KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI

COLLEGE OF AGRICULTURE AND NATURAL RESOURCES FACULTY OF AGRICULTURE

DEPARTMENT OF AGRICULTURAL ECONOMICS, AGRIBUSINESS AND EXTENSION

ASSESSMENT OF RISKS AND CONSTRAINTS FACED BY ACTORS ALONG THE SWEET POTATO VALUE CHAIN IN GHANA

BY:

PROSPER WIE

BSc. (Hons.) AGRICULTURE

A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES, KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF PHILOSOPHY IN AGRICULTURAL ECONOMICS

May, 2016

DECLARATION

I, **Prosper Wie**, author of this thesis do hereby declare that apart from the references of other people's work, which has been duly acknowledged, the research work presented in this thesis was done entirely by me at the Department of Agricultural Economics, Agribusiness and Extension, Kwame Nkrumah University of Science and Technology, Kumasi from May 2014 to August 2015.

I do hereby declare that, this work has neither been presented in whole nor in part for any degree at this University or elsewhere.

Prosper Wie ……. ……

(PG9001913) Signature Date

(Student ID)

Certified by:

Dr. Robert Aidoo ……. ……

(Supervisor) Signature Date

Dr. Dadson Awunyo-Vitor ……. ……

(Head of Department) Signature Date

DEDICATION

This work is dedicated to my unforgettable father; Flavianus Wie (the late), my dear mother; Paulina Doglier for her motherly love and care throughout my life, and my lovely siblings Primus, Perpetual and Philemon.

ACKNOWLEDGEMENT

For a work of this nature, covering a wide range of areas, it is very difficult indeed, if not impossible to recollect all the sources of ideas used or adequately acknowledge debts where they are due. Any observed failure of such acknowledgment should not be taken as instances of intellectual dishonesty. Most importantly, my unreserved thanks go to the Almighty Lord, the giver of every good thing for his gift of life and strength for seeing me through both good and bad moments during the period. I say I am yours and all that I have today is yours.

Secondly, my utmost gratitude goes to my supervisor, Dr. Robert Aidoo for his professional advice, fatherly guidance and unfailing encouragement throughout the entire research period. He has enriched this work considerably by his own research experience and critical appraisal of all sections of the work. I am greatly indebted to him for his keen interest in following the progress of this work. I am also highly appreciative of the comments and suggestion of Prof. Olav Jull Sørensen of the Aalborg University of Denmark which also helped improve this work.

To all the lecturers of the Department of Agricultural Economics, Agribusiness and Extension who contributed immensely to the successful fruition of this work with their constructive criticisms and suggestions during seminars, I am so much grateful.

Also, my heartfelt gratitude goes to all the field/research assistants who assisted me unreservedly during my field data collection which fundamentally has made this work what it is today. The efforts of the staff of the Ministry of Food and Agriculture (MoFA) in the Fanteakwa and West Mamprusi districts particular Mr. Adzi Doku and Mr. Abraham Ayirekeh respectively cannot be over-emphasized. I am appreciative of their effort.

This research was made possible through the financial assistance from the Danish International Development Agency (DANIDA) through the *"Strengthening the Root and Tuber Value Chains project in Ghana"*. I am exceedingly grateful for such a gesture and honour done me.

Finally my special thanks go to my family and all my friends especially Ibrahim Latif Apaassongo, Stanley Boakye Acheampong and all the scholars on the *"Strengthening the Root and Tuber Value Chains project in Ghana"* for their constructive suggestions and constant encouragement throughout the work.

ABSTRACT

This study was aimed at examining risks and constraints of actors along the sweet potato value chain in Ghana by focusing on Fanteakwa (Southern sector) and West Mamprusi (Northern sector) districts. Data were collected from both primary and secondary sources with primary data forming the core of the study. Selection of 200 producer respondents was done using the simple random sampling technique whilst a combination of accidental sampling and snowballing techniques were used to select 100 traders and 80 processors of sweet potato. Value chain mapping was done to establish the linkages and relationships among actors along the value chain and the produce pathways. Descriptive statistics were used to identify and analyze risks and management strategies employed by value chain actors to mitigate them. The multinomial logit model and Kendall's coefficient of concordance were used to analyze the choice of risk management strategies and constraints respectively. The study results revealed that, the main actors along the sweet potato value chain are input suppliers, producers, collectors, wholesalers, retailers, processors and consumers. The sweet potato value chain was found to be buyer-driven and governed by collectors. The chain was also found to be weak. in terms of integration and access to market information. Risks along the sweet potato value chain were seen to be identical for particular group of actors. However, there was wide variation in terms of predictability and management strategies employed by actors. It was also realized from the study that, producers are constrained with high cost of chemical inputs, poor road network to farms and high cost of labour which hamper sweet potato production. Low commodity price, poor road network to market centers and long market distance are the most pressing marketing constraints for farmers. Traders also identified high transport cost, inadequate storage facilities and high post-harvest losses as the most critical constraints which are inimical to their sweet potato business. Limited working capital, limited access to credit and high perishability of produce were identified as the most constraining factors at the processor level. The multinomial logit model results revealed that farm size, amount of money saved, income from sweet potato, credit, sweet potato farming experience, output from previous season, education, extension contact and off-farm income significantly influenced the choice of production risk management strategy whilst the choice of price risk management strategy by farmers was significantly influenced by output from previous season, farm size, access to extension services, sweet potato farming experience and amount of money saved. Therefore, policies and strategies aimed at improving savings habit of farmers, education and sensitization through access to extension services, and enhanced access to credit are recommended by the study.

