ANALYSIS OF FARM RISKS AND MANAGEMENT STRATEGIES AMONG HOUSEHOLDS IN FCT, ABUJA, NIGERIA

BY

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DECLARATION

I hereby declare that this thesis titled **"Analysis of Farm Risks and Management Strategies among Households in FCT, Abuja, Nigeria"** has been written by me and it is a record of my research work. No part of the work has been presented in my previous application for another degree or diploma at any Institution. All borrowed ideas have been duly acknowledged in the text and a list of references provided.

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CERTIFICATION

This thesis titled **"Analysis of Farm Risks and Management Strategies among Households in FCT, Abuja, Nigeria"** by Olawoyin Taiwo AGBOOLA meets the regulations governing the award of the degree of Master of Science (Agricultural Economics) of Ahmadu Bello University, Zaria. It is adequate in scope and is approved for its contribution to knowledge.

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DEDICATION

The thesis is dedicated to the glory of the Lord God Almighty, who is my Wisdom, Strength and the Lifter of my head. May His Name be praise forever.

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My friends, Folarin, Adewale, Okorie, Hamza, Sule, Jide, Chucks, Bulama, Idris, Mrs Iyenagbe, Mrs Bakwo, Segun, bro Adeola your motivation and love are highly appreciated. Indeed you are good friends. My special thanks to my mother, Madam Serah Folashade Agboola who has been my tower of strength and support. May your strength equal your days in Jesus Name. (Amen). My mother-in-law, Mummy Abigail Areo, thank you, although daddy departed not too long, his memory was blessed, Late Pa Thomas Adebayo Areo. My sisters, Mrs R.M Afolabi, Mrs A.O Dahunsi and Mrs J.B Olorundare and their families, God will not forget your labour of love.

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LIST OF ABBREVIATIONS

ADP   Agricultural Development Programme

AMAC   Abuja Municipal Area Council

ASA   Attitudinal Scale Approach

ATA   Agricultural Transformation Agenda

CISC   Corrected Item Score Correlation

EU   Expected Utility

FCT   Federal Capital Territory

MFBs   Microfinance Banks

MFIs   Microfinance Institutions

NFDP-II   Second National Fadama Development Project

NFDP-III   Third National Fadama Development Project

NIRSAL   Nigeria Incentive Based Risk-Sharing System for Agricultural Lending

NPFS   National Programme for Food Security

PCM   Paired Comparison Method

PT   Prospect Theory

RTEP   Root and Tuber Expansion Programme

SPFS   Special Programme for Food Security

VNM   Von Neumann Morgenstern

ABSTRACT

The main objective of the study examined farming households' risk attitudes and their management strategies toward risk. While the specific objectives identified the major sources of risks to agricultural production in the study area, determined household's perceived magnitude of these risks and risk attitude of rural households, determined the relationship between risk attitudes of the household and their social-economic characteristics and identified risk management strategies available and used by rural households in the study area. Primary data on what the farm households identified as source of risks to their agricultural production, perceived magnitude of these risks, socio-economic characteristics, risk attitudes, management strategies of the rural households etc were collected with the aid of well structured questionnaire using interview method. And analytical tools employed in achieving the study objectives were descriptive statistics such as pie chart to describe risks to agricultural production among the households and the magnitude of the perceived risks; Attitudinal Scale Approach (ASA) model addressed the rural farming households' risk attitudes and multiple regression analysis was used to estimate the relationship between risk attitudes of the farming households heads and their social-economics characteristics. The study revealed that the major threats and risks that posed threat to agricultural production within the last five years were inadequate farming land, high interest rate, ill health of the farmers and lack of animal vaccination. These were reported by 60.00%, 53.78%, 48.06% and 38.73% of the sample households, respectively. The R^2 values of 0.410 and 0.424 showed that about 41% and 42% of the risk attitudes of the rural farm households were explained by the socio-economic characteristics and management strategies employed by the households respectively. The ratio of risk aversion to preference attitudes was about 1:2 implying that in every three farming households, one could be categorized as having risk averse attitude and would adopt management strategies. Risk neutral was not common among the farmers. The farmer's age, year of farming experience, farm size, off-farm income and gross farm income were significantly related to the risk attitudes of the respondents at between 5 and 10 percent levels, respectively. The results further showed that involvement in livestock production to complements household income, Off-farm activities, household members' interest in farming were the most effective management strategies used by households, respectively. The study recommended that with the government' Agricultural Transformation Agenda (ATA), the youth, whose age brackets are prone to risk taking in farming enterprises should be mobilized into agricultural ventures to serve as platform for job creation for youths. Secondly, the government should ensure that the farm risk-sharing facility window of Nigerian Incentive-based Risk Sharing System for Agricultural Lending (NIRSAL) should network with Microfinance Institutions (MFIs), Microfinance (MFBs), and Commercial banks etc, to mitigate high interest rate in their credit facilities to farming households.

CHAPTER ONE

INTRODUCTION

1.1   Background to the Study.

The knowledge of how subsistence farm households make economic decisions under risk is important in determining strategies and formulating policies for agricultural development. With the return to democratic rule in 1999, Nigerian government has reaffirmed its commitment to increasing growth and reducing poverty, especially through a strong focus on the agricultural and rural sector. About 90 percent of the total agricultural output is accounted for by households, which on the average cultivate about 2 ha of land (NPFS Main Report, 2006). The level of poverty among these producers is high, and with the low contribution of the nonagricultural sector in rural economy, any strategy for increasing rural incomes has to focus on generating rapid growth in the agricultural sector. To this end, the Nigerian government has also launched a series of development and poverty reduction programs, such as the Special Programme for Food security (SPFS, 2001); National Programme for Food Security (NPFS, 2007); National Fadama Development Project-II (NFDP-II, 2003); National Fadama Development Project-III (NFDP-II, 2008); Community-Based Agriculture and Rural Development Programme (CBARDP, 2003) and Root and Tuber Expansion Programme (RTEP, 2000). However, these programmes, which target the rural households, will only achieve their set out goal and purpose if knowledge of farm related risk attitudes among the rural households and the management strategies adopted to cushion the effects of threats are taken into consideration.

Wolgin (1975) studied impact of risk on households' production, consumption and technology decisions, and found out that high degree of risk is caused by erratic

rainfall, poorly functioning or missing markets, pests and diseases and poor health situation. Other studies by Udry (1990, 1994), Townsend (1994) and Dercon (1996) analyzed risk coping management strategies and reported use of assets, savings, effective public safety nets and financial markets as some of the sustainable mechanisms to manage and mitigate risk. Under conditions where insurance and credit markets are incomplete or do not exist, such financial strategies are typically weak or insufficient, and they represent only one element of small scale farming households' responses to risk. Farming households' savings may be too little to cope with the risk, hence there is need to devise sustainable mechanisms to manage and mitigate risk.

A possibly more important strategy is small scale farmers' effort to diversify economic activities before shocks occur, or to re-adjust labor supply decisions after a shock has occurred. Here the importance of the presence and well functioning of a labor market is significant given that labor is the principal asset owned by the poor. The following researchers who had related works on risk studies had reported that there is strong evidence that poor farm households are risk-averse (Moscardi and de Janvry, 1977; Dillion and Scandizzo, 1978; Binswanger, 1980, 1981, 1982; Antle, 1983, 1987). These general conclusions and observations have stimulated considerable research into the effects of risk on farming households' economic decisions.

Empirical evidence is still lacking on how rural households respond to shocks resulting from risks in non-dynamic and subsistence agricultural environments in contrast to more dynamic rural settings. It will be important for policy makers to understand the risk attitudes and management strategies of rural households. Small scale farming households' off-farm diversification, crops choice, socio-economic characteristics etc

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are important factors affecting their ability to smooth consumption during income shocks. To this end this study will focus on understanding the risk attitudes and strategies used by rural households in managing negative farm related risks using Federal Capital Territory as a case study.

1.2. Problem Statement

There is a common perception that rural households are averse to modifications in their production, financial and marketing practices due to their risk aversion behaviour. A distinctive feature in the lives of rural farming households is the importance of risk. This is immediately apparent due to the fact that they depend upon farming for their livelihoods (NPFS, 2006). Differences/variations in climatic conditions, intensity and amount of rainfall, the incidence of diseases and pests, crop failure, fire outbreak, price fluctuations, unstable government policies, farmers ill-health etc, cause farm income to fluctuate unpredictably. The variations in climatic conditions, intensity and amount of rainfall are source of risk and uncertainty to production activities of the rural farming households. The crop production activities which are largely rain-fed and irrigated would be largely affected if the threshold variation in the rainfall distributions is either too high or low. This constitutes risk, which not only affects crop income; it has an indirect effect on off-farm income as well as the households' livelihood (Wolgin, 1975).

The farmers ill-health coupled with high level of household poverty are factors which primarily affects downward income fluctuations, and may be very risky situation limiting the economic activities of the farmers. Furthermore, poor subsistence farming households tend to live furthest away from health facilities and in areas with poor infrastructure. Weak health and bad nutrition also affects labor supply for farming and wage market. In such health situations, households face extreme unfavorable trade-offs.

They must engage in short term responses which provide an immediate gain in income and consumption smoothing.

The problems of price fluctuation may constitute a risk to the farmers since government policies on price that are not farmers friendly could be a threat to the farming activities of the rural households. Also, incidence of diseases and pests, crop failure and fire outbreak as may be experienced in the dry session are factors that have impact on the rural household economic activities. Meanwhile, the risk attributed to the above mentioned factors, if not well managed will result in multiplier effects in negating the farmers' productivity, and rural households' livelihood improvement. To this end, the study attempted to answer the following research questions:-

i. What are the major sources of risks to agricultural production in the study area?

ii. How do households perceive magnitude of these risks?

iii. What are risk attitudes of rural households in the study area?

iv. Are risk attitudes influenced by households' socio-economic characteristics?

v. What are the risk management strategies used by rural households?

vi. What is the effectiveness of risk management strategies used?

1.3   Objectives of the Study

The main objective of the study is to examine farming households' risk attitudes and their management strategies toward risk. The specific objectives are to:-

i   identify the major sources of risks to agricultural production in the study area.

ii   determine household's perceived magnitude of these risks.

iii   determine risk attitude of rural households in the study area.

iv   determine the relationship between risk attitudes of the household and their social-economic characteristics.

v   identify risk management strategies available and used by rural households.

vi   determine the effectiveness of the risk management strategies used.

1.4   Justification of the study

This study is important in the sense that knowledge of rural households' attitudes to risk and their management strategies under risk could help in determining strategies and formulating policies for agricultural development. This will lead to the development of normative decisions theory (i.e identifying the best decisions to take) based on the inclusion of stochastic (random) element in whole farm planning models for agricultural development via the small-scale farmers. Thus, this study examined risk decision behavior of small scale farmers in Bwari and Kuje Area Councils of FCT, Nigeria. Particularly, the focus of this research was on identifying farmers risk behaviors (attitudes) and their management strategies. This is an avenue to identify the opportunities and constraints faced by the rural farming households in the process of maintaining smooth income and consumption. Moreover, it would also serve as a guide in determining appropriate risk management policies.

Also, more immediate gains in rural households' welfare can be achieved through proper and better understanding of their management strategies and knowing their

attitudes towards risk. Knowing the attitude of the rural households would enable policy makers to devise policies that can overcome some of the critical constraints they now face in meeting their basic needs. Therefore, there is a need for field level studies to assess the validity of such perception in the study area for effective interventions through development policies, programmes and farm advisory services.

1.5   Hypotheses

The following hypotheses were tested:

i.   There is no significant relationship between the rural households' risk attitudes and their management strategies.

ii.   There is no significant relationship between the rural households' risk attitudes and their socio-economic characteristics.

