive and significant at 1 percent. This implies that male-headed households adopt more risk-coping strategies than female-headed household. This is in line with the a-priori expectation. Male- headed household have relatively more access to information, land, technology, inputs and credit than female-headed households (Saito and Weidemann, 1991).

Dependency ratio is positive and significant at 1 percent. This implies that as the dependency ratio increases, the likelihood to adopt risk-coping strategies also increases. This is in line with the apriori expectation. The reason is that owing to the scarcity of

resources, an increase in household size especially the non-working members put pressure on consumption than production and, therefore, the greater the food requirements to meet the needs of the unproductive group (the young and the old). therefore, less likely to adopt risk-coping strategies (Feleke *et al.*, 2003).

The expected sign of the coefficient of farm size is hypothesized to be positive and significant at 5%. This implies that as the farm size increases, the likelihood to adopt agricultural risk-coping strategies also increases. This is in line with the a-prior expectation. The reason is that the large-scale farmers are usually high capital base farmers and, therefore, can easily purchase and use improved inputs and practices than small-scale farmers thus, increasing the adoption of risk-coping strategies (Njoku, 1991).

The expected sign of the coefficient of amount of credit received is hypothesized to be positive, implying that the availability of credit enhances farmers' ability to purchase the inputs embodied in a new technology and also pay hired labour needed for the use of these inputs and improved management practices which increases the adoption of risk-coping strategies (Njoku, 1991). The result from the study reveals that amount of credit received is negative and significant at 1 percent. This implies that as the amount of credit received increases, the tendency to adopt risk-coping strategies reduces. This finding may be as a result of the fact that farmers are not using the credit they access from financial institutions for their production activities. The farmers may sometimes use the credit they access to cater for other household needs. Therefore, this could be the reason why financial services do not contribute significantly to the adoption of risk-coping strategies (Onumah *et al.*, 2014).

Table 4.29: Factors influencing the adoption of risk-coping strategies among farmers in the study area

Variables	Coefficient	Standard Error	T-value
Constant	6.01	1.12	5.38**
Age(X1)	0.04	0.02	2.51**
Farming exp. (X2)	0.03	0.02	1.68
Gender (X3)	1.25	0.46	2.73**
Household size (X4)	0.13	0.07	1.85
Dependency ratio (X5)	1.86	0.56	3.31**
Educational level (X6)	0.22	0.14	1.55
Extension (X7)	0.26	0.20	1.27
Cooperative (X8)	0.00	0.37	0.12
Farm size (X9)	0.12	0.06	2.21**
Amount of credit (X10)	6.92E-07	1.12	5.38**
R² = 0.8744,			
Adjusted R² = 0.8653			

** = P<0.05

Hypothesis 2: There is no relationship between the socio-economic characteristics of small-scale Irish potato farmers and the adoption of risk-coping strategies. The test was significant at 1% level of Probability with an F-value of 96.75 therefore, hypothesis 2 was rejected. This implies that the socio-economic characteristics of small-scale Irish potato farmers significantly affect the risk-coping strategies adopted.

4.7 Effect of Risk-Coping Strategies on Poverty Status of Irish Potato Farmers in the Study Area

The results presented in Table 4.30 revealed that there is a significant relationship between risk-coping strategies and the poverty status of the farmers. The R² value was 0.35 and implied that 35 percent of the variation that occurred in the poverty status of the farmers could be explained by the coping strategies adopted among the respondents.

The coefficient obtained for the coping strategy index (-2.73) was negative and significant at 5 percent of probability. This implied that as coping strategies adopted increases, the poverty status of the respondents reduces. This result is similar to that of Abdelhak *et al.* (2012), who found that there exists a negative relationship between poverty and households' coping strategies.