TABLE OF CONTENTS

LIST OF TABLES

TABLE **PAGE**

LIST OF FIGURES

FIGURE **PAGE**

ABBREVIATIONS AND ACRONYMS

AEAs	Agricultural Extension Agents
CIP	International Potato Center
CRI	Crop Research Institute
DADU	District Agricultural Development Unit
DDO	District Development Officer
EU	European Union
EC	European Commission
FAO	Food and Agricultural Organization of the United Nations
FBOs	Farmer Based Organizations
FGDs	Focus Group Discussions
FIs	Financial Institutions
GDP	Gross Domestic Product
GSS	Ghana Statistical Service
ILO	International Labour Organization
MNL	Multinomial Logistic Regression
MoFA	Ministry of Food and Agriculture
NGOs	Non-Governmental Organizations
RIs	Research Institutions
RMS	Risk Management Strategy
RTIP	Root and Tuber Improvement Program
RTIMP	Root and Tuber Improvement and Marketing Program
RVI	Random Variability Index
R&T	Roots and Tubers
SARI	Savanna Agricultural Research Institute
SP	Sweet Potato
TVI	Total Variability Index
SSA	Sub-Sahara Africa

USAID	United State Agency for International Development
VIF	Variance Inflation Factor
WAAPP	West African Agricultural Productivity Programme

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

In Ghana, agriculture employs more than 50 percent of the economic active population and contributes more than 30 percent to export receipts and 22 percent of Gross Domestic Product (GDP) (GSS, 2013). Within food crop production, diverse crop enterprises are managed in order to improve food security and household income generation. Major among such enterprise are cereals and grains followed by Root and tuber (R&T) crops (Babaleye, 2005). Root and tuber crops consumption forms between 16 and 31% of per capita daily calorie intake in Ghana (GSS, 2005).

The main roots and tuber crops in Ghana are cassava, yam, cocoyam and sweet potato. Sweet potato has seen minimal work on value chain development. However, the crop holds the position as one of the main food security crops in Africa due to its resistance to drought, flexible planting, harvest cycle and tolerance of low-quality soils. Due to the crop's versatility and adaptability, it is ranked as a universal crop and seventh most important food crop next to wheat, rice, maize, potato, barley, and cassava since it contains a substantial source of carbohydrate, carotene and vital vitamins (CIP, 2000; FAO, 2002). The consumption of the crop is mainly in the fresh form by either frying, boiling or roasting; the vegetative parts (vines) are mostly fed to livestock predominantly in areas such as central Kenya where zero grazing management systems particularly in small scale dairying is well established. They may also be utilized by young calves as starter feed and partial milk replacer (Orodho *et al.*, 1995).

Notable production areas and sweet potato supply centers in Ghana are Eastern, Central, Northern, Upper East, and Volta Regions; the later three regions intersect/coincide with the country's poverty map. The sweet potato value chain in Ghana comprises many actors interlinked by different governance structures which expose them to different risks and constraints. In the sweet potato enterprise like most agricultural enterprises, its production and marketing is subject to many risks emanating from weather, technical and institutional constraints. Addressing constraints of sweet potato production as well as physical, facilitating and exchange functions of marketing thus promises improvements in poverty and food security.

Weather, market developments, hazards and other unforeseen events may not be controllable at the firm level but have direct effects on the returns from agricultural production, marketing and processing activities and all economic and business activities for that matter (Baquet *et al.*, 1997). Value chain activities are therefore associated with several potential outcomes with different variations and likelihood of occurrence. In this context, participation in sweet potato value chain necessarily involves risk management. The risk management strategies adopted and how effective they are would determine the business outcome of producers, traders and processors in the sweet potato value chain. Effective risk management strategies will lead to favorable business outcome which could include high productivity, improved income or profits, enhanced household food and livelihood security.