1.6   Operational definition of terms

Risk- can be defined:- (a) as the probability that an action or event will occur either with adverse or beneficial results; (b) situation which is possible to assign a probability to each of the possible outcomes; (c) a concept that denotes precise probability of specific eventualities; (d) as an indicator of threat, vulnerability, impact and uncertainty (FARMD,2009).

Risk Attitudes- is a concept of responses to option(s) under risk. Such responses could be aversion, neutrality or preference response.

Risk Aversion- is the reluctance of a person to accept a probability with an uncertain payoff rather than another probability with more certain, but possibly lower payoff (FARMD, 2011)

Risk Neutrality- is indifference to accept a probability with certain or uncertain payoff (FARMD, 2011)

Risk Preference- can be defined as preferring a probability with the guaranteed option, rather than taking another probability (FARMD, 2011)

Management Strategy- can be defined as concise effort(s) to reduce risk adverse effect(s).

Rural Households- according to Karlsson, Pfuderer and Salvioni (2004), rural household was defined as a group of people living together in the same dwelling unit in rural area, and sharing essentials of living such as food with or without pooling of income and resources

CHAPTER TWO

LITERATURE REVIEW

2.1   Risk Attitudes of Small-Scale Farmers in Nigeria

Agricultural production is characterized by risk. Dependence of production on biological processes makes it susceptible to uncertain climatic conditions, incidence of pests and diseases, crop failure, fire outbreak, price fluctuation, farmers' ill health etc . These lead not only to uncertainty in the level of production, but also to uncertainty in output prices. This can result in severe income losses and to fluctuations in consumption. Given their limited ability to offset these shocks, many rural small scale farm households suffer from extreme farm income fluctuations (Wolgin, 1975).

Ayinde (2008) conducted a study on the risk attitude of small scale crop producers in Kwara State, Nigeria and found out that the farming households in the study area placed different preference on their risk attitude namely, risk taking, risk neutral and risk averse. However, her study revealed that the risk averse behavior of the small scale farmers was ranked first, while risk neutral behavior ranked second and risk taking behavior ranked third among the small scale farmers attitudes towards risk in their crop production.

Farmers, most especially small holders in developing countries, are risk averse. This is probably because of their low resource base and the consequences of failure on their social and economic status in the community. Oguntade and Bamire (1994) using safety-first rule indicated that 81% of the arable crop farmers of Odo-Otin LGA of Osun State in Nigeria exhibited risk averse behaviors. However, variation exists in the degree

of farmers' aversion to risk such that for some of them to absorb additional risk would require higher compensations than others. Thus, a farmer or a group of farmers could be described as showing a high or low aversion to risk or occupy a position in between the two extremes and therefore exhibit either increasing or constant or decreasing aversion towards risk. Furthermore, Oguntade and Bamire (1994) using linear programming model reported that risk loving arable crop farmers in Odo-Otin LGA of Nigeria were compensated for by a higher return compared to those who exhibited risk averse behaviors. The duo concluded that Nigerian farmers like other farmers in developing countries are risk averse.

Alimi and Ayanwale (2005) conducted a study on the risk attitude and management strategies of onion production in Kebbi State of Nigeria and reported that a risk loving farmers should engage in onion enterprise only and a risk averse farmer in non-onion crop enterprise if crop enterprise specialization is compulsory. Whereas, in enterprise diversification, a low risk averse farmer should put high proportion of farm to onion. And risk aversion attitudes of the farmer increases as proportion of farm to onion reduces until onion farm is 20% of total farm size for high risk averse farmer.

Therefore, different studies in Nigeria had shown that risk attitudes of rural farming households had supported the general assumption that farmers exhibited aversion behavior towards risk in their farming enterprise. Though the prevalence of these uncertainties and risks may not be new, small scale farmers have developed ways of reducing and managing risk (e.g. crop and off-farm diversifications, storage and asset accumulation). Kochar (1999) argued that labor supply readjustments rather than asset or financial strategies are the main strategy used by rural households in India to cope

with negative farm income shocks. Dercon (1998) discussed the importance of activity diversification in managing risk. Similarly, Rose (2001) provided evidence on *ex-ante* and *ex-post* response to risk finding that in response to large rainfall variability, farming households are more likely to participate in off-farm employment in India. Kurosaki and Fafchamps (2002) examined farmers' crop choices (*ex-ante*) in the presence of price and yield risk in Punjab, Pakistan, and found that even in well-developed markets, crop choices are dependent on risk.

2.2   Farmers' Risk Management Strategies

The qualities of risk management mechanisms are widely recognized, but not without limitations. Farmers risk management strategies consist of a variety of responses which may reduce the probability of an unfavorable event occurring and/or reduce the adverse consequences if the event occurs. The strategies can be costly in terms of the income opportunities that rural small scale farm households forego (e.g. crop diversification is typically less profitable than specialization). Farmers have limited capacity to spread covariate risks like droughts that affect almost all households in a region at the same time. In theory, these limitations would not exist if capital and insurance markets were perfect and could pool risks more widely, but the reality for many developing countries is quite the opposite. Relevant capital and insurance markets are poorly developed and they are weakly linked across regions and with urban areas (Hazell, 1982). As a result of these limitations farm households' economic decisions are highly influenced by the absence of credit and insurance markets (Binswanger, 1982; Antle, 1987).

Surveys of farmers' use of various risk management strategies identified some of the following: crop insurance; forward contracting; diversification; keeping cash at hand;

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farmers' associations; traders / cooperatives etc. In evaluating the risk management strategies of small scale farmers, various sources of risk in agricultural enterprise could be grouped into business and financial risk. Business risk occurs when there is variation in income levels and it is divided into the categories of technical, market and social risk. The technical risk is the risk associated with adverse variation in yield because of abnormally bad weather, disease or other climatological events (Penson and Lins, 1980). Market risk is that borne when actual prices are different from that originally expected. Social risk are derived from human factors such as theft, strikes, sudden death, accidents, wars etc that can lead to unexpected decline in yield or total loss of output. The use of debt in financing farm enterprise exposes it to financial risk. Financial risk, therefore, occurs when enterprise profitability (rate of return) is less than the cost of capital. It varies directly with financial leverage ratio (debt/equity ratio) and inversely with profitability. Since level of profitability of an enterprise depends on yield and prices of output and, inputs (cost of capital inclusive), financial risk is thus a by-product of business risk.

Barry and Frazer (1984) noted that the risk sources are as a result of gestation lag, biological nature of farmer and farming enterprise. The rural households in Ethiopia are exposed to a variety of risk sources that include harvest failure as a result of drought, floods, frost and other climatic events; policy shocks such as changes in taxation and bans on migrants; and death and illness of livestock (Dercon, 2002). High yearly yield fluctuations (in monetary term) per unit of land for the dominant crops in India (Townsend, 1994) and harvest failures of rural households in a resettlement area in Zimbabwe (Kinsey *et al*., 1998) are identified risk sources.

The risk sources vary in importance from one enterprise to another and from a group of farmers to another. The California agricultural producers ranked output price and input cost highest among their production and financial risks (Blank and McDonald, 1995). Ezeh and Olukosi (1991) identified irregularity in input availability, fluctuations in market prices, irregularity in water supply and variability in weather conditions as major risk sources responsible for variation in farmers' income in dry season farming. Osotimehin (1996) opined that many factors including vagaries of nature, diseases, insect infestations, general economic and market conditions contribute to the price, yield or net return variability of agricultural producers. In risk management strategies, these risk sources are uncontrollable by farmers. In developing countries, crop insurance markets are limiting or lacking, diversification does not allow for optimal use of scarce resources, production expansion is limiting due to limiting factors of production accessible to the small scale farmers etc are limitations to risk management mechanism. But, for many crops, price risk could be controlled. If a market exists for many important crops, including coffee, cocoa, cotton, sugar, palm oil, rubber, wheat and maize), farmers could in theory use them to lay off their risks - just like taking out crop insurance shifts part of their risks to the insurance company. Small scale farmers are unlikely to have direct access to markets where price risk could be managed due to their farm size. Farmers' associations, however, can invest in the necessary information systems and skills, and be active on the risk management markets on their members' behalf (Barry *et al.*, 1984)

It has been found that managing risk associated with price fluctuations, using hedging strategies, short-term price movements would have less impact on farming. In some countries, farmers burned down their coffee trees in response to exceptionally low

prices, with the result that they were unable to benefit from the tripling of coffee prices which occurred just a few years later. With price risk management strategies (hedging), farmers can take a longer-term perspective to mitigate the adverse effects of risks associated with crops' prices fluctuations. (Barry *et al*., 1984)

2.3   Measurement of Risk in Agriculture

Amongst decision theories used in analyzing and measuring the "riskiness" of a decision in the farm enterprise include the classical expected utility model of individual choice under risk and the non-expected utility model (Prospect theory), which assumes that individuals do not maximize expected utility. Others are Paired Comparison Method, as used by Brandley and Ralph (1976) and adapted by Adewumi and Omotesho (2002) to analyze farmers' attitude toward risk decisions; Attitudinal Scale Approach, as used by Bard and Berry (2000) to measure the risk attitude of the farmers as a determinant of the adopted risk management strategies.

2.3.1   The expected utility theory

The expected utility (EU) model has been the dominant model for the last decades in modeling behavior under risk. Von Neumann and Morgenstern (VNM) are the major contributors to a large body of work that provides the justification for the use of the expected utility model by a rational decision maker. This model views decision making under risk as a choice between alternatives. Decision makers are assumed to have a preference ordering defined over the probability distributions for which the axioms of the EU model hold (Mas-Colell *et al*., 1995). Risky alternatives can be evaluated under these assumptions using the expected utility function U(x).

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In maximizing the decision maker's utility, a risk prospect in which the decision maker does not know ex-ante which state of the world will occur is considered.. However decision maker can list the various alternatives and can attach probabilities to them. For simplicity, assume two possible states of the world, state 1 and state 2, with respective probabilities p^1 and p^2 and denote x_1 the individual's monetary gain if state 1 occurs and x_2 if state 2 occurs. The individual must choose ex-ante between the risky bundles (x_1, x_2). Ex-post, the individual gets x_1 or x_2 depending upon which state of the world has occurred. If the decision maker's preference ordering over risky alternatives satisfies all the axioms of expected utility, including the independence and continuity axioms, then there exists a Von Neumann and Morgenstern (VNM) expected utility function. This VNM expected utility function reflects the decision maker's choice as if he maximizes utility of the different states weighted by the probabilities for each state to occur.

VNM began by stating that utility maximization is a rational goal when a decision maker is faced with risky choices. In this framework, an individual will evaluate the expected value and objectively given probability of occurrence of each alternative. This evaluation is carried out by first entering the probabilities and expected outcomes into an individual's utility function. It is then a matter of selecting the combination of available alternatives that maximizes the function. The manner in which individuals choose among available alternatives is then dependent upon their utility function. For this setting the VNM expected utility function can be specified as:

$$U(p_1,..,p_i,..,p_N) = \sum_{i=1}^{N} p_i u(x_1) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \quad (1)$$

Where U is the VNM expected utility function, $u(x_i)$ is the utility of the ith element of a vector of possible outcomes, and p_i is the probability of outcome x_i, $\Sigma \, p_i = 1$. The VNM expected utility function $U(p_1,..,p_i,..,p_N)$, defined up to a positive linear transformation, characterizes both the utility of the outcome and the individual's attitude toward risk. The curvature of this utility function contains information about the degree of individual's risk aversion (Mas-Colell *et al.*, 1995: 173).

Axioms of the expected utility theory

There are three main axioms in the expected utility framework. They are defined over a binary relation where: $\geq$ denotes weak preference; $>$ denotes strict preference, and $\sim$ denotes indifference.

