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

BY
Olawoyin Taiwo AGBOOLA
P13AGAE8001

A Thesis submitted to the School of Postgraduate Studies, Ahmadu Bello University, Zaria in partial fulfillment of the requirements for the award of the degree of Master of Science in Agricultural Economics

Department of Agricultural Economics and Rural Sociology,
Faculty of Agriculture
Ahmadu Bello University, Zaria Nigeria

JUNE, 2015
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.

________________________  ________________
Olawoyin Taiwo AGBOOLA        Date
(Student)
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.

Prof. S.A. Sanni
Chairman, Supervisory Committee

Prof. S.A. Rahman
Member, Supervisory Committee

Prof. Zakari Abdulsalam
Head, Department of Agricultural Economics & Rural Sociology

Prof. Zoaka A. Hassan
Dean, School of Postgraduate Studies
Ahmadu Bello University, Zaria
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.
ACKNOWLEDGEMENTS

My profound gratitude goes to the Almighty God for granting me the grace and courage to complete this work.

Many thanks to my supervisors Prof. S.A Sanni and Prof. S.A Rahman, for their meticulous review of the work and very thoughtful suggestions for improvement from the inception of the study. You are indeed scholars, I owe great honour. I will always refer to you as my “Dream Helpers”. May God continuously bless all your efforts in life with great success.

I appreciate the Head of Department (Prof. Zakari Abdulsalam) and all my lecturers in the department, especially Prof Omokore and Dr Damisa, for being part of the instrument in the process of my making. Special thanks to my “Mentor”, Prof. and Mrs E.I Ikani and the children. Indeed your advice, encouragement and moral supports are immensely acknowledged.

I also acknowledge my immediate boss, Mrs A.U Ufaruna, you gave me all the supports I needed to complete this work. May God reward your labour of love. Also, my thanks goes to my NPC, Mr M.O Azeez; you are ever supportive. I thank all RUFIN staff members.

I say a big thank you to the following families: The Akintunde, Areo, William, Igue, Adeyemi, Oke, Alao, Ogunyemi, Rev Idowu Akintola, Pastor Osuntope, Evangelist Adeyemi, Pastor Akin Alawode, Pastor Yinka Adewuni, Sunday School Department family of NEBC.
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.

My brothers, Mr Olayinka Agboola, CSP Olajide Agboola, Mr Olasunkanmi Agboola and Kehinde Agboola and their families, you are indeed “Mentors” and more than a friend. May you live to eat the good fruits of your labour.

My warmest regards to my “precious jewel”, Agnes Olubukola Agboola, for having you by my side on my path to greatness. You are indeed a virtuous wife. My children, Grace and Glory, blessed are you of the Lord at your coming into our lives and home.
**TABLE OF CONTENTS**

TITLE PAGE ........................................................................................................... i
DECLARATION ......................................................................................................... ii
CERTIFICATION .................................................................................................... iii
DEDICATION ......................................................................................................... iv
ACKNOWLEDGEMENTS ....................................................................................... v
TABLE OF CONTENTS ....................................................................................... vi
LIST OF TABLES ................................................................................................... x
LIST OF FIGURES ................................................................................................. xi
LIST OF ABBREVIATIONS ................................................................................... xii
ABSTRACTS .......................................................................................................... xiii

**CHAPTER ONE**

INTRODUCTION ................................................................................................... 1
1.1 Background to the Study ............................................................................... 1
1.2 Problem Statement ....................................................................................... 3
1.3 Objectives of the Study ............................................................................... 4
1.4 Justification of the Study ............................................................................ 5
1.5 Hypotheses .................................................................................................. 6
1.6 Operational Definition of Terms ................................................................ 6

**CHAPTER TWO**

LITERATURE REVIEW ......................................................................................... 8

| 1.2.1 | Risk Attitudes of Small-Scale Farmers in Nigeria | 8 |

*Formatted: Indent: Hanging: 0.75", Line spacing: single, Outline numbered + Level: 2 + Numbering Style: 1, 2, 3, ..., Start at: 1 + Alignment: Left + Aligned at: 0.5" + Indent at: 0.75"*
CHAPTER THREE
METHODOLOGY