Agricultural risk and risk management instruments, however, may have a certain number of specificities. Among the myriad of risks directly affecting decisions and welfare of actors along the sweet potato and/or any agricultural value chain, two stand out. They include price risk and production (output) risk with likelihoods of increasing due to trade liberalization and climate change respectively (Freshwater and Jette-Nantel, 2008). The former is caused by potential fluctuations in prices and the latter results from uncertainty about the levels of production achievable from current activities due to uncontrollable events such as weather.

1.2 Problem Statement

Agriculture is very important to the Ghanaian economy, contributing to employment generation, income, food security and poverty alleviation. Unfortunately in Ghana, agricultural promotion only takes into account a limited number of crops namely rice, maize, cassava, yam, groundnut, cocoa etc. One of the neglected (orphan) crops in the country is sweet potato. Like other root and tuber crops, sweet potato is a food security crop which contributes not only to calorie intake but employment creation, income and poverty alleviation in production and distribution centers. A number of farmers are involved in the production of the crop in some Southern and Northern Regions of Ghana. Due to its short gestation period, it can be cultivated three times in a calendar year by farmers serving as a constant and stable source of income for them. The marketing and distribution as well as processing of sweet potato have generated employment to many households especially women, and livelihoods to such households largely depend on the crop. Production, marketing and processing of root and tubers like many food crops is dominated by small scale resource poor groups.

Nutritionally, the crop is known to be a well-balanced major plant food with a good proportion of protein and calories, whilst complemented largely by substantial quantities of vitamins, especially vitamin C, minerals, and trace elements. As a result of the correct balance between protein and calories, it is regarded as a start-up food for growing children (Berga *et at*, 1993). Whilst potentially sweet potato is regarded as being widely versatile in its uses, substantial risks and constraints of production and marketing have caused the sector to remain considerably sluggish in terms of productivity and value chain development.

Sweet potato is a subsistence crop in its production zones because it does not play a key role in international trade due to transport and conservation problems (Aho and Kossou, 1997). For this reason, it is a secondary crop that does not receive due attention in Ghana. For instance, Thiele *et al.* (2009) assert that significant issues confronting the sweet potato value chain are; limited access to quality planting materials and other production inputs due to the use of vegetative method of propagation. There is also limited market for the crop as it competes with other prominent roots and tuber crops like yam which is a much accepted alternative to the crop. High perishability of the crop is also seen as the main issue which has made the development of the crop's value chain sluggish. The crop potentially can be cropped at least three times yearly. However, heavy dependence on rains rather than irrigation has made the crop seasonal reducing its cropping potential. Also, limited utilization base (few products currently made from the crop) and knowledge in the processing of already existing products cannot be gainsaid since the only known products from the crop are seen in its boiled, fried and roasted forms with the fried form dominating local processing. Limited coordination among value chain actors has made the value chain of sweet potato less developed since it further leaves actors prone to risks due to limited knowledge or uncertainty of the market. Diverse efforts at improving production of domestic staples like cereals and roots and tubers abound, however, Africa records the lowest in terms of yields as compared with the other continents (regions) of the world (McGranahm, 1999) of which sweet potato is the highest hit. The foregone discussion is indicative that sweet potato value chain is one bedeviled with many risks and constraints whereas research effort has been very low.

The spectrum of risks that impact on the returns of sweet potato value chain actors is wideranging. The two predominant risks are: price risk, mainly resulting from fluctuations in market prices for the produce and production inputs; and output or production risk, reflecting variations in the quantity and/or quality of the goods/commodity produced and channeled along

the value chain. For instance, with inadequate access and inappropriate credit facilities, actors have very little option than to rely on the conventional risk coping strategies which are widely seen as inadequate in reducing the impact of these risks and constraints that they are typically faced with. Actors along the sweet potato value chain can use several tools, when appropriate to deal with these multiple sources of agricultural risk. Value chain actors (sweet potato) might make a decision to avoid risk; for example, producers by selecting not to plant specific sweet potato varieties which they deem to be of high risk in terms of output prediction for the region or space in which their farmlands are situated. They can reduce (mitigate) risks by; for example, planting crops only in very conducive environments or improving their infrastructure to develop irrigation or lessen the impact of drought which substantively has a rippling effect on output or do not trade at all in a particular product on the part of traders (Swiss Re. 2007). Actors along the sweet potato value chain may also mitigate the financial consequences of these risks by creating emergency reserve from returns in good years—a form of self-insurance (Harris and Weiss, 1984). Agricultural risks and constraints are not mutually exclusive for only a section of the chain, the entire sweet potato value chain is affected since activities of actors are interconnected (Freshwater et al., 2008). Every actor along the value chain, from the producer to the final consumer, is subject to these risks and constraints.