For preferences over probability distributions p,q,$r \in$ P, that are defined over a common (discrete or continuous) outcome vector X. The three axioms that are necessary and sufficient for the expected utility representation $U(.)$ over preferences are:

Axiom O (Order):

The asymmetric part of axiom O says that the decision maker will not both prefer p to q and prefer q to p. According to expected utility theory, it is irrational to hold a definite preference for p over q and a definite preference for q over p at a time. However, there is a possibility that neither p nor q is preferred (i.e. *p~q*, the decision maker is indifferent between *p* and *q*). The transitivity part of axiom *O* holds if and only if both $>$ and $\sim$ are transitive, i.e., for all, p,*q,r* $\in$ P, ($p \geq$q, and $q \geq$r) $\Rightarrow$ $p \geq$r; (*p~q and q~*r) $\Rightarrow$ p~r. Transitivity implies that it is impossible to face the decision maker with a sequence of pair wise choices in which preferences appear to cycle.

Axiom C (Continuity):

For all p,q,$r \in$ P with $p \geq q$ and $q \geq r$ there exists α, β $\in$ (0,1) such that: $\alpha p + (1-\alpha) r \geq q$ *and* $q \geq \beta p + (1-\beta)r$. This axiom gives continuity to the preferences. Continuity means that small changes in probabilities do not change the nature of the ordering between two lotteries (Mas-Colell *et al.*, 1995). Continuity rules out lexicographic preferences.

Axiom I (Independence):

For all p,q,$r \in$ P and for all α $\in$ (0,1), if $q \geq p$, then $\alpha p + (1-\alpha) r \geq \alpha q + (1-\alpha)r$. This axiom states that preferences over probability distributions should only depend on the portions of the distributions that differ (p and q), not on their common elements (*r*) and of the level of α that defines the linear combination. In other words, if we mix each of two lotteries with a third one, then the preference ordering of the two resulting mixtures does not depend on the particular third lottery used.

Axioms O, C, and I can be shown to be necessary and sufficient for the existence of a function *U(.)* on the outcomes $x \in X$ that represents preferences through $\geq$. The role of the order, completeness and continuity axioms are essential to establish the existence of a continuous preference function over probability distributions. It is the independence axiom which gives the theory its empirical content and power in determining rational behavior. That is, the preference function is constrained to be a linear function over the set of probability distribution functions, i.e. linear in probabilities (Machina, 1982: 278).

Theoretical Measures of Risk Attitude

A theoretical measure of risk aversion was independently proposed by Pratt (1964) and Arrow (1970) based on the VNM utility function. Two measures have resulted. One is a measure of absolute risk aversion:

$$r_A(x) = -\frac{U''(x)}{U'(x)} \quad\text{...} \quad (2)$$

The other is a measure of relative risk aversion:

$$r_R(x) = -x\frac{U''(x)}{U'(x)} \quad\text{.............................} \quad (3)$$

Where $U(x)$ is a VNM expected utility function with properties $U' > 0$ and $U'' < 0$, U' and U'' indicate the first and second order derivative of the expected utility function and x is the wealth or income position.

The indexes are positive, zero, or negative for risk-averse, risk neutral, and risk taking decision makers, respectively. Both Pratt (1964) and Arrow (1970) hypothesized that a risk-averse decision maker would display decreasing (non-increasing) absolute risk aversion for increases in x. A risk-averse individual with decreasing relative risk aversion will exhibit decreasing absolute risk aversion, but the converse not necessarily holds (Mas-Colell *et al*., 1995).

Following the work of Pratt (1964) and Arrow (1970), Menezes and Hanson (1970) proposed a related measure of risk aversion referred to as partial relative risk aversion. It is defined as

$$P(x,t) = -t\frac{U''(x+t)}{U'(x+t)} \quad\text{...} \quad (4)$$

Where $U(x)$ and x are as defined above and *t* is income associated with a new prospect that is increasingly risky for increases in its payoff. Both Menezes and Hanson (1970) hypothesized that a risk-averse decision-maker would display increasing (non-decreasing) partial relative risk aversion for increases in the prospect *t*.

To conclude, the expected utility model is based on axioms explaining individual behavior. The axioms are assumptions in choosing risk alternatives and describe how a rational individual should behave. If an individual obeys the expected utility axioms, then a utility function can be formulated that reflects the individual preferences (Mas-Colell *et al*., 1995: 175; Robison and *et al*., 1984: 13). Further individual's risk attitude can be inferred from the shape of his/her utility function. To this end, the predictive power of expected utility theory is tested through experiments or inferences made from actual observed economic behavior. Since VNM (1947), the expected utility model has been the dominant model in predicting choice behavior under risk. Starting with the well-known paradox of Allais (1953), however, a large body of experimental evidence has been documented which indicates that individuals tend to violate the axioms underlying the expected utility model systematically. This empirical evidence has motivated researchers to develop alternative theories of choice under risk able to accommodate the observed patterns of behavior. A wave of theories designed to explain the violation of expected utility theory began to emerge at the end of the 1970. Examples are prospect theory (Kahneman and Tversky, 1979), regret theory (Loomes and Sugden, 1982), dual theory (Yaari, 1987), cumulative prospect theory (Tversky and Kahneman, 1992), and rank-dependent utility (Quiggin, 1993). For a thorough review see Starmer (2000). In the empirical literature prospect theory is the dominant theory.

2.3.2 The non-expected utility model: prospect theory (PT)

As mentioned earlier the most commonly accepted model of decision making under risk is the expected utility theory. In the late 1970s the completeness of EU theory in explaining behavior has been challenged. These challenges give rise to the development

of competing theories that attempt to explain individual behavior under risk. This section presents one of these alternative theories: prospect theory (PT).

PT was developed first by Kahneman and Tversky (1979). They developed this theory as an alternative to expected utility theory for explaining the outcomes of individual decision making under risk. They argued that choices that individuals make in risky situations exhibit several characteristics that are inconsistent with the basic axioms of expected utility theory. They argued that individuals underweight probable outcomes in comparison with outcomes that are certain. They called this phenomenon the certainty effect. They also pointed out that the certainty effect brings about risk-aversion in choices involving certain gains and risk-seeking in choices involving certain losses (Kahneman and Tversky, 1979).

Kahneman and Tversky (1979) distinguished two sequential phases in a decision process: the editing phase and the evaluation phase. In the editing phase, decision makers contemplate the choice situation and if possible simplify the problem. This includes the operation of coding that is outcomes are coded as gains or losses, prospects are simplified by combining probabilities associated with identical outcomes, and risky components of a prospect are separated from the risk less component of the prospect, and finally components of choices that are common to all prospects are discarded. The edited prospects are then evaluated and the most highly valued risky outcome is chosen. Prospect theory employs two functions: a probability weighting function π (p), and a value function v (x). These functions are combined to form the basic equation of the theory which determines the overall value of a prospect. Following is the equation that Kahneman and Tversky (1979) used for simple prospects with the form (x,p ; y,q), a

gamble between two outcomes (x,y) with associated probabilities (p,q) which has at most two nonzero outcomes:

$$V(x,p;y,q) \quad = \quad \pi (p)v(x) + \pi (q)v(y) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. \quad (5)$$

When the prospects are strictly positive or negative, the evaluation follows a different rule. In the editing phase the prospects are separated into a risk less (the minimum gain or loss which is certain to be gained or paid) and a risky component (the additional gain or loss which is actually at stake). Thus, if p+q = 1, and either x>y>0 or x<y<0, so $\pi (q)$ = [1- $\pi (p)$], then,

$$V(x,p;y,q) \quad = \quad v(y) + \pi (p) [v(x) - v(y)]\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. \quad (6)$$

One of the essential features of prospect theory is that the overall value of a prospect is based on changes in a decision-makers wealth reference point rather than on final wealth states, as in the case of the EU theory. Kahneman and Tversky propose the value function, one of the most widely used components of prospect theory, a function that is commonly S-shaped. It is generally concave for gains (implying risk aversion) and commonly convex for losses (implying risk-seeking), and steeper for losses than for gains (see Figure 1).

Another major departure of prospect theory from the EU theory is the treatment of the probabilities. In EU models the uncertain outcome is weighted by its probability, the uncertain outcome in prospect theory is multiplied by the decision weight $\pi (p)$. The weighting function, π, which relates decision weights to stated probabilities, is a monotonic function of p, with $\pi (0) = 0$ and $\pi (1) = 1$, but is not a probability and should not be interpreted as a measure of degree of belief.

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According to prospect theory, very low probabilities are over-weighted, that is, the decision weight attached to the rare event is larger than the probability $\pi(p) > 1$. Furthermore, prospect theory suggests that for all $0 < p < 1$, $\pi(p) + \pi(1-p) < 1$, this is sub-certainty. It implies that as low probabilities are over-weighted, moderate and high probabilities are underweighted, that is the decision weight is smaller than the probability $\pi(p) < p$.

Figure 2.1:- A hypothetical value function and a weighting function (Kahneman and Tversky, 1979: 279)

As in the EU model, values and weights are combined in prospect theory. Outcomes transferred into values by the value function, are weighted by the decision weights and then summed. This summed index is the index by which probability distributions are rank ordered and the subject is assumed to choose the distribution with the highest index (Smidts, 1990). Consider, the choice between the gamble (x,p;y,q), a gamble between two outcomes (x,y) with associated probabilities (p,q): in expected utility maximization theory the value of the utility function is $U(x) = pu(x) + qu(y)$ and in prospect theory the value function is $V(X)= \pi (p)v(x) + \pi (p)v(y)$. In both cases the summed function is maximized and the highest value is chosen. Prospect theory and EU theory coincide when $\pi (p) = p$ for all p and when $u(x) = v(x)$. In this case the expected utility of a lottery defined on U(X) equals the value V(X) of the gamble in prospect theory.

Prospect theory (Kahneman and Tversky, 1979) and its modification, cumulative PT (Tversky and Kahneman, 1992), represent a challenge to EU formulations. PT is widely recognized by economists as the most comprehensive and best-known alternative to EU

models of decision-making (Rabin, 2000), PT's central assertion, which is in clear contrast to the core claim of theories based on the maximization of expected value, is that the value of a possible outcome is not determined by multiplying the utility of this outcome by its estimated probability of occurrence. Instead, the expected value of a prospect is a product of the probability of occurrence adjusted by a probability weighting function and the utility of this outcome filtered through a value function. The core elements of PT's value calculations contradict key tenets of EU theory. By showing that individuals tend to be driven by gains and losses relative to a reference point rather than by final wealth levels. The empirical findings that drive PT, however, offer a more profound challenge to EU models of decision-making. First, the finding that individuals demonstrate a non-linear response to probabilities clearly differs from EU theory expectations. Individual's tendency to underweight moderate and high probabilities means that in these situations their utility calculations will grant more weight to the utility of a possible outcome than to its probability of occurring (the reverse happens when probabilities are overweight). In contrast, in EU theory individuals possess linear probability functions, utility and probability estimates are given equal weight in the generation of individual's EU values. Second, individuals' attitudes toward risk, and thus their decisions, are likely to change depending on whether the same situation is seen as a gain or a loss (a phenomenon known as preference reversal). This violates EU theory's assumption that people will possess consistent and transitive preferences (Starmer, 2000). So, EU theory assumes that logically identical situations should produce similar results regardless of the frame of reference.

In terms of theory testing, when the evidence shows that individuals (when they operate in loss-frames) consistently engage in risky behavior, this finding, by definition, calls into question the adequacy of those EU theories that are based on the maximization of expected value. When the same individuals switch from risk-seeking to risk-averse behavior when either their domain changes or their probability estimates are in the ranges in which people are likely to overweight the impact of these estimates on their value calculations, EU theories that claim that decision-makers possess convex utility functions are also hard-pressed to account satisfactorily for outcomes. Both these sets of decisions, however, conform to the predictions of prospect theory.