Table 4.30: Maximum likelihood estimates of the Logit regression model for the effect of risk-coping strategies on poverty status

Variable	Coefficients	Standard Dev.	T-value
Constant	2.98	1.42	2.1
Coping Strategies	-2.73	1.22	-2.23**
Goodness of Fit			
F-value	13.35		0.002***
R-squared	0.35		
Number of observations	150		

Note: ** = Significant at 5% level of probability

Hypothesis 3: Adoption of risk-coping strategy has no effect on poverty levels of Irish potato farmers.

The test was significant at 5% level of probability with the T-value at -2.23, therefore hypothesis 3 was rejected. This implies that adoption of risk-coping strategy has effect on poverty levels of Irish potato farmers.

4.7.1 Risk-coping strategies and their contribution to poverty reduction

Table 4.31 shows the distribution of respondents based on their risk-coping strategies and the contribution to poverty reduction. Contribution to poverty reduction was measured as the ratio of the number of non-poor Irish potato farmers who had adopted a given risk-coping strategy to the total number of non-poor estimated from the pooled

data. The total number of non-poor estimated from the pooled data was found to be 65 people. However, given that the sampled Irish potato farmers adopted more than one coping strategy so a case of multiple responses where 335 farmers were observed to be non-poor. Following this reasoning, the modal class of risk-coping strategies was found to be mixed cropping, followed by irrigation and drawing up on savings while the least risk-coping strategy was found to be those withdrawing children from school. According to Table 4.31, 50 sampled Irish potato farmers who practised mixed cropping to cope with risk were found to be non-poor out of the 65 farmers who are poor from the pooled data. 45 sampled Irish potato farmers that practised irrigation farming to cope with risk were found to be non-poor out of the 65 farmers who are poor from the pooled data. 42 sampled Irish potato farmers who drew up on their savings to cope with risk were found to be non-poor out of the 65 farmers who are poor from the pooled data. 3 sampled Irish potato farmers that withdrew their children from school to cope with risk were found to be non-poor out of the 65 farmers who are poor from the pooled data.

Table 4.31: Distribution of the respondents based on their risk-coping strategy and their contribution to poverty reduction

Coping Strategies	Poverty status			Percentage
	Count	Poor	Non-poor	
Selling of assets	64	38	26	7.74
Mixed cropping	64	14	50	14.88
Irrigation	111	66	45	13.39
Migration	59	39	20	5.95
Savings	89	47	42	12.50
Off-farm activities	67	35	32	9.52
Adjustment in food intake	64	35	29	8.63
Borrowing money	61	35	26	7.74
Receiving remittances	57	37	20	5.95
Spreading sales	61	39	22	6.55
Selling to final consumers	58	38	20	5.95
Withdrawing children from school	3	0	3	0.89

Total	758*	423*	335*	100
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* Multiple responses were allowed, hence total frequency exceeded sample size

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The broad objective of this study is to analyse poverty, risk and risk-coping strategies of small-scale irish potato farmers in selected local government areas in Plateau State of Nigeria. The specific objectives were to describe the socio-economic characteristics of irish potato farmers in the study area, determine the poverty levels of irish potato farmers, determine the socio-economic factors influencing the poverty level of irish potato farmers, describe the various risks associated with irish potato production, describe the risk-coping strategies adopted by irish potato farmers, determine the socio-economic factors influencing the adoption of risk-coping strategies by irish potato farmers, determine the effect of adoption of risk-coping strategies on poverty levels of irish potato farmers.

Primary data were used for this study and these were collected with aid of structured questionnaire by trained enumerators over 2014 rainy season. The first stage involved a purposive selection of 3 Local Government Areas (Bokkos, Mangu, and Barkin-Ladi). The second stage involved a random selection of nine villages from the 30 villages in the three selected LGAs, using probability proportional to size method during the rainy season of 2014. In the third stage of the sampling procedure, 10 % of the irish potato farmers were selected from the sample frame of irish potato farmers in each of the 9 villages. Finally, systematic random sampling method was used in selecting the irish potato farmers in each village, giving a total of 150 respondents for

the study.