As the interconnection between the sweet potato value chain actors becomes more close and complex, the probability of such outcomes being transmitted along the chain are increasing (Moschini and Hennessey, 2001) For example, the easy perishability of the crop in question after harvest makes it difficult to associate risk to just a specific level (section) of the value chain. Solving the risks and constraints at one level still leaves the chain in a vulnerable state particularly in the quest of ensuring food security through the provision of alternative livelihood options. These risks if not critically examined and dealt with can affect the reliability, cost and efficiency of the chain and subsequently hamper the role of sweet potato value chain in improving household livelihood.

This issue of food and livelihood security cannot be harnessed especially through the sweet potato value chain among resource poor actors without critically addressing the risks and constraints faced along the sweet potato value chain. This study, therefore sought to carry-out an in-depth risks and constraints assessment of the entire sweet potato value chain in Ghana to inform policy and strategy formulation by key stakeholder in the sector.

1.3 Research Questions

The study therefore sought to answer the following research questions;

1. Who are the major actors along the sweet potato value chain in Ghana?
2. What are the major risks faced by actors along the sweet potato value chain in Ghana?
3. What are the risk management strategies adopted by actors along the sweet potato value chain in Ghana?
4. What factors influence the choice of specific risk management strategies of producers along the sweet potato value chain in Ghana?
5. What are the constraints faced by actors along the sweet potato value chain in Ghana?

1.4 Research Objective

This study aimed at achieving the following main and specific objectives;

1.4.1 Main Objective

The main objective of the study was to examine the risks and constraints faced by actors along the sweet potato value chain in Ghana.

1.4.2 Specific Objectives

The following specific research objectives were addressed by the study;

1. To map out the sweet potato value chain in Ghana and examine the governance structure in the chain.
2. To identify and examine the major risks faced by actors along the sweet potato value chain in Ghana.
3. To examine various risk management strategies adopted by actors in mitigating risks along the sweet potato value chain.
4. To determine the factors that influences the choice of specific risk management strategies of producers in the sweet potato value chain in Ghana.
5. To identify the constraints faced by actors along the sweet potato value chain in Ghana.

1.5 Justification of the Study

The importance of roots and tubers in terms of present and future potential in employment generation and poverty reduction cannot be overemphasized (Haggblade and Theriault, 2012).

Sweet potato has received minimum attention compared to other roots and tuber crops in the country. This study was an attempt to bridge the knowledge gap by providing empirical information for an in-depth understanding of how sweet potato value chains work in Ghana. This study would add to the existing knowledge in the field of value chains and sweet potato as a crop in developing countries where empirical evidence suggests high level food insecurity.

The study is unique in the sense that risks analysis, which is scarcely part of any previous crop value chain study, was the central focus of this study. Practically, the study sought to bring to fore the key risks and constraints in the sweet potato value chain to help policy makers and other stakeholders to develop strategies to address them. This will help in the decision making process of people going into various aspects of the crop's value chain as entrepreneurs. Policy makers would also be better informed in order to make appropriate investment decisions and strategic interventions based on the empirical evidence provided by this study.

1.6 Organization of the study

This thesis is structured/divided into five (5) chapters. Chapter one (1) comprises of a brief background to the study. In the said chapter, issues concerning food security, the role of agricultural value chain in dealing with the menace and for that matter sweet potato as a crop, agricultural related risk and constraints are discussed. The remaining section of the thesis is organized as follows;

Chapter two (2) reviews literature extensively on the theoretical and conceptual framework/basis of the study. Here, a review of literature on agricultural value chains is provided. The concept of risk and risk management in agricultural value chains are reviewed from different perspectives and finally, literature on constraints confronting sweet potato value chain is also reviewed.

Consequently description of the study area and the methodologies used in the work is presented in chapter three (3). This is where issues relating to type and sources of data, sampling techniques, and data collection methods are discussed. Also, analytical tools employed to examine risks and constraints as well as determinants of the choice of alternative risk management strategies have been presented.

Chapter four (4) deals with the general description of the characteristics of the value chain actors. Also, a descriptive analysis of chain actors and activities and the risk faced is provided,

a detailed discussion of the results from the econometric models of the choice of risk management strategy adopted and finally the constraints along the sweet potato value chain are presented.