It can be concluded that prospect theory leads to more accurate descriptions than expected utility theory. Prospect theory is capable of explaining decisions that expected utility theory is incapable of explaining. For example, expected utility theory cannot account for certainty gains, such as the certainty effect that may have a strong influence on individual's decision preferences.

2.3.3   Paired comparison method (PCM)

The method of paired comparisons used by Brandley and Ralph (1976), and adapted by Durojaiye (1991) and Adewumi and Omotesho (2002) was used to develop the farmers' attitude toward risk. The assumptions of the paired comparisons model:-

- The model requires that the respondent be presented with a list of all possible pairs of risk attitudes and that the respondent select all preferred attitude in each pair. The number of pairs for a given set of risk attitudes is given by:

    $\{n(n-1)\}/2$……………… (7) ;   where n= number of risk attitude to be ranked.

- The relative frequency with which an attitude is chosen would be used to establish its ordinal rank.

- This attitude ranking would be tested for statistical significance. The test statistic such as reported by Urquhart and Clyde(1978) could be employed as follows:

$$LSD = 1.96\{SF(n)(n+1)/6\}^{1/2} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(8)$$

where LSD = Least Significance Difference; SF = no of small scale farmers in the survey ; and n = no of risk attitude to be ranked.

- The hypothesis testing under this model would be:-

H_0: small scale farmers' risk attitudes are equally ranked (i.e statistically no difference)

H_1: small scale farmers' risk attitudes are not equally ranked (i.e statistically difference)

- Decision criteria:-

Reject H_0, if difference between the preference frequency > the calculated LSD

The Least Significance Difference could be employed in ranking the small scale farmers' management strategies.

2.3.4   Attitudinal scale approach (ASA)

An aggregate score based on households' responses to a total number of statements (items), each representing a risk management strategy adopted in responding to risk is estimated. The responses to each of the statements correspond to the socio-psychological attribute of the individual small scale farmer and his rating of the item conveys his attitude towards risk, based on his proclivity to adopt the particular risk

management strategy that the item reflects. This methodology of developing a risk attitudinal scale was used by Bard and Berry (2000), Lagerkvist (2005) and Meuwissen *et al.,* (1999). The underlying assumption in this method (model) of measuring the risk attitude:-

- Is that if attitude towards risk is a determinant of risk management strategy utilized by the farmer, the farmer's response to specific risk management strategy would be an indicator of their risk attitude.

- The respondent's rating of the items would be summed up to yield an aggregate score for the respondent, which is a quantitative measure of his attitude.

The widely used Likert's scale could be used due to its suitability in measuring an individual's attitude as established by Chattopadhyaya (1963), Samanta (1977) and Bhattacharya (1993). The responses would be measured on a 5-point scale. Strong disagreement (score of 1) implies the utilization of the risk management tool in question (risk aversion). On the other hand, strong agreement (score of 5) indicates a risk taking attitude. In between the two extremes, disagreement (score of 2), undecided/neutral (Score of 3) and agreement (score of 4) are inclusive as alternative responses. Thus, a lower total for the respondent is then hypothesized to correspond to higher degree of risk aversion. While administering the schedule, both positive and negative statements should be included to avoid response bias. For instance, for negatively worded statements, the scoring of options would be done in such a way that the option of strongly disagreeing got a score of 1, while that of strongly agreeing is assigned a score of 5. Thus, the lower the score for an individual statement, more likely the farmer is going to utilize the risk management strategy that the statement reflects, due to his risk-

averse attitude. Before drawing inferences on the basis of the total score obtained by an individual on the attitudinal scale, it is pertinent to test how well the statements reflect on the risk attitude of the farmers. The empirical analysis consists of reliability testing and validity testing. The reliability of the attitudinal scale depends on the extent to which individual statements reflect the risk attitude of the respondents.

2.3.4.1 Validity Testing- empirical analysis of attitudinal scale approach (ASA)

Construct validity testing analyze the extent to which the total risk attitudinal score is related to different categories of respondents, in this study to different categories of farmers based on their landholdings. Convergent validity testing measures how different measures of the same risk attitudes are correlated, for instance how total score based on the attitudinal scale and self-assessment score relate to each other. Convergent validity testing would be done by evaluating the correlation between the total score obtained on the basis of the attitudinal scale and the self-assessment score (which is a single item scale) of the individuals (both being measures of the same construct). If the two measures are positively and significantly correlated, the results imply that the scale has convergent validity (Devillis, 1991).

2.3.4.2 Reliability Testing- empirical analysis of attitudinal scale approach (ASA)

The purpose of reliability testing is to optimize the number of statements, by including such statements in the final refined scale which really contribute to explaining and measuring the risk attitude of the respondents. For reliability testing, Cronbach's coefficient alpha as used by Bard and Berry (2000) and Lagerkvist (2005) could be used to evaluate the reliability of the attitudinal scale. It is measured as:

$$\alpha = k/k\text{-}1 \; \{1\text{-} \; (\textstyle\sum \sigma^2{}_i / \sigma^2{}_y)\} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \quad (9)$$

Where, α = Cronbach's coefficient alpha

   k= number of statement items in the ASA Model

   $\sigma^2{}_i$ = variance of ith statement item

   $\sigma^2{}_y$ = total variance of the k- statement item scale

The higher the Cronbach's coefficient, alpha, the better is its reliability. For instance, if the overall coefficient alpha is 0.783, it suggests that the management strategies (statements) included in the scale accounted for 78% of total variation of risk attitudes of the farming households. Therefore, the scale would be optimized by deleting statements with negative or very low CISC. The deletion of statements continues as long as such deletions increased the value of coefficient alpha. When further deletions actually reduce the total alpha value, it signifies that the scale has been optimized and its reliability cannot be increased any further. The deleted statement(s) indicates a weak relationship to remaining statements' responses (Devillis, 1991). This relationship is found through Corrected Item Score Correlation (CISC), which is measured as:

$$r_{i(y\text{-}i)} = (r_{yi}\sigma_y \; \text{-} \; \sigma_i)/\surd(\; \sigma^2{}_i + \sigma^2{}_y + 2\sigma_i.r_{yi}\sigma_y)\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots..(10)$$

Where, $r_{i(y\text{-}i)}$ = correction statement item i with sum of scores of all statement items, excluding statement i (Bard and Berry, 2000 and Lagerkvist, 2005)

   r_{yi} = correction of statement item i with total score y

   σ_y = standard deviation of the total score y

   σ_i = standard deviation of statement item i

The scales are then optimized and the value of Cronbach's coefficient alpha is increased by deleting statements with negative or low- item score correlation. The minimum acceptable alpha value of 0.65 was proposed by Devillis (1991). Also, Bard and Berry (2000) and Lagerkvist (2005), reported a minimum acceptable alpha value of 69% and 83% respectively.

2.4   Some Findings of Previous Researches on Risk Studies

Alimi and Ayanwale (2005) identified risk sources and ranked them in order of importance as follows technical drought, pest/diseases, flood, input/output market prices, social related-theft, ill-health, death, unavailability of labour, capital and land. The study did show that the farmers considered flood was considered inconsequential as onion farming was during the dry season and controlled irrigation was employed to supply necessary moisture for plant growth. None of the farmers the research was conducted on anticipated any civil disturbance and land tenure insecurity in the nearest future that could affect their farming. All the farmers stated drought, pest/diseases, input price, output price, theft and lack of capital as important risk sources. The respondents considered each of the risk sources of ill health, death and unavailability of labour important. Also, Ezeh and Olukosi (1991) identified irregularity in input availability, fluctuations in market prices, irregularity in water supply and variability in weather conditions as major risk sources responsible for variation in farmers' income in dry season farming.

Another researchers Samuel and Henry (2012), who recently worked on attitudes toward risk and coping responses, a case of food crop farmers in Ghana found out that in the socioeconomic characteristics of the respondents more than half (52.5%) of the

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food crop farmers were within the ages of 41 and 50 years; and also about 28% were in the age range of 31 and 40 years. These people belong to the active labour force and are expected to manage their farms effectively. About 70% of farm households' family size range from 1-5 members. This suggests an average family size of about 3 members. Family size might affect the labour capacity of the farm household in which case a larger family size implies greater capacity to assume risks. Whiles more than half (57.5%) of the farmers had formal education only up to primary level, further 30% have had no formal education. This stands to reason that there is high illiteracy rate amongst farmers. Inadequate training has implication for farmers' ability to work efficiently in the decision-making environment within which they operate, which is characterized by high incidence of risks and uncertainties.

Furthermore, the regression analysis was estimated to investigate the effect of income status of food crop farmers and other socioeconomic variables on farmers' attitude towards risk by Samuel and Henry (2012), revealed a coefficient of determination (R Square) was 0.473. This implies that about 47% of the variation in farmer risk attitude was explained by the independent variables. The chi-square test of the regression model was significant at alpha level of 0.01 and this means that income status and the other socioeconomic variables have significant composite effect in explaining food crop farmers risk attitudes.The test of beta coefficients of the predicting variables in the model shows that, household size, educational level, and access to credit were significant at 0.01 alpha level in explaining the probability of farmer risk averse attitude. Age and income status were also significant at 0.05 alpha level. Age was found to be inversely related to risk-averse attitude. This implies that the lower the age of the farmer, the more risk averse he/she will be. According to Aye and Oji (2007), the larger

the household size, the greater will be the total consumption needs of the farm family and hence, the more risk-averse behaviour a food crop farmer would put up.

David (2008) submitted that farmers have developed copping strategies and various mechanisms to deal with risk within farm households Most of these mechanisms offer short-term protection. Food crop farmers managed risk by implementing practices that would reduce their exposure to risk. These coping responses were grouped as production, marketing and human risk related coping strategies. These strategies generally act to reduce variability of cultivation in food crop farming business. Farmers use irrigation and drainage as a management strategy to deal with risk of drought, erratic rainfall, and insufficient amount of rainfall and flood. According to the researcher, as much as 92.5% and 77.5% of the farmers used occupational diversification (i.e. supply of labour for non-farm wage income) and geographical diversification respectively as risk coping mechanisms.

CHAPTER THREE

METHODOLOGY

3.1   Study Area

The Federal Capital Territory (FCT) Abuja, is located in the middle belt of Nigeria, between latitudes 8°25' and 9°20' North of the equator and longitudes 6°45' and 7°39' East of Greenwich Meridian. FCT Abuja, (created by an Act of Law in 1976) occupies an estimated land area of 800,000 hectares. The forest reserve occupies about 270,000 hectares; natural resources such as rivers, hills etc occupy 6,000 hectares and about 250,000 hectares earmark for development of the city centres and infrastructure. The FCT has six (6) Area Councils, namely Abaji; Abuja Municipal; Bwari; Gwagwalada; Kuje and Kwali. The total farming families in all these six Area Councils were put at 93,092 (FCT ADP, 2006).

Bwari and Kuje Area Councils of FCT, were carved out on 1st October, 1996 for administrative convenience. Prior to this, they had functioned as Development Areas overseen by the Abuja Municipal Area Council (AMAC) through administrative secretaries before attaining their present status as full-fledged Area Councils in October, 1996. The study areas which comprise of Bwari and Kuje are situated North East and West axis of FCT respectively. Bwari shares boundaries with Tafa Local Government Area of Niger state; Kagarko Local Government Area of Kaduna State; AMAC and Gwagwalada Area Councils of FCT. Kuje shares boundaries with Karishe community in AMAC; Gwagwalada and Kwali Area Councils of FCT.

The settlement pattern in the study area is typical of indigenous clustered type of settlement. The main ethnic groups include Gwari; Koro; Fulani and other tribes.

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Farming and trading are the major occupations of the people in the area. Amongst major religions found in the area includes Traditional religion, Christianity and Islam.