Descriptive statistics, Foster Greer and Thorbeck, regression model involving Tobit, multiple regression and Logit were employed to analyze the data. The results revealed that 34 percent of the farmers were within 41-50 years. Only 4 percent were below 30 years of age. The mean age of the farmers was 48 years. About 83.3 percent were male and 16.7 percent female. Only 20 percent were unmarried while 80 percent were married. About 37.33 percent had 4-6 members in their household and the average household size was 7 members. About 57.34 percent had dependency ratio of between 0.21-0.6. About 28 percent had between 11-20 years of farming experience while only 0.67 percent had farming experience greater than 50 years. Average farming experience was 16 years. Only 15.33 percent did not have formal education. About 71.34 percent had farm size between 0.1-2.0 hectares, average farm size was estimated to be 1.8 hectares. Majority of the farmers (82.67 percent) had no contact with extension agent while 11.33 percent had between 1-2 contacts. It was found that 63.33 percent had no access to credit. About 20.67 percent obtained credit between ₦1-3000, while 8 percent received between ₦30001-60000. About 68 percent did not belong to any cooperative association while 14.67 percent had between 1-5 years of cooperative membership.

It was found that 49.02 percent derived their income from crop farming. About 7.84 percent had agricultural wage employment as their source of income and 11.11 percent obtained their income from non-agricultural wage employment. Average income for farm and non-farm sources of income was ₦ 169656 and ₦ 28840 per annum. The results revealed that 24.67 percent of Irish potato farmers earned per capita income

above ₦25000. It was further found that the poverty line was ₦ 16861. About 43, 29, 28 percent of the Irish potato farmers belong to non-poor, moderate poor and core poor poverty profile respectively. The determinants of poverty in the study area were farming experience, sex, household size, education, amount of credit received. These variables were positively related to the poverty status.

It was found that 89.3 percent rated disease incidence as the most important source of production risk. About 68.7 percent rated inadequate price due to output quality as the most important source of market risk. About 94 percent rated difficulty in having a form of insurance for farm as the most important source of financial risk. About 54.5 percent rated loss of output due to wrong information disseminated from a group belonged to as the most important source of institutional risk. It was further found that about 49.3 percent rated household member being sick during the last cropping season as the most important source of human risk. Marketing risk had the highest level of risk with a mean of 0.6.

The results revealed that 74 percent used irrigation as a coping strategy against production risk. About, 40.7 percent used spreading of sales over several time periods as a coping strategy against marketing risk. It was further found that holding cash (saving) was used as a coping strategy against financial risk. The determinants of risk-coping strategy in the study area were age, farming experience, sex, dependency ratio, farm size, amount of credit received. These variables were positively related to the number of risk-coping strategies adopted.

Risk-coping strategy was also found to be significantly related with the poverty status of

the respondents in the study area. The estimated coefficient (-2.73) obtained for the risk-coping strategy was negative and significant at 5 percent level of probability. This implied that as risk-coping strategies increases, poverty status of the respondents also decreases. It was also found that mixed cropping contributed the most to poverty reduction.

5.2 Conclusion

Empirically, the incidence of agricultural risk is high among irish potato farmers in Plateau State. The farmers experienced different types of risk, however, the farmers adopted different types of coping strategies against the risk encountered. Socio-economic characteristics such as sex, education, amount of credit received, age, and dependency ratio were the main determinants of risk-coping strategies, meaning that adequate attention should be given to these variables. About 56 percent of the respondents were poor. Socio-economic characteristics such as farming experience, household size, education, amount of credit received were the main determinants of poverty. The adoption of risk-coping strategy and poverty status of the respondents were negatively and significantly related, meaning that as risk-coping strategies increase, the poverty status of the respondents' decreases. Mixed cropping was the most effective risk-coping strategy that contributed to poverty reduction.

5.3 Recommendations

Based on the findings of this study, the following recommendations, among others are put forward:

- i. Government and private insurance companies should develop more effective insurance product for irish potato farmers to patronize and use as shock

absorbers against risky events.