Finally, chapter five (5) covers the findings of the study, conclusions and appropriate policy recommendations to help improve the crop's (sweet potato) value chain.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

In this part of the study, the crop (sweet potato) is described, the basic concepts guiding agricultural value chains, the concept of risk, risk associated with agribusinesses and risk management-as well as risk measurement have been reviewed Empirical studies on agricultural value chains, and constraints associated with the value chain of sweet potato have also been reviewed in this chapter.

2.1 Sweet Potato and its Importance

The crop under investigation, sweet potato, is botanically referred as *Ipomoea batatas* L. and it has starchy tubers which develop underground. The, tuberous roots which is edible grows between 15 and 100 centimeters and mostly has mass that ranges between 0.5 and 2.0 kilograms (Hillocks, 2002). Its resistance to disease and drought conditions, flexibility in terms of its planting and harvesting cycles, and tolerance of low quality soils positions it as a basic food security crop in Africa particularly in hunger prone areas. Due to its versatility and adaptability, the crop ranks in the world as the seventh most important food crop after wheat, rice, maize, potato, barley and cassava (CIP, 2000; FAO, 2002). Sweet potato is propagated vegetatively mainly through its vines and each single vine provides multiple cuttings. Some countries in Africa such as Kenya, Ethiopia and Ghana have improved on the traditional system of this multiplication and introduced the rapid multiplication system to increase the production of the crop. Propagation rates of sweet potato are low seed propagation in comparison vegetative propagation; however it can be problematic in terms of spread of virus related diseases. In terms of yields of edible energy and good quality protein per unit and per unit time, it is one of the most productive (Burton, 1989). Sweet potato is considered as a well-balanced major plant food with a fair composition between protein and calories, and has significant amounts of vitamins, particularly vitamin C, minerals and trace elements. Due to its correct balance between protein and calories, it is used when weaning children of breast milk. Ghana is recognized as one of the countries with a good environment conditions (both soil and climate) for increased sweet potato production and productivity (CIP, 2000). According to the Food and Agriculture Organization of the United Nations (FAO, 2005), China led the world production in 2004 with 105 million tons out of the 127 million tons of sweet potatoes produced.

Annually, Sub-Saharan Africa produces more than seven million tons of sweet potatoes, which constitutes 5% of global production (Ewell, 2002). The leading producers of sweet potato in Africa are Uganda (1.7 million tons) and Nigeria (1.6 million tons) followed by Tanzania (1.3 million tons) (FAO, 2004). In 2013, Ghana's production was recorded as 135000 tons which was the highest in fifteen years (FAO, 2014). The average yield for the country is seen as 8mt/ha (MoFA, 2010). Although the yield compared to Africa's average of 6t/ha is good, it is still below the global average yield of 14t/ha and a yield potential of 18t/ha (Smith, 2004). The crop is mostly consumed in the fresh form and also in processed forms (boiled, fried or roasted); however vegetative parts may be fed to livestock particularly in areas such as central Kenya and Asia where dairying at the small scale level and zero grazing systems are very developed. They may also be used as starter feed and partial milk replacer for young calves (Orodho *et al.*, 1995).

2.2 Definitions and Concepts in Value Chain Analysis

The classification of industry chains are done on the basis of being either a 'supply; or value chain. The following definitions within the general term 'industry chain' are used:

S**upply chain:** It refers to the physical channeling of commodities that are required as raw materials for its transformation into processed (finished) products. According to Royal Tropical Institute (KIT) et al. (2006), supply chain refers to the system that is made-up of players and organizations, relations, functions and products, cash and value flows that make possible the transfer of goods and services from the primary level (producer) to the end use. However, producers who participate in the supply function mostly have little bargaining power. This essentially disincentives them to produce quality commodities and traders are at a risk of obtaining low quality commodities.

Dunne (2001) noted that effectiveness and efficiency are the utmost aim of every supply chain manager by making the entire chain better in terms of flow schedule and resource use, control and upgrading quality, food safety risk minimization and contamination, and decreasing the agricultural industry's response to changes in consumer demand for food attributes.

Value chain: Conventionally, a value chain is seen as the full range of activities required to bring a product from its conceptualization, through the different stages of production and transformation. It has also been used to describe firms working collectively to satisfy a common

market demand. It also encompasses a chain of activities that are associated with adding value to a product through the production and distribution phases of each activity (Schmitz, 2005). An organization's competitive advantage is based on its product's value chain which is to deliver optimal value to the end user for the least possible total cost to the company, thereby maximizing profit. However, Gerefi (2005) focused fundamentally on the economic governance patterns of value chain. A value chain comprises of a series of actors (or stakeholders) from input suppliers, producers and processors, to exporters and buyers engaged in the activities required to bring an agricultural product from its conception to its end use (Kaplinsky and Morris, 2001). The value chain has been identified to comprise of three levels (Bammann , 2007). This comprises value chain actors, chain supporters and chain influencers. The value chain actors are those who deal directly with the product through its production, processing and trading stages and ultimately the products. The chain supporters deal with the provision of essential services to enable the effective functioning of the chain actors. Finally, the value chain influencers constitute the policies, infrastructures and the entire regulatory framework that govern operations in the chain.