The mean annual rainfall is put between 1145 and 1632mm and spans through the months of April to November. The single maximum rainfall is usually experienced in August/September of each year. The topography of the study area is largely flat with undulating hills and rocks. The vegetation and soil type of the area are typically savannah and sandy clay loam, with some alluvial soils in the fadama locations. The major agricultural activities of the people is crop farming especially roots and tubers (yam), legumes (groundnut and cowpea), grains (maize, sorghum and rice), seeds and nuts (melon and beniseed). Also, the people engage in animal production especially small ruminants (sheep and goats).

3.2   Sampling Procedure

A multi-stage sampling procedure was employed to select respondents for the study. In the first stage, purposive sampling technique was used to select two (2) Area Councils with second highest and lowest farming households, which are known as food basket of FCT (FCT ADP, 2006). The highest farming households figure was 26,246 in Abuja Municipal Area Council (AMAC), which is more of urban areas. Therefore, Kuje and Bwari that are known as the food basket of FCT, Abuja with 19,320 and 9,245 farming households respectively (FCT ADP, 2006), were selected for this study.

In the second stage, from the ten (10) wards that make up each selected Area Council, a random selection of ten (10) villages (i.e 1 village per ward) was carried out:-Ija; Igu; Kau; Kunapa; Ushapa; Jiba; Shere; Kabusu; Dakwa; and Kuchiko villages (Bwari Area

Council); Pesu; Bamishi; Simani; Buzun kire; Kabi mangoro; Chida; Lanto; Gwargwada; Tupechi and Kuje (Kuje Area Council).

In the last stage, simple random technique was used to select a total of 150 farming households for the study, using proportional allocation technique. Using this technique, the number of sampled farming households in each Area Council was obtained from the equation:-

$$S_h = \{n*N_h\} / N_T \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (11)$$

Where,

S_h =   number of rural households to be selected in an Area Council

n   =   total number of rural households for the survey

N_h =   rural households in an Area Council

N_T =   sum of rural households in the two Area Councils

Therefore, a sample of 101 and 49 farming households were randomly selected from Kuje and Bwari Area Councils, respectively. The distribution pattern of the sample (150 respondents) among the 20 villages was as follows:-

(i) Bwari Area Council (101 farm households):- Ija(10 farm households); Igu(10 farm households); Kau(10 farm households); Kunapa(10 farm households); Ushapa(10 farm households); Jiba(11 farm households); Shere(10 farm households); Kabusu (10 farm households); Dakwa(10 farm households); and Kuchiko(10 farm households);

(ii) Kuje Area Council (49 farm households):- Pesu (5 farm households); Bamishi (5 farm households); Simani (5 farm households); Buzun kire(5 farm households); Kabi mangoro(5 farm households); Chida(5 farm households); Lanto(5 farm households); Gwargwada(5 farm households); Tupechi(5 farm households) and Kuje(6 farm households) (FCT ADP, 2006)

3.3   Methods of Data Collection

The study used primary data, which were collected with the aid of structured questionnaire administered to selected farming households in the study area. The data collected from the respondents include: socio-economic characteristics of the households, economic activities, risk attitudes and management strategies. Also, to ensure a level of accuracy and minimize bias in data collection, basic training was given to enumerators. Other materials were sourced from the FCT Agricultural Development Programme (ADP) office.

3.4   Analytical Tools

The analytical tools employed in achieving the study objectives are:-

   i.   Descriptive Statistics

  ii.   Attitudinal Scale Approach (ASA)

 iii.   Multiple Regression Analysis

3.4.1   Descriptive Statistics

Pie chart was used to describe risks to agricultural production among the households and the magnitude of the perceived risks (objectives i & ii). Also, frequency distribution table, percentages, mean and bar chart were used to describe socio-economic characteristics of the rural households.

3.4.2   Attitudinal scale approach (ASA)

The rural farming households' risk attitude was analyzed by applying a model formulated by three social scientists (Carmines, 1981; DeVellis, 1991; and Spector, 1992) to develop a ranking procedure for peoples' risk attitudes using an Attitudinal

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Scale Approach (ASA). The ASA model's underlying principle is that risk attitudes are proxied by various responses to risk and establishing a score reflecting a quantitative measurement of the attitude. The model consists of defining a scale of statements that reflect the respondent's attitude toward an underlying variable (risk attitudes proxied by various responses to risk) and establishing a score reflecting a quantitative measurement of the attitude. An aggregate score based on households' responses to a total of "K" number statements (items), each representing a risk management strategy used by the households was estimated. The responses to each of the statements correspond to the socio-psychological attribute of the individual rural farming household head and his rating of the item conveys his attitude towards risk, based on his natural tendency to adopt the particular risk management strategy that the item reflects.

A 5-point Likert scale was used to measure an individual's attitude as established by Bhattacharya (1993). The responses measured on a 5-point scale include, Strong disagreement (score of 1) implies the risk aversion attitudes of the respondent, willingness of farmer to utilize the risk management strategy in question. On the other hand, strong agreement (score of 5) indicates a risk taking attitude. In between the two extremes, disagreement (score of 2), undecided/neutral (Score of 3) and agreement (score of 4) were included as alternative responses. Thus, a lower total for the respondent is then hypothesized to correspond to higher degree of risk aversion. While administering the schedule, both positive and negative statements were included to avoid response bias.

Table 3.1:- Quantitative measure of rural households' risk attitude, using Likert's scale
        (attitudinal scale)

	Statements	SD 1	D 2	UN 3	A 4	SA 5
1	I never insure my farm					
2	I adopt new technology in my farming practice					
3	I never have future market for my farm produce					
4	I do not have formal life insurance					
5	I do practice both rain-fed and dry season farming					
6	Income generated from farming activities is not enough for the financial survival of my household					
7	In case of emergency, I do not have sufficient back-up labour to carry on farming activities					
8	I used tractor for my farming activities					
9	I never rear animal to sell for complementing my income					
10	I practice mixed cropping in my farm					
11	I never sell my farm produce at market					
12	I plant my crop(s) because it is profitable					
13	I do not have any other job apart from farming					
14	I belong to farmers' groups / association					
15	I do not benefit from credit from cooperative / banks					
16	Off-farm income is not important source of income for me and my household					
17	I do have access to ADP extension agents					
18	I rely heavily on market information in making my marketing decisions					
19	There is nobody else in the household who has interest in farming as business					
20	I do use insecticide/pesticide in my farm					
21	I never apply fertilizer in farm					
22	I save greater share of my income in bank					
23	I never have storage facility to store my farm produce					
24	I do keep record of my farming work					
25	I never use improved seeds in my farms					
26	I do use traditional method of farming					
27	I never use organic manure on my farms					
28	I often fall sick					
29	Weather is never favourable for my farming activities in the previous farming seasons.					
30	I benefit in government project in my village/community e.g Fadama , NPFS, RTEP etc					
31	I have ready-made market for my farm produce					
32	I do not have enough money for my farming activities / business					
	Others:-					
	Aggregate score (Y)					

Where SD= Strong Disagreement (1); D= Disagreement (2); UN=Undecided (3); A=Agreement (4) and SA= Strong Agreement (5)

Before drawing inferences on the basis of the total score obtained by an individual on the attitudinal scale, it is pertinent to test how well the statements reflect on the risk attitude of the farmers. The empirical analysis consists of reliability testing.

3.4.3   Reliability testing of ASA model

The reliability testing of the attitudinal scale depends on the extent to which individual statements reflect the risk attitude of the respondents. Reliability is measured using Cronbach's coefficient (α). The coefficient measures the proportion of total variation due to true differences in a person's attitude toward the construct being measured.

$$\alpha = k/k\text{-}1 \; \{1\text{-} \; (\textstyle\sum \sigma^2_i / \sigma^2_y)\} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \quad (12)$$

where, α = Cronbach's coefficient (alpha)

    k= number of statement items in the ASA Model

σ^2_i = variance of ith statement item

σ^2_y = total variance of the k- statement item scale

The objective is to have α as high as possible. The implication of a very high α is that the statement (management strategies) included in the ASA model accounted for a total variation of the risk attitudes of the respondent.

3.4.4   Optimizing the ASA Model

To optimize the ASA model and increase value of α, statement item (K) with negative or low Corrected Item Score Correlation (CISC) were deleted. The more correlated the individual statement's response to the remaining statements' responses, the more desirable is the item as part of the scale. Also, deleting the items increases α for the remaining statements, thereby improving the statistical quality of the ASA model.
The CISC is measured as follows:-

$$r_{i(y-i)} = (r_{yi}\sigma_y - \sigma_i)/\surd(\sigma^2_i + \sigma^2_y + 2\sigma_i.r_{yi}\sigma_y)\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(13)$$

Where, $r_{i(y-i)}$ = correlation of statement item i with sum of scores of all statement items, excluding statement i (Bard and Berry, 2000; Lagerkvist, 2005)

r_{yi} = correlation of statement item i with total score y

σ_y = standard deviation of the total score y

σ_i = standard deviation of statement item i

3.4.5 Multiple regression model

Multiple regression analysis was used to estimate the relationship between risk attitudes of the farming household heads and their socio-economic characteristics (objective iv). The specification of general form of the multiple regression require that variable to be explained (dependent variable Y) be hypothesized as a function of independent variables $x_1, x_2, x_3\ldots x_n$.

The general form of the multiple regression model is given below:-

$$Y = f(X_1, X_2, X_3, X_4, X_5 X_6, X_7, E_i)\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(14)$$

Where: Y = aggregate score of risk attitude scale (From ASA model, the respondent's rating of the statement items summed up to yield an aggregate score (Y) for the respondent, which was a quantitative measure of his risk attitude.); X_1= farmer's age (yrs); X_2= years of farming experience (yrs); X_3 = household size (number); X_4= farm size (ha); X_5= number of years in school (yrs); X_6= off-farm income (naira); X_7= gross farm income (naira); E_i= error term.

Relevant data from the field were fitted into four functional forms, namely linear, semi-log, double-log and exponential functions. Hence the best functional form was selected

based on the goodness of fit for regression (R^2) i.e coefficient of determination; t and F-values and signs and statistical significance of estimated regression parameters.

Linear form:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + E \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..(15)$$

Semi-log form:

$$Y = \alpha + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 + \beta_5 \log X_5 + \beta_6 \log X_6 + \beta_7 \log X_7 + E...(16)$$

Double log form:

$$\log Y = \alpha + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 + \beta_5 \log X_5 + \beta_6 \log X_6 + \beta_7 \log X_7 + E..(17)$$

Exponential form:

$$\log Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + E \ldots\ldots\ldots\ldots\ldots\ldots..(18)$$

Where: β_1 to β_7 are the regression coefficients of the corresponding variables and other variables are as defined in the general form (eq. 14).

A multiple regression analysis was used to establish the effect of household's attribute on risk attitude. The statement items that correspond to used management strategies were obtained from optimized ASA model as given in (eqn. 13). Multiple regression analysis was carried out using four functional forms, namely: the linear, semi-log and double log and exponential functions to choose the best fit.

Risk Attitude Category of the Respondent Range   **Hypothesized Aggregate Score (Y)**

Risk Averse Category (Y_a) $32 \leq Y_a \leq 95$

Risk Neutral Category (Y_n) $Y_n = 96$

Risk Preference Category (Y_p) $97 \leq Y_p \leq 160$

The explicit forms of the equations are given as:

$$Y_a = f(S_i) \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \quad (19)$$

$$Y_n = f(S_i) \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \quad (20)$$

$$Y_p = f(S_i) \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \quad (21)$$

Where,

Y_a = aggregate score for the risk averse household

Y_n = aggregate score for the risk neutral household

Y_p = aggregate score for the risk preference household

S_i = independent variables (statements from Corrected Item Score

   Statement) (optimized ASA)

CHAPTER FOUR

RESULTS AND DISCUSSION

The presentation of the results is organized to cover the following issues: major risks to agricultural production; farm household perceived magnitude of these risks; risk attitude of the farm households; the relationship between the respondents' risk attitude and their socio-economic characteristics; management strategies used by the farm households in coping with risk and effectiveness of the management strategies used.