- ii. Financial institutions and banks as well as government poverty alleviation fund programs are encouraged to strengthen the provision of credit assistance to Irish potato farmers to enable them to adopt the most efficient practices to increase production beyond subsistence level.
- iii. Farmers are encouraged to form formidable cooperatives to manage production and marketing related problems. This brings out the suggestion that when choosing group members, farmers working towards the same goal should be grouped together. In addition, rules and roles within the group ought to be specified from the beginning and strictly observed.
- iv. It has been highlighted in the study that loss of output due to wrong information disseminated from a group belonged by the farmers is still a problem among Irish potato farmers. As such, market information should be consistently supplied to the farmers through the help of both private and governmental organizations through radio programs conducted in different languages and farmer workshops can be considered for information dissemination.
- v. The ministry of agriculture, agricultural sector and the agricultural bank are encouraged to help Irish potato farmers find markets for their produce. This can be achieved through encouragement of time contracts, preventing monopolies, marketing and storing the crops until they are sold.
- vi. The existing research centres established by Government for potato research, namely National Root Crop Research Institute, Umudike and Potato Research

Institute, Jos, should be strengthened to achieve their mandates for research into better varieties that can withstand prolonged storage conditions.

5.4 Contribution of the Study to Knowledge

- i. The study revealed that marketing risk had the highest level of risk with an average of 0.6 among the irish potato farmers.
- ii. The study revealed that mixed cropping was the most effective risk-coping strategy that reduced poverty by 14.88 percent.
- iii. The study revealed that irrigation (74percent), spreading of sales over time period (40.7 percent), and holding cash (59.3 percent) were the most pronounced coping strategies adopted by irish potato farmers against the risks they encountered.

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APPENDIX

ANALYSIS OF POVERTY, RISK AND COPING STRATEGIES OF IRISH POTATO FARMERS IN SELECTED LOCAL GOVERNMENT AREAS OF PLATEAU STATE, NIGERIA

Dear Respondent,

This questionnaire will be used by a student of the Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University, Zaria. Please, fill as appropriate. All information will be treated with confidentiality and strictly for the purpose of research. Thanks for your co-operation.

Section 1: Identification information

Name of farmer (optional):
Tel. No. (optional):
Questionnaire ID No:

Section 2: General information

LGA:
Village:

Section 3: Socioeconomic Characteristics

- Sex a. Male () b. Female ()
- Age of household head -----years
- Marital status
a. Single () b. Married () c. Separated () d. Divorced () e. Widowed ()
- How many people are living with you and sharing your meals daily? -----
- How many members of your household are less than 15 years of age? -----
- How many members of your household are greater than 65 years of age?
- Level of education a. Non- formal () b. Primary () c. Secondary ()
d. Tertiary () e. Others ()
- What is your main occupation?
a. Crop farming () b. livestock rearing () c. Mixed farming ()
d. Petty trading () e. Civil servant () f. laborer () g. Others ()
- What is your secondary occupation?
a. Crop farming () b. livestock rearing () c. Mixed farming ()
d. Petty trading () e. Civil servant () f. laborer () g. Others ()
- How long have you been into Irish potato farming-----Years

11. What farming system did you adopt during the last cropping system?
 a. Monocropping () b. Mixed Cropping () c. Intercropping ()
 d. Others ()
12. Kindly give the estimate of your land size-----hectares
13. What is the main source of land used for farming?
 a. Inherited () b. Bought () c. Rented () d. Gift ()
 e. Other sources ()
14. Do you belong to any cooperative organization/ farmers' association?
 a. Yes () b. No ()
15. If yes, how long have you been in that cooperative organization/ farmers' association?-----years
16. Did you use credit last year?
 a. Yes () b. No ()
17. If yes, specify the source
 a. Commercial bank () b. Bank of Agriculture ()
 c. Cooperative Societies () d. Money Lenders () e. Friends and Family ()
 f. Others ()
18. What was the amount of credit used in the last cropping year? -----
19. Did you invest part of the money on Irish potato production?
 a. Yes () b. No ()
20. Have you been visited by an extension agent?
 a. Yes () b. No ()
21. If yes, how many times have you been visited by an extension agent? -----