Porter (1985) however stressed that in conducting value chain analysis, the firm is divided into primary and support activities. Primary activities are those involved in the direct transformation process (i.e. production, trading, processing, etc.) whilst support activities are those who provide the environment necessary for the effectiveness and efficiency of the firm such as human resources management and an appropriate regulatory framework to harness the resources of the firm for it to thrive. The concept of value chain entails the addition of value as product progresses from input suppliers to producers and consumers. A value chain therefore incorporates the productive and/or physical transformation and value addition at each stage of the chain. At each stage in the value chain, the product changes hands through chain actors, transaction costs are incurred and generally, some form of value is added.

Value chain in the case of a typical agricultural perspective results from diverse activities including bulking, cleaning, grading, packaging, transporting, storing and processing (Anandajayasekeram and Gebremedhim, 2009). Value chains encompass a number of mutually dependent organizations, and related institutions, resources, actors and functions involved in supply of inputs, commodity production, processing and distribution of a commodity. Alternatively, a value chain can be viewed as a set of actors and activities, organizations and

the rules governing those activities. Value chain management entails adding some value at every stage in the chain and a justifiable competitive advantage for the firms in the chain

2.2.1 Market Chains versus Value Chains

There are some important differences that has been observed between production chain, supply chain, market chain and value chain although there are often used interchangeably. The engagement of any economic activity which employs the use of inputs or goods and services to ensure that a product is made available to the end consumer is termed as a production chain or a supply chain or a market chain. On the contrary, a value chain is understood as a strategic network between a number of independent business organizations. According to Hobbs *et al* (2000), a value chain is differentiated from production/supply chain since actors in the value chain have a long-term strategic vision, disposed to work together, oriented by demand and not by supply, shared commitment to control product quality and have a high level of confidence in one another that allows greater security in business and facilitates the development of common goals and objectives.

The ultimate goal of any agricultural value chain is to maximize performance in that industry using the collaborated expertise and abilities of the actors along the chain. Successful chains depend on integration, coordination, communication and cooperation between partners with the traditional measure of success being the return on investment or the margin obtained at each level of the chain (Dunne, 2001; Bryceson and Kandampully, 2004).

2.2.2 The Sweet Potato Value Chain

The sweet potato value chain like any other value chain is one operated by various actors. These actors have their specific roles they play in order to attain an effective value chain performance. The numerous activities that are undertaken to produce various commodities and make them readily available for consumers are applied in the concept of value chain. These systems encompass actors and organizations, functions and products, cash and value that make possible the transfer of goods and services from the producer to the final consumer. According to Bezabah and Nigussie (2011), the major processes involved in the sweet potato value chain comprises of input supply, technical support (extension service), production, processing, trading and consumption. At every stage of the chain, some form of cost is incurred, transactions take place and generally some form of value is added.

The key actors in the sweet potato value chain as identified by Kasina and Nderitu (2009) in Tanzania were seen to be farmers, brokers, transporters, wholesalers, vendors/retailers, processors and consumers. However, Rahko (2012) noted that countries that are closer in terms of boundaries could have exporters being part of their value chain although perishability of the crop and the poor nature of the transport and storage systems make the crop difficult to be an active part of international trading activities. Bezabah and Nigussie (2011) stressed that agro-input dealers in the sweet potato value chain basically perform the function of procuring agricultural inputs for onward sales to farmers to ensure the physical production of the crop. Main inputs supplied by these dealers for sweet potato production include fertilizer, chemicals (herbicides, pesticides) and farm tools. However, most input dealers provide technical support to farmers in the form of appropriate chemical recommendation and proper agro-input usage based on instructions since most farmers can hardly read prescriptions on labels for appropriate usage.

Also, Mmasa and Msuya (2012) established that the sweet potato value chain in Tanzania is comprised of actors who mainly perform the primary functions as producers who are into the physical cultivation of the crop, rural hawkers who basically buy sweet potato from farmers and transport their produce by the aid of a bicycle to known sales centers. He further added that these rural hawkers are mostly resource constrained. Input suppliers, processors, retailers and consumers were also identified to be critical actors of the sweet potato value chain.