4.1   Major Risks to Agricultural Production

The sources of risks perceived by the farming households as threats to agricultural production are presented in Table 4.1. Drought, high cost of animal vaccination, ill health of the farmer, inadequate credit facilities, inadequate family labour, inadequate farm land and high interest rate were perceived by the households as the threats experienced yearly within the last five years. Among these threats, inadequate farm land and high interest rate were reported by 60% and 53.78% of the respondents, respectively. Threats such as lack of functional credit banks e.g MFBs (63.77% of respondents), inadequate market for farm produce (55.56%) and livestock diseases outbreak (50.00%) were identified as threats that were experienced twice within the last five years. About 52.38% of the respondents also identified too much rainfall/flood as threats to their agricultural production, although it was experienced once within the last five years.

Majority (44.00%) of the respondents said the major threats to their agricultural production were experienced two times within the last five years. About 28.00% of the farming household experienced threats five times within the same period, while,

16.00% and 12.00% of the respondents experienced these threats thrice and once within the last five years, respectively.

Table 4.1: Identified risks that posed threats to agricultural production.

Risk to agricultural production	Frequency of occurrence within last 5years.	Percentage of Occurrence(%)	Percentage of respondent(%)
Plant pest & diseases	2	2.78	42.61
Drought	5	6.94	6.60
Inadequate improved varieties	2	2.78	20.00
Desert encroachment	2	2.78	35.58
Inadequate soil nutrients	2	2.78	44.78
High cost of vaccination	5	6.94	38.73
Inadequate inputs e.g fertilizer, herbicides, pesticides	3	4.17	37.65
Livestock disease outbreak	2	2.78	50.00
Dangerous weed	2	2.78	33.33
Destruction of crops by animals	3	4.17	41.94
High cost of inputs	3	4.17	41.51
Low market prices	2	2.78	44.74
Erratic rainfall	2	2.78	37.37
Inadequate market for farm produce	2	2.78	55.56
Ill health of the farmer	5	6.94	48.06
Inadequate credit facilities	5	6.94	31.65
Inadequate family labour	5	6.94	31.58
Inadequate farm land	5	6.94	60.00
High interest rate	5	6.94	53.78
Lack of access to functional credit bank e.g MFBs	2	2.78	63.77
Adulteration of farm inputs e.g chemicals	3	4.17	33.01
Lack of technical know-how of improved farming technologies	2	2.78	37.50
Farm land flooding	1	1.39	52.38
Conflict within the community	1	1.39	35.56
Conflict with Fulani cattle rearers	1	1.39	35.56
	72	100.00	

Source: Field survey data, 2011

4.2   The Farm Household Perceived Magnitude of these Risks

Majority (64%) of the sampled households ranked the risks that posed threats to agricultural production as mild, while 36% ranked the threats as severe. The study also revealed that perceived magnitude of the threats occurred mostly during raining season as indicated by 56.00% of the households, while 40% of the households reported that the threat occurred all year round (Table 4.2). The identified threats to agricultural production perceived as severe were high interest rate, inadequate farm land, ill health of the farmer, and high cost of animal vaccination as indicated by 65.55%, 60.00%, 55.81% and 52.11% of the households respectively. Other perceived threats to agricultural production which the households identified as severe, especially in the raining season were conflict within the community, conflict with Fulani cattle rearers, erratic rainfall as indicated by 46.67%, 46.67% and 40.40% of the respondents respectively.   The implication of high interest rate is that most of the farming households (66%) would not be able to increase production due to inability to access credit. This also has ripple effects on the productivity, returns on investment and efficiency of the farmer because cheap fund to procure high yielding varieties, chemicals etc would not be available to the farmer and low cost of production is not guaranteed.

The farming households identified inadequate farm land as severe threat to agricultural production. This implies that farm land availability is a limiting constraint,   hence expansion of farm land is inhibited.

The ill health of the farmers will definitely limit farming household labour availability and invariably affect household income generation through farming enterprise.   The implication of high cost of animal vaccination as severe threat to agricultural production

would affect the cost of animal production, this in turn would affect the complementary purpose animal production is serving farm households in term of gross farm income, household nutrition etc. Directly the farm animals not been vaccinated could results is not immune from animal diseases that may wipe out the entire animal population, thereby a great loss to the farmer.

Table 4.2: Farm households' perceived magnitude of the threats.

Risks	Perceived threats ranked	% of respondents perceiving threats	Period of the year threats most severed	% of respondents severity
Plant pest & diseases	Mild	61.74	raining season	44.35
Drought	Mild	10.38	raining season	12.26
Inadequate of improved varieties	Mild	20.00	raining season	20.00
Desert encroachment	Mild	60.58	raining season	47.12
Inadequate soil nutrients	Mild	44.78	all year round	44.78
High cost of vaccination	Severe	52.11	all year round	47.18
Inadequate of inputs e.g fertilizer, herbicides, pesticides etc.	Mild	56.47	all year round	54.12
Livestock disease outbreak	Mild	63.00	raining season	63.00
Dangerous weed	Mild	50.93	raining season	54.63
Destruction of crops by animals	Severe	47.58	all year round	43.55
High cost of inputs	Mild	44.34	all year round	47.17
Low market prices	Mild	68.42	raining season	86.84
Erratic rainfall	Severe	40.40	all year round	56.57
Inadequate market for farm produce	Mild	68.06	dry season	34.72
Ill health of the farmer	Severe	55.81	all year round	64.34
Inadequate credit facilities	Mild	46.84	raining season	43.04
Inadequate family labour	Severe	44.74	raining season	47.37
Inadequate farming land	Severe	60.00	all year round	65.00
High interest rate	Severe	65.55	all year round	64.71
Lack of access to functional credit bank e.g MFBs	Mild	59.42	raining season	53.62
Adulteration of farm inputs e.g chemicals	Mild	54.37	all year round	49.51
Lack of technical know-how of Improved farming technologies	Mild	37.50	raining season	75.00
Farm land flooding	Mild	80.95	raining season	28.57
Conflict within the community	Severe	46.67	raining season	45.56
Conflict with Fulani cattle rearers	Severe	46.67	raining season	45.56

Source: Field survey data, 2011

High interest rate, inadequate farm land, ill health of the farmer, and high cost of animal vaccination were reported to have occurred all year round as indicated by 64.71%, 65.00%, 64.34% and 47.18% of the households, respectively. Threats that were perceived mild were livestock diseases outbreak (63.00%) and lack of functional credit

bank e.g MFBs (59.42%), and occurrence was during raining season as indicated by 63.00% and 53.62% of the households' respectively.

4.3   The Risk Attitude of the Farm Households in the Study Area

The result of ASA using Likert's scale analysis, as presented in Table 4.3, showed that 48(32.4%) of the respondents were categorized as risk averse individuals, while, 5(3.4%) of the respondents were categorized as neutral to risk and 94(63.5%) of the respondents were categorized as risk preference individuals. The mean score and the standard deviation of all the statements were given as 3.02 and 1.066 respectively .i.e there was cohesiveness in the all the statements and about one percent of the responses occurred within the average response.

Table 4.3: Distribution of aggregate score measuring risk attitude of the respondents

Probable Risk Category (%)	Frequency	Percentage
Risk Aversion($32<=Ya<=95$)	48	32.0
Risk Neutral($Yn=96$)	8	5.3
Risk Preference ($97<=Yp<=160$)	94	62.7 Total
	150	100.0

Source: Field survey data, 2011

From the ASA model, using Likert's scale as shown in table 4.4, statement with attitudinal scores statistically lower than the neutral score of value three (3), correspond to socio-psychological attribute of the individual rural farm household and rating of the following item statement conveys risk averse attitude of the respondent. Hence, the following statements conveys usage of the management strategy the statement item explains- statements 9 (I never rear animal to sell for complementing my income),11 (I practice mixed cropping in my farm), 13 (I do not have any other job apart from

farming), 16 (Off-farm income is not important source of income for me and my household),19 (There is nobody else in the household who has interest in farming as business),21(I never apply fertilizer in farm), 22 (I save greater share of my income in bank), 24 (I do keep record of my farming work), 25 (I never use improved seeds in my farms), 27 (I never use organic manure on my farms), 28 (I often fall sick), 29 (Weather is never favourable for my farming activities in the previous farming seasons),and 31 (I have ready-made market for my farm produce).

Table 4.4:- ASA model using Likert's scale (risk averse attitude)

	Statements	SD 1	D 2	UN 3	A 4	SA 5
9	I never rear animal to sell for complementing my income					
11	I never sell my farm produce at market					
13	I do not have any other job apart from farming					
16	Off-farm income is not important source of income for me and my household					
19	There is nobody else in the household who has interest in farming as business					
21	I never apply fertilizer in farm					
22	I save greater share of my income in bank					
24	I do keep record of my farming work					
25	I never use improved seeds in my farms					
27	I never use organic manure on my farms					
28	I often fall sick					
29	Weather is never favourable for my farming activities in the previous farming seasons.					
31	I have ready-made market for my farm produce					
	Others:-					
	Aggregate score (Y)					

Where SD= Strong Disagreement (1); D= Disagreement (2); UN=Undecided (3); A=Agreement (4) and SA= Strong Agreement (5)

4.4.1 The household's socio-economic characteristics

The household socio-economic characteristics that were hypothesized to influence the risk attitudes of the farm households are: age of household head, household size, year of farming experience, farm size, education level, off-farm income in 2010 and gross farm income from farming activities in 2010 farming season.

i. Age of farm household head in years

The majority (70.3%) of the respondents were male-headed households, while female-headed households were 29.7%. The age range of the respondents was between 24 and 66 years and the mean age was 45years.

ii. Years of farming experience

The mean year of farming experience by the respondents was approximately 24 years. The result showed that 16(11%), 47(32.2%), 56(38.3%), 23(15.8%) and 4(2.7%) of the respondents had farming experience of l-10years; 11-20years; 21-30year; 31-40years and 41years and above, respectively as shown in table 4.5 and figure 4.1.

Table 4.5: Frequency of year of farming experience of the respondents

Year of farming experience	Frequency	Percentage (%)
1-10 years	16	11.67
11-20 years	51	34.00
21-30 years	56	37.33
31-40 years	23	15.33
Above 41 years	4	2.67
Total	150	100.00

Source: Field survey data, 2011

Figure 4.1:- Years of farming experience of the respondents (Source: Field survey data, 2011)

 iii.   Household size

The mean household size was 8 members, while the household size range of 6 to 10 members had the highest percentage of 65.6% (Figure 4.2).

Figure 4.2:-Household Size of the Respondents (Source: Field survey data, 2011)

iv.   Farm size in hectares

The farm sizes of the households had a mean of 2.87 hectares. The frequency distribution of the farm size showed that 108 (72.00%) of the respondents had farm sizes within the range of 1 to 3 hectares, while 40 (26.67%) and 2 (1.33%) of the respondents had farm sizes ranging from 3.1-7 hectares and 7.1 hectares & above respectively (Figure 4.3). The majority (83.9%) of the respondent reported that they obtained their farm land from inheritance.

Figure 4.3:- Farm Size of the Respondents (Source: Field survey data, 2011)

v.   **Off-farm income in naira**

Although, the result showed that 73.2% of the respondents were involved in one off-farm activity or the other, majority of the households (40.2%) were engaged in trading. The result also showed that the respondents had average off-farm income of ₦218, 243.73 in 2010.