1.10 Study Area

1.11 Sampling Procedure

1.12 Methods of Data Collection

1.13 Analytical Tools

1.13.1 Descriptive statistics

1.13.2 Attitudinal scale approach

1.13.3 Reliability testing of ASA model

1.13.4 Optimizing the ASA model

1.13.5 Multiple regression model
**CHAPTER FOUR**  
RESULTS AND DISCUSSION .......................................................... 42  

4.1 Major Risks to Agricultural Production ........................................ 42  
4.2 The Farm Household Perceived Magnitude of These Risks .......... 44  
4.3 The Risk Attitude of the Farm Households in the Study Area .......... 47  
4.4.1 The household’s socio-economic characteristics ...................... 48  
4.4.2 Risk attitude and their socio-economic characteristics ............... 52  
4.5 Management Strategies Used by the farm households in coping with Risk ....................................................................................... 55  
4.6 Effectiveness of the Management strategies used ........................ 57  

**CHAPTER FIVE**  
SUMMARY, CONCLUSION AND RECOMMENDATIONS ................. 59  

5.1 Summary ....................................................................................... 60  
5.2 Conclusion ................................................................................... 60  
5.3 Contribution to Knowledge .......................................................... 61  
5.4 Recommendations ....................................................................... 61  
REFERENCES ................................................................................... 63  
APPENDIX: Interview Schedule ...................................................... 68
**LIST OF TABLES**

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Quantitative measure of rural households’ risk attitude, using Likert’s</td>
<td>37</td>
</tr>
<tr>
<td>4.1</td>
<td>Identified risks that posed threats to agricultural production</td>
<td>43</td>
</tr>
<tr>
<td>4.2</td>
<td>Farm household perceived magnitude of the threats</td>
<td>46</td>
</tr>
<tr>
<td>4.3</td>
<td>Distribution of aggregate score measuring risk attitude of the respondents</td>
<td>47</td>
</tr>
<tr>
<td>4.4</td>
<td>Attitudinal scale approach (risk aversion attitudes)</td>
<td>48</td>
</tr>
<tr>
<td>4.5</td>
<td>Frequency table for year of farming experience</td>
<td>49</td>
</tr>
<tr>
<td>4.6</td>
<td>Multiple regression estimates (exponential) for the relationship</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>between farm household risk attitudes and socio-economic characteristics</td>
<td></td>
</tr>
<tr>
<td>4.7</td>
<td>Reliability testing of attitudinal scale</td>
<td>56</td>
</tr>
<tr>
<td>4.8</td>
<td>Linear regression on the relationship between farm household</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>risk attitudes and management strategies used</td>
<td></td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 2.1</td>
<td>A hypothetical value function and a weighting function</td>
<td>22</td>
</tr>
<tr>
<td>Figure 4.1-</td>
<td>Years of farming experience of the respondents</td>
<td>50</td>
</tr>
<tr>
<td>Figure 4.2-</td>
<td>Household size of the respondents</td>
<td>51</td>
</tr>
<tr>
<td>Figure 4.3-</td>
<td>Farm size of the respondents</td>
<td>52</td>
</tr>
</tbody>
</table>
# LIST OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADP</td>
<td>Agricultural Development Programme</td>
</tr>
<tr>
<td>AMAC</td>
<td>Abuja Municipal Area Council</td>
</tr>
<tr>
<td>ASA</td>
<td>Attitudinal Scale Approach</td>
</tr>
<tr>
<td>ATA</td>
<td>Agricultural Transformation Agenda</td>
</tr>
<tr>
<td>CISC</td>
<td>Corrected Item Score Correlation</td>
</tr>
<tr>
<td>EU</td>
<td>Expected Utility</td>
</tr>
<tr>
<td>FCT</td>
<td>Federal Capital Territory</td>
</tr>
<tr>
<td>MFBs</td>
<td>Microfinance Banks</td>
</tr>
<tr>
<td>MFIs</td>
<td>Microfinance Institutions</td>
</tr>
<tr>
<td>NFDP-II</td>
<td>Second National Fadama Development Project</td>
</tr>
<tr>
<td>NFDP-III</td>
<td>Third National Fadama Development Project</td>
</tr>
<tr>
<td>NIRSAL</td>
<td>Nigeria Incentive Based Risk-Sharing System for Agricultural Lending</td>
</tr>
<tr>
<td>NPFS</td>
<td>National Programme for Food Security</td>
</tr>
<tr>
<td>PCM</td>
<td>Paired Comparison Method</td>
</tr>
<tr>
<td>PT</td>
<td>Prospect Theory</td>
</tr>
<tr>
<td>RTEP</td>
<td>Root and Tuber Expansion Programme</td>
</tr>
<tr>
<td>SPFS</td>
<td>Special Programme for Food Security</td>
</tr>
<tr>
<td>VNM</td>
<td>Von Neumann Morgenstern</td>
</tr>
</tbody>
</table>
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 R² 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
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;
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 \( U(x) \).
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, the 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:

$$U(p_1,...,p_n) = \sum_{i=1}^{N} p_i u(x_i)$$
Where $U$ is the VNM expected utility function, $u(x_i)$ is the utility of the $i$th 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 $U(p_1,\ldots,p_n)$, 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: $\succeq$ 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. $p\sim q$, 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, $p,q,r \in P$, ($p \succeq q$, and $q \succeq r$) $\Rightarrow$ $p \succeq r$; ($p \sim q$ and $q \sim r$) $\Rightarrow$ $p \sim r$.

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 $p \succeq q$ and $q \succeq r$ there exists $\alpha, \beta \in (0,1)$ such that: $\alpha p + (1-\alpha) r \succeq q$ and $q \succeq \beta p + (1-\beta)r$. 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 $\alpha \in (0,1)$, if $q \succeq p$, then $\alpha p + (1-\alpha) r \succeq \alpha q + (1-\alpha)r$. 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 $\alpha$ 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 $\succeq$. 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:
The other is a measure of relative risk aversion:

\[ r_R(x) = -x \frac{U''(x)}{U'(x)} \]  \hspace{1cm} (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

\[ P(x,t) = -t \frac{U''(x+t)}{U'(x+t)} \]  \hspace{1cm} (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 \( \pi(p) \), 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:

\[ V(x,p;y,q) = \pi(p)v(x) + \pi(q)v(y) \]  

(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,

\[ V(x,p;y,q) = v(y) + \pi(p)[v(x) - v(y)] \]  

(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, \( \pi \), 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.
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 farmer’s 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:

  \[ \frac{n(n-1)}{2} \]  

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:

\[ \text{LSD} = 1.96 \sqrt{\frac{\text{SF}(n)(n+1)/6}{}} \]  

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:
\[ \alpha = \frac{k}{k-1} \left\{ 1 - \left( \frac{\sum_{i=1}^{k} \sigma_i^2}{\sigma_y^2} \right) \right\} \]

Where, \( \alpha = \text{Cronbach’s coefficient alpha} \)

- \( k = \text{number of statement items in the ASA Model} \)
- \( \sigma_i^2 = \text{variance of ith statement item} \)
- \( \sigma_y^2 = \text{total variance of the k- statement item scale} \)

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:

\[ r_{\bar{y}_i-y} = \frac{(r_{y_i}\bar{y}_i - \bar{y}_i)^3}{\left( \bar{y}_i \bar{y}_i + \sigma_y^2 + 2\bar{y}_i r_{y_i}\bar{y}_i \right)} \]

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

- \( r_{y_i} = \text{correction of statement item i with total score y} \)
- \( \bar{y}_i = \text{standard deviation of the total score y} \)
- \( \sigma_i = \text{standard deviation of statement item i} \)
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
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. While 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 coping 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.
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; Usahap; Jiba; Shere; Kabusu; Dakwa; and Kuchiko villages (Bwari Area
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:

\[ S_h = \left( \frac{n * N_h}{N_T} \right) \]  

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
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)

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

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.