2.2.3 Value chain governance

Kaplinsky and Morries (2000) refer to governance the role of coordination and identifying dynamic profitable opportunities and assigning roles to key players. Value chains entail repeating linkages through actor interactions. In ensuring governance among actors along a value chain, chain managers are to ensure that these relationships are reflective of their organization rather than some randomness of those events. The conception of value chain governance stems from a requirement to set a product and process through adequate logistic standards which then impact an action from either the downstream or upstream of the chain. The terms coordination and governance tend to have been used in a synonymous manner in the literature particularly in the 1980s. Williamson (1979, 1985) conceptualized governance to mean the set of institutional organizations in which involves some transaction. Gereffi's used the term governance to mean coordination which he defined as meaning the vertical organization of activities and functions of actors in work on Global Commodity Chains.

Williamson (2002) stressed that the gradual shift from spot trade to contract ordering of goods and services leads to the reconceptualization of the firm not being a production function (mainly for the production activities) but as a governance structure. According to Raikes *et al.* (2000), the central and most important factor for the effective performance of goods and services particularly those whose characteristics change frequently is a trust-based coordination. This improves the quality of standards for the benefit of industrial coordination which is mainly seen in the agri-food chains where commodities are perishable and frequently change form as it progresses towards its target consumer.

Also, the network theory stipulates that, relationships are not only shaped by economic considerations; other concepts like trust, reputation and power also have a key impact on the structure and duration of inter-firm relationships (Uzzi 1997). Since the 1990s, social capital theory has become an important branch within the network approach. Network relations may enhance the "social capital" of a company, by making it feasible to get easier access to information, technical know-how and financial support (Coleman 1990; Burt 1997) and by encouraging knowledge transfer between network partners (Humphrey and Schmitz 2002), thereby reducing transaction costs and improving access to markets (e.g. Gulati, 1998). Firms/companies would therefore select the governance form that minimizes transaction costs, under conditions of bounded rationality and opportunistic behavior of partners. The trust that is existent between firms makes it possible for an industry to have several coordination forms.

Kaplinisky and Morris (2000) classified value chains based on whether the said chain exhibits a market oriented (buyer-driven) or a produce oriented (producer-driven) governance structures or setting:

Buyer-driven chains are usually associated with labor intensive industries, and so it is more important for international development and agriculture. In such industries, the lead role in coordination in terms of products specification and volume is determined by buyers. This is particularly the case for crops whose shelf life is short. In such situations, producers have very minimum to no control over the sales of the crop since a little delay could lead to a total loss. In producer-driven value chains which are more capital intensive, the control of key technologies and product specification is determined by key producers in the chain whilst playing the lead role in coordinating the various links. It is not unusual for some chains to exhibit both producer and buyer driven governance. Yet in further works, it is argued that

governance, in the sense of a clear dominance structure, is not necessarily a constitutive element of value chains (Humphrey and Schmitz, 2002; Gibbon and Ponte, 2005). Whilst some value chains exhibit no governance or very thin governance, others tend to have multiple points of governance which involve setting rules, performance monitoring and/or assisting producers especially where such producers are the most vulnerable in the chain.

Chain governance may also be viewed in terms of 'richness' and 'reach', *i.e.,* in terms of its depth and pervasiveness (Evans and Wurster, 2000). The richness or depth of value chain governance is the extent to which core activities of chain actors is affected by the governance structure it exhibits. Reach or pervasiveness on the other hand refers to how broadly the governance is applied and whether or not competitive basis of power in terms of pricing and information flow exists. In the real world, value chains which exhibits multiple governance structure, often results conflicting rules which disadvantages poor producers (MSPA, 2010). Tegegn (2013) however identified that; the sweet potato value chains in developing countries were heavily dominated by exported and in-country wholesalers and so constitute the major determiners of prices. Therefore, the governance structure of the value chains are seen to be buyer driven with virtually traders been the main decision makers with no vertical coordination among actors due to mistrust between the various actors. The food and agribusiness industry is also characterized by very complex value chains that are not well coordinated, particularly among the up-stream stages (Bröring, 2008).

2.2.4 Value chain upgrading

Upgrading refers to the acquisition of technological capabilities and market linkages that enable firms to improve their competitiveness and move into higher-value activities (Kaplinsky and Morris, 2000). Value chain upgrading takes the form of the product, process, functions and consequently the entire chain. Upgrading entails not only improvements in products, but also investments in people, knowhow processes, equipment and favorable work conditions. Empirical studies in some countries and sectors provide evidence of the importance of upgrading in the agricultural sector especially highly perishable commodities such as vegetables and some root and tuber crops (*e.g.* Humphrey and Schmitz, 2000; Humphrey, 2003; Humphrey and Memedovic, 2006). An analysis of the upgrading process includes an assessment of the profitability of actors within the chain as well as information on constraints that are currently present. Governance along a chain contributes significantly in defining how

such upgrading should be done. In addition, the structure of regulations, entry barriers, trade restrictions, and standards can further shape and influence the environment in which upgrading can take place.