Section 4: On-farm and off-farm Income (Please provide estimates)

	Amount (₦)
a. Irish potato	
b. Maize	
c. Soya beans	
d. Beans	
e. Sweet potato	
f. Vegetable	
g. Acha	
h. Millet	
I. Sorghum	
J. Others specify	
Off-farm income	
a. Non-farm self-employment (trading, tailoring, carpentry, crafts, bricklaying, blacksmithing, barber's work, shoe cobbling, repairing motorcycles etc.	
b. Non-Agricultural wage employment	
c. Agricultural wage employment	
d. Remittance income(money sent by children and relative	
e. Others specify	

Section 5: Risks faced by Irish Potato Farmers**Production Risks**

1. Did inputs' prices increase during the last cropping season?
 - a. Yes () b. No ()
2. Were your Irish farm (s) affected by any disease/pest during the last cropping season?
 - a. Yes () b. No ()
3. Was the level of rainfall in excess?
 - a. Yes () b. No ()
4. Was the level of rainfall insufficient?
 - a. Yes () b. No ()
5. Did you have insufficient labour?
 - a. Yes () b. No ()

Marketing Risks

1. Is there a market within your village?
a. Yes () b. No ()
2. Did you experience any loss in output due to inadequate storage facilities/market?
a. Yes () b. No ()
3. Did you receive inadequate price due to low output quality?
a. Yes () b. No ()
4. Did you have problems in transporting your output to market?
a. Yes () b. No ()

Financial Risks

1. Did you have difficulty in securing loan due to high interest rate?
a. Yes () b. No ()
2. Did you experience any form of difficulty in repayment of borrowed money?
a. Yes () b. No ()
3. Did you have any difficulty in having a form of insurance for your farm?
a. Yes () b. No ()

Human Risks

1. Did you experience a loss in asset due to theft/conflict?
a. Yes () b. No ()
2. Did you lose any member of your household that used to help you with farm activities?
a. Yes () b. No ()
3. Were you or any of your household' members sick during the last cropping season?
a. Yes () b. No ()
4. Did you experience any loss in income due to vandalism?
a. Yes () b. No ()
5. Did you experience a destruction of your house due to rains or fire?
a. Yes () b. No ()

Institutional Risks

1. Did you experience any difficulty in getting money from a cooperative you belonged to?
a. Yes () b. No ()
2. Did you experience any loss in output due to wrong information disseminated from a group you belonged to?
a. Yes () b. No ()
3. Did you have a delay in service delivery by a group you belonged to?
a. Yes () b. No ()

Section 6 Risk-Coping Strategies adopted by Irish Potato Farmers

1. Did you sell some of your assets in order to address some problems caused by the risks encountered?
a. Yes () b. No ()
2. Did you plant your Irish potato with other crops on the same plot?
a. Yes () b. No ()
3. Did you engage in any form of irrigation farming?
a. Yes () b. No ()
4. Did you or any member of your household migrate to a different location in search of a source of livelihood?
a. Yes () b. No ()
5. Did you use part of your savings to address some of the risks encountered?
a. Yes () b. No ()
6. Did you engage yourself in off/non-farm activities?
a. Yes () b. No ()
7. Did you adjust your food intake due to the risks encountered?
a. yes () b. No ()
8. Did you borrow money in order to cope with the risks encountered?
a. yes () b. No ()
9. Did you receive any form of remittance from people?
a. yes () b. No ()
10. Did you spread your sales while selling?
a. yes () b. No ()
11. Did you sell to the final consumer?
a. yes () b. No ()
12. Did you receive any relief from government/NGOs?
a. yes () b. No ()
13. Did you withdraw your children from school in order to cope with the risks encountered?
a. yes () b. No ()