4.4.2   The Relationship between the Respondents' Risk Attitude and their Socio-economic Characteristics.

The households socio-economic characteristics that were hypothesized to influence the risk attitude of the households include: age of household head, household size, year of farming experience, farm size, education level, off-farm income in 2010 and gross farm income from farming activities in 2010 farming season. The results of the multiple regression analysis of the four functional forms showed that the exponential function had the best fit (table 4.4). The results of multiple regression analysis showed that there

was a negative and significant (10% level) relationship between age of the respondents and the total risk score (y) measuring risk attitude. This implies that as the age of the farmer increases, aggregate score measuring risk attitudes decreases, and thereby increasing risk aversion. The result contrasted earlier work carried out by Dwaipayan *et al.*, (2006), that the relationship between the age of head of household and risk attitude was not significant, though there existed positive relation between them.

The analysis also showed that year of farming experience exhibited statistically significant (10% level) and positive relationship with the total risk score, implying that with the increase in the years of farming experience of the respondents, the risk score also increases, meaning that the risk taking/preference behavior increases. A positive relationship was observed between household size and risk attitude, but this was not statistically significant.

The result showed a negative and significant (10% level) relationship between farm size and total risk score. With decrease in farm size, aggregate score measuring risk attitudes increases (risk preference/taking attitude). This implies that farmers with small farm holdings tend to be risk takers. This is in consonance with the findings of Dwaipayan *et al.*, (2006), who reported that herd size showed a negative relationship with the total risk score, measuring risk attitudes. Although this negative and significant relationship between farm size and risk attitude was not expected, the result is in opposite direction of what was reported by Bard and Berry (2000), that there exist positive significant relationship between farm size and the risk attitude, further explained farmer with small farm holding is risk averse and large size farm owner is risk taker/preference.

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The off-farm income was statistically significant (5% level), and negatively related to total risk score, implying that with increase in households' income from off-farm activities the aggregate score measuring risk decreases and risk aversion increases. This could be because the farm household off-farm enterprises were considered less risky and income generation through the off-farm is more or less stable. The result was expected as reported by Dwaipayan *et al*. (2006) that since off-farm activities could be perceived by the farmers as a tool for managing risk, off-farm income can be considered as a measure for risk aversion. The gross income from farming activities (both crop and livestock production) was significant (10% level), and negatively related to risk attitudes. The result reveals that income of farm enterprises increases risk aversion attitude of the respondent. A farmer will utilize risk management strategy to compliment for his risk aversion attitude and to maintain smooth income flow from farm enterprises, a reason suggested by Adewumi and Omotesho (2002).

The value of R^2 (0.410) indicated that the explanatory variables considered in the study together explained about 41 percent variation in risk attitudes of farm households. The value of R^2 obtained was supported by similar results obtained by other studies by Bond and Wonder (1980); King and Oamek (1983) and Tauer (1986) found that there was systematic relationship between farmers' socio-economic characteristics and risk attitudes. Also, Samuel and Henry (2012) reported that about 47 percent of the variation in farmer risk attitude was explained by the socio-characteristics as independent variables. They concluded that empirical relationship between socio-economic factors and risk attitudes are very complex and often difficult to quantify.

Table 4.6: Multiple regression estimates (exponential) for the relationship between farm household risk attitudes and socio-economic characteristics.

Variable	Coefficients	Std. Error	t-value
Constant	2.107*	0.044	47.802
Farmer's age (yrs)	-0.002***	0.001	-1.910
Years of farming experience	0.002***	0.001	1.886
Household size	0.000	0.002	0.024
Farm size	-0.032**	0.014	-2.178
Level of formal educ.	0.245*	0.089	2.767
Off-farm income (₦)	-0.045**	0.021	-2.129
Gross farm income (₦)	-0.018***	0.009	-1.962
Coefficients Multiple Det. (R^2)	0.410		
F-value = 5.146			

Source: Field survey data analysis, 2011 (Significant level: *10%; **5% & ***1%)

4.5 Management Strategies Used by the Farm Households in Coping with Risk.

The Reliability and Optimizing tests were conducted on the Attitudinal Scale Approach (ASA) using Likert's scale. A 5-point scale that had 32 statement items about managing risk was used for the analysis. It was established that statement with attitudinal scores statistically lower than the neutral score of 3 were statements 9, 11, 13, 16, 19, 21,22,24,25,27,28,29 and 31 (Table 3.1 refers). Thus, management strategies such as livestock production to complement household income (statement 9), sales of farm produce (statement 11), engagement in off-farm jobs/activities (statement 13), off-farm income as important source of household income (statement 16), household members ' interest in farming (statement 19), application of fertilizer (statement 21), use of improved seeds/input (statement 25) and use of organic manure (statement 27) were utilized as valid risk management strategies among the farm households with risk

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aversion attitude. The result of reliability and Optimizing tests are presented in Table 4.5.

Table 4.7: Reliability Testing of Attitudinal Scale

Statement-items	Corrected Item-scale Correlation(CISC)	Cronbach Coefficient (α) if item is deleted
I never rear animal to sell for complementing my income (9)	0.122	0.720
I never sell my farm produce at market (11)	0.312	0.708
I do not have any other job apart from farming(13)	0.263	0.710
Off-farm income is not important source of income for me and my household (16)	0.268	0.71
There is nobody else in the household who has interest in farming as business (19)	0.205	0.714
I never apply fertilizer in farm (21)	0.296	0.708
I never use improved seeds in my farms (25)	0.167	0.716
I never use organic manure on my farms (27)	0.177	0.715
Coefficient Alpha for the entire 32 statement		**0.723**
Coefficient Alpha for the entire 26 statement		**0.725**

Source: Field survey data, 2011

The reliability test showed that Cronbach Coefficient (α) for the entire 32 statement-items was 0.723, and this was the minimum acceptable range for an aggregate Coefficient Alpha of between 0.65 and 0.70 as reported by De Vellis (1991). The result showed that the 32 statement-items included in the test accounted for 72.3% of the total variation in risk attitudes of the farm households. Therefore, the ASA was optimized by deleting statement-items with very low CISC, (8, 12, 15, 22, 24 and 28) (Table 4.5) and the Coefficient Alpha for the remaining 26 statement-items was 72.5%. More importantly, the optimized attitudinal scale revealed that these eight statements items (9, 11, 13, 16, 19, 21, 25 and 27) were included in the remaining 26 statement-items (Table 4.5), and implied that they reflected the management strategies identified by the farm households due to the risk aversion attitude of the respondents.

4.6   Effectiveness of the Management Strategies Used.

The multiple linear regression analysis of the aggregate score measuring risk attitude of the respondent and the identified used management strategies showed statistical significance (1% to 10% levels) and positive relationship between the statements: 9, 11, 13, 16, 19 and 21 and the risk attitudes of the respondents (Table 4.6). It could therefore be inferred that livestock production to complement household income (statement 9), sales of farm produce (statement 11), engagement in off-farm jobs/activities (statement 13), off-farm income as important source of household income (statement 16), household members' interest in farming(statement 19) and application of fertilizer(statement 21) were the effective management strategies used by the farm households who had risk aversion attitude in the study area. The result is supported by Robison *et al.* (1982) and Hardakar *et al.* (1997) who reported a positive relationship between risk aversion and risk management strategies. The R^2 value was 0.424, meaning that 42.40 % of the risk attitudes (risk aversion attitude) of the farm households was explained by the used management strategies.

Table 4.8: Linear multiple regression on the relationship between farm household risk attitudes and management strategies used

Variables	Regression Coefficients	Std Error	t-value
Constant	64.13*	3.528	18.178
Livestock production to compliment household Income (statement 9)	1.16***	0.615	1.887
Sales of farm produce(statement 11)	3.05*	0.789	3.862
Engaged in off-farm jobs/activities(statement 13)	1.34***	0.695	1.922
Off-farm income as important source of Household income(statement 16)	1.73**	0.734	2.354
Household members 'interest in farming(state 19)	1.37***	0.768	1.785
Application of fertilizer(statement 21)	2.86*	0.790	3.621
Use of improved seeds/input(statement 25)	0.99	0.970	1.018
Use of organic manure(statement 27)	1.09	0.841	1.294
R^2	0.424		
Significant level: *10%; **5% &***1%			

Source: Field survey data, 2011

CHAPTER FIVE

SUMMARY, CONCLUSION, CONTRIBUTION TO KNOWLEDGE AND RECOMMENDATIONS

5.1   Summary

The study examined the risk and management strategies among farm households in Bwari and Kuje Area Councils of Abuja. The study aimed to identify the major sources of risk to agricultural production; determined households' perceived magnitude of the risks; risk attitudes of the farm households; relationship between households risk attitude and their socio-economic characteristics. Furthermore, the study also seeks to identify risk management strategies available and used by the farm households and the effectiveness of the management strategies. Structured questionnaires were used to collect relevant data from 150 randomly selected rural farm households in the study area. The data collected were analyzed using descriptive statistics, attitudinal scale approach and multiple regressions.

The farming households identified drought, high cost of animal vaccination, ill health of the farmer, inadequate credit facilities, inadequate family labour, inadequate farm land and high interest rate as the major threats to their agricultural production. Amongst these threats, high interest rate, inadequate farm land, ill health of the farmer and lack of animal vaccination were perceived as severe and occurred all year round. This finding could be useful source of information in designing intervention programme, so that severe source of risk to agricultural production could be factored into the risk assumptions during appraisal stage. The study also revealed that the farm households in the study area exhibited the 3-probable categories of the risk attitudes obtainable. It was noted that the proportions of households being risk averse and risk taker was 32.0% to

62.7% respectively. This implies a ratio of 1:2. It was inferred that to every three farming households, one could be categorized as having risk averse attitude and would adopt management strategies. This could be useful piece of information in planning adoption process for farming households in the study area.

The exponential multiple regression results showed that with increase in age of the respondent and off-farm income, risk aversion attitude increases. On the other hand, with increase in year of farming experience, risk preference behavior of the household increases. The independent variables included in the analysis explained about 41 per cent of variation in risk attitude score.

The result of linear multiple regression showed that with increase in risk management strategies such as livestock production to complement household income, sales of farm produce, engagement in off-farm jobs/activities, off-farm income as important source of household income, household members' interest in farming and application of fertilizer used by the farm household in the study area, risk aversion attitude also increases.

5.2   Conclusion

The study of risk and management strategies among the farm households in the Bwari and Kuje Area Councils of Federal Capital Territory, Abuja Nigeria, showed that the studied farm households identified inadequate farm land, ill health among others as severe and all year source of risk to their agricultural production. The study also revealed farm households in the study area were more of risk taking than risk averse attitude. Age was seen as the significant reason for their risk taking attitude. This could be a threshold for the policy maker in agricultural development to engage the farm

households in adoption of improved agricultural innovations, bearing in mind risk taking attitude of the people. It was noted that the farm households that exhibited risk aversion attitude have livestock production as complementary to income from crop production, engagement in off-farm activities, household members' interest in farming, steady income from off-farm jobs/activities as optional effective management strategies used to reduce risk adverse effects.

5.3   Contribution to Knowledge

- With the result from the study that shows that proportion of farm households being risk averse and risk taker/risk preference was 32.00% to 62.7%, which implies a ratio 1:2, this could contribute to baseline information for Platform on Agricultural Risk Management (PARM), which is a new initiative to help farmers to better cope with the risks they are facing.

- Also, from the study 64% of the sampled farm households confirmed that the magnitude of the threat to their agricultural production is mild, while the remaining 36% says the threat magnitude is severe. Hence holistic approach in risk management should not be only focused on agricultural production issues. It should also address trade policies and regulations, infrastructure, food security and nutrition issues, budget management, credit systems etc

5.4   Recommendations

i.   The study revealed that as the farm size increases risk averse attitude becomes more pronounced. Since there is a Nigeria government paradigm shift in agriculture from small holders farming to commercial farming, there is need for all stakeholders (policy makers, non-governmental organizations, community

based organizations, development partners etc) to factor-in more actions on risk management/coping strategies.

ii. The study also showed that the older farmers take less risk than the younger ones. With the current government' Agricultural Transformation Agenda (ATA), the youths, whose age brackets are prone to risk taking in farming enterprises should be mobilized into agricultural ventures.

iii. Majority (about 66%) of the farm households perceived high interest rate as severe and an all year round risk to agricultural production. With the coming on board of Nigeria Incentive-Based Risk Management System for Agricultural Lending (NIRSAL) there is need for government to ensure that the risk-sharing facility window of NIRSAL should network with Microfinance Institutions (MFIs), Microfinance Banks (MFBs), Commercial banks etc, which actually have farmers as focus in their credit facilities.

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APPENDIX

QUESTIONNAIRE

DEPARTMENT OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY, AHMADU BELLO UNIVERSITY, ZARIA NIGERIA

PROJECT TITLE: ANALYSIS OF FARM RISKS AND MANAGEMENT STRATEGIES AMONG HOUSEHOLDS IN FCT, ABUJA, NIGERIA

All the information given here are to be used for research purpose. You are therefore assured of absolute confidentiality of all the information.

Date of interview: ---------------**LGA**--------------**Ward**:----------**Village Name**------------------ -

A. SOCIO – ECONOMIC DATA-*objective iv*

1.Age: ---------years

2.Gender: Male (   ); Female (   )

3.Marital status: Single (   ); Married (   ); Divorced (   ) Widowed (   )

4.How long have you been farming in this area: -----------------years

5a.Educational Status of the respondent: i.formal (   ); ii.non-formal (   ) (tick as appropriate).

5b.If formal, what is the highest level attended? i.Adult Education(   ) ii.Primary Education(   ) iii.Post Primary Education(   ) iv.Tertiary Education(   )

6.What is the composition of your household size? (fill table below)

Household Category	Number
Wives/Husband	
Male Children (< 15yrs)	
Male Children (> 15yrs)	
Female Children (< 15yrs)	
Female Children (> 15yrs)	
Others (specify)	
Total	

7.What is the total farm size cultivated in 2009/2010 farming season in------- hectares (note, 2.5 acres = 1hectare = 1 football field)

8.How did you obtain your land? i.Inheritance ( ) ii.Lease/Rent ( ) iii.Gift ( ) iv.Family land ( ) v.purchased ( ) vi.Borrowed ( ) vii.Government owned ( ) viii.Others(specify)---------

9.If rented, how do you pay your rent? i.Once a yr( ); ii.2twice a yr( ); iii.every 2yrs( ); iv.every 3yrs( ); v.others--------------------.

10.If the land is bought, what is the purchase price ₦ --------------------------------

11.Can you get extra land if you want to expand farming enterprise? ( )Yes ( )No

12.Is land a constraint to your farming enterprise? ( ) Yes ( ) No

13.If yes, give reasons and how you cope with land limitation …………………………………………………………………..

14a.Do you belong to any cooperative group? ( ) Yes ( ) No

14b. If yes, which one ---

14c. If No, why? ---

14d.If yes, how much do you pay as membership fee in ₦ ?-----------

14e.If yes, how long have you been a member ?---------------------- in years.

15a.What is your primary source of income? i.Farming ( ) , ii.Carpentry ( ) iii.Trading ( ) iv.Bricklaying( ) v.Civil service work( ) vi.Contractor ( ) vii.Tailoring ( ) viii.Others (specify) ----------------------------------

15b.What other source(s) of income do you have? i.Carpentry ( ) ii.Trading ( ) iii.Bricklaying( ) iv.Civil service work( ) v.Contractor ( ) vi.Tailoring ( ) vii.Others (specify) -------------

B. HOUSEHOLD ECONOMIC ACTIVITIES DATA-*objective iv*

(i) Farming System

16.What type(s) of farming system do you practiced? i. crop farming( ) ii.livestock( ) iii.both( ) iv.others(specify)………………..

17a.How do you grow your crop(cropping system)? i.Sole ( ) ii.Mixed ( ) iii.Intercropping ( ) vi. Crop rotation ( ) v. others (sprcify)--------------------

17b.Give reasons for your response in (18a) i.………………………….; ii.……………………..

17c.List five most important crops you cultivate 1……............. 2………….. 3…………… 4…………….. 5……….............

18.What type of livestock do you keep? i.Poultry keeping( ) ii.Pigery ( ) iii.Goat&Sheep( ) iv. Rabbitry( ) v. Cattle( ).

19.How much did you make in 2009/2010 farming session? i.From crops in ₦ …………

ii.From livestock in ₦ …………..

(ii) Off-farm Enterprises

20a.Do you engage in Off-farm activities? ( ) Yes ( ) No

20b.If yes, what Off-farm enterprise do you engage in? i.Carpentry ( ) ii.Trading ( ) iii.Bricklaying( ) iv.Civil service work ( ) v.Contractor ( ) vi.Tailoring ( )vii.Barbing

( ) viii.Grinding ( ) ix.Others (specify)…………………………………

21.How much did you make from Off-farm enterprise in 2010 in ₦ ………………..

(iii) Capital availability and use

22.From where did you obtain capital for your farming activities? i. Personal savings( )

ii. Relatives and friends ( ) iii. Cooperatives society( ) iv. Money lender( )

v. Government ( ) vi. N.A.C.R. D.B( ) vii. Other (specify)……………………..

23.From where did you obtain capital for your Off-farm activities? i.Personal savings( ) ii.Relatives and friends( ) iii. Cooperatives society( ) iv. Money lender( ) v.Government ( ) vi. N.A.C.R. D.B ( ) vii. Other (specify)……………………..

(iv) Labour Availability

24.What source of labour do you use on your farm? i.Family ( ) ii.Hired ( ) iii. Communal ( ) iv. Others (specify)……………………….

25. How often do you get labour for farming activities? i. Regularly ( ) ii. Occasionally ( ) iii. when needed ( ) iv. Not at all ( )

(v) Inputs Use

26. What are your sources of farm inputs e.g chemicals, seedlings, DOCs, drugs etc used? i. Open market ( ) ii.Friends and relations ( ) iii.Old stock ( ) iv.ADP, MANR ( ) v.others (specify)-------------------------------------

(vi) Risks to farming activities-*objectives i&ii*

1	2	3	4	5	6	7
S/No	Suggested Risks	Have you experience this risk (Yes/or No)	How many times have you experience this risk in last 5 years?	Rank this Risk (1,2, or 3)*	Period of the year which risk is most several (1,2 or 3)**	Mention the management strategies used to address the risks
1	Plant pests and diseases					
2	Drought					
3	Inadequate of improved varieties					
4	Desert encroachment					
5	Inadequate soil nutrients					
6	No vaccinations					
7	Inadequate of inputs e.g. fertilizer, herbicides, pesticides					
8	Livestock disease outbreak					
9	Dangerous weed					
10	Destruction of crops by animals					
11	High cost of inputs price					
12	Low output (farm produce) prices					
13	Erratic rainfall					
14	Inadequate market for farming produce					
15	Ill health of the farmer					
16	Inadequate credit facilities					
17	Inadequate family labour					
18	Inadequate farming land					
19	High interest rate					
20	Lack of functional credit bank e.g. MFBs					
21	Adulteration of farm inputs e.g. chemicals					
22	Lack of technical					

S/N	Statements					
23	Too much rainfall/flood					
24	Conflict within the community					
25	Conflict with Fulani cattle rearers					
	Others (specify)					

* Column 5 = Rank 1 = severe; Rank 2 = mild; Rank 3 = Pose no risk

** Column 6 = put 1 for raining season; put 2 for dry season and put 3 if all year round

C. RISK ATTITUDE & MANAGEMENT STRATEGIES-*objectives iii & v*

28.Indicate as appropriate the extent to which you agree with the statements below.

SA = Strongly Agreed =5; A = Agreed=4; UN = Uncertain=3; D = Disagreed=2;

SD = Strong Disagreed=1.

S/N	Statements	SD 1	D 2	UN 3	A 4	SA 5
1	I never insure my farm					
2	I adopt new technology in my farming practice					
3	I never have future market for my farm produce					
4	I do not have formal life insurance					
5	I do practice both rain-fed and dry season farming					
6	Income generated from farming activities is not enough for the financial survival of my household					
7	In case of emergence, I do not have sufficient back-up labour to carry on farming activities					
8	I used tractor for my farming activities					
9	I never rear animal to sell for complementing my income					
10	I practice mixed cropping in my farm					
11	I never sell my farm produce at market					

S/N	Statements	SD 1	D 2	UN 3	A 4	SA 5
12	I plant my crop(s) because it is profitable					
13	I do not have any other job apart from farming					
14	I belong to farmers' groups / association					
15	I do not benefit from credit from cooperative / banks					
16	Off-farm income is not important source of income for me and my household					
17	I do have access to ADP extension agents					
18	I rely heavily on market information in making my marketing decisions					
19	There is nobody else in the household who has interest in farming as business					
20	I do use insecticide/pesticide in my farm					
21	I never apply fertilizer in farm					
22	I save greater share of my income in bank					
23	I never have storage facility to store my farm produce					
24	I do keep record of my farming work					
25	I never use improved seeds in my farms					
26	I do use traditional method of farming					
27	I never use organic manure on my farms					
28	I often fall sick					
29	Weather is never favourable for my farming activities in the previous farming seasons.					
30	I benefit in government project in my village/community e.g Fadama , NPFS, RTEP etc					
31	I have ready-made market for my farm produce					
32	I do not have enough money for my farming activities / business					
33	Others…					

S/N	Statements	SD 1	D 2	UN 3	A 4	SA 5
34						
35						
36						
	Aggregate score (Y)					

D DECISION MAKING / ASSISTANCE.

29.From your experience for the past 5 farming years, which crops are risky in terms of variability in returns generated? (list in decreasing order) i---------------------------------ii-----------------------iii------------------------------and iv---------------------------------

30.From your experience for the past 5 farming years, which livestock types are risky in terms of variability in returns generated? (list in decreasing order) i--------------------------ii----------------iii-------------------------------and iv---------------------------------

31.From your experience in the past 5yrs, which off-farm enterprise(s) are risky in terms of variability in returns generated? (list in decreasing order) i---------------------------------ii----------------iii--------------------------------and iv---------------------------------

32.What steps do you think can be taken to minimize such variation in output and income as farmers ----------------------;---------------------------; -----------------------

33.Do you have access to any extension services? Yes/No

34.What assistance do you receive from extension services/agent: i. Technical Assistance ( )   ii.Loan ( )   iii.Tractor hiring ( )   iv.Training Programmes ( ) v.others (specify) ----------------

35. In what ways has your household benefited from extension services? i.----------------------------ii-------------------------; iii-------------------------------; iv--------------------------------------

E. GENERAL

36a.What major problems do you encounter in your crop farming activities? i-------------------------ii---------------------------, iii--------------------------------- iv---------------------------------

36b.What are your suggestions for solving your crop farming problems? i----------------------------ii-------------------------------; iii---------------------------; iv-------------------------------

37a.What major problems do you encounter in your livestock farming activities? i-------------------ii--
-------------------------, iii----------------------------- iv-----------------------------

37b.What are your suggestions for solving your livestock farming problems? i-----------------------ii--
--------------------------; iii----------------------------; iv-------------------------------

38a.What major problems do you encounter in your off-farm activities? i-----------------------------ii--
--------------------------; iii----------------------------; iv-------------------------------

38b.What are your suggestions for solving your off-farm problems? i------------------------;   ii-------
-----------------; iii----------------------------; iv-------------------------------

39. Any other suggestion? i--ii-----------

THANK YOU