2.3 Risks and Constraints in the Sweet Potato Value Chain

Agriculture related ventures throughout the world are known to be inherently risky and further constrained with a number of factors for many reasons. Some of which may be controllable by these actors whilst others by virtue of their nature are uncontrollable by them.

Agricultural production for instance depends crucially on biotic and abiotic processes that are not completely understood (e.g., why some crops are less susceptible to drought than others). Even when there is a reasonable understanding of certain processes, there may still be little that can be done to control them (e.g., rainfall and drought). Agricultural production is a physically demanding occupation that subjects farmers to a variety of health and human related hazards which may not be easily predictable by the farmer (e.g., exposure to chemicals, unanticipated bush fires and the physical injury that may be caused as a result of undertaking a particular activity on the farm). Markets for agricultural produce are often volatile, particularly in developing countries. This subsequently puts actors at a point of being faced with some risk related to both price of the output and cost of inputs and transactions (Anderson and Lorch, 1999). This section of the literature review tries to adequately deal with these issues relating to risks and constraints.

2.3.1 The Concept of Risk

The terms risk and uncertainty are both associated with exposure to events that can result in losses. Risk can be defined as where a firm has *a priori* or fore knowledge of the probabilities, and uncertainty exists when these probabilities are not known – though the terms are often used interchangeably (Knight, 1921; Siegel, 2005). Combination of the likelihood of occurrence of an event or exposure(s) and the severity of the outcome is termed as risk.

Deloach (2000) also defines business risk as "the level of exposure to uncertainties that the enterprise must understand and effectively manage as it executes its strategies to achieve its business objectives and create value". A more standard definition of risk is that "risk is the chance, in quantitative terms, of a defined hazard occurring. It therefore combines a probabilistic measure of the occurrence of a primary event(s) with a measure of the

consequence of that/those event(s)" (The Royal Society, 1992). Hence, risk is an attribute that reflects both the range of possible outcomes and the distribution of respective probabilities for each of the outcomes.

However, in contemporary times, risk has been seen and described by investment economists as the variation from expected outcomes due to imperfect knowledge of investors in decision making such as variations in market prices for agricultural commodities and production inputs and variations in the volume or quality of the commodity produced (Kuyrah et al., 2006; Swiss Re. 2007).

Alimi and Ayanwale (2005) however maintained that a situation of defective (imperfect) knowledge is more pervasive in agribusiness enterprises (such as the sweet potato value chain). Hence, investors (chain actors) face the vulnerability of what they expect *ex-ante* not being achieved *ex-post* (Ndugbu, 2003). For instance each time an investor borrows money for a venture in an agribusiness enterprise, there is the possibility that returns on investment may be less than the cost of borrowed funds (interest rate) due to the myriad of risk the agribusiness investor may be faced with. Also, in this era of global climate change, an investor cannot predict with certainty especially in this part of the world where technology seems to be deficient on the degree of fluctuation in prices of input and output and weather. Obviously, agricultural activities are exposed to greater risk. Agricultural activities are seen to be more susceptible to the physical and natural uncertainties than other enterprises. Agricultural activities entail extensive, direct and continuous contact with the forces of nature (both physical and natural). Value chains are seen to be interconnected in terms of reliance on the various levels for effective and efficient performance which makes transmission of these risks easier. Therefore, a critical decision faced by the actor in the chain is the reduction in the extent of variations in the key variables of performance (output, price, information flow etc.).

2.3.2 Measurement of Risk

The discussion on the choice problem under uncertainty and risk can be thought of as a choice among distributions (lotteries), with risk-averse agents preferring distributions that are "less risky". This is looked at in the face of the idiosyncratic risk faced by the individual actors along the commodity (sweet potato) value chain. With the interconnection of the activities along the chain, a comparison of these idiosyncratic risk identified will be done to rank which of the levels is more risky to operate using the appropriate measures of risk as reported in literature.

Earlier contributions tried to provide such ranking based on a univariate measure of variability, such as the variance or standard deviation For example, the portfolio theory of Markowitz (1952) and Tobin (1958) relied on a *mean-standard deviation* approach. Studies conducted by Matthews (2010) to determine the rate/level of variability in European Union (EU) prices and world prices for appropriate comparison used the coefficient of variation approach for a period between 1983 and 2010. The study revealed that the most volatile crop in the European Union was wheat and maize rising increasingly above the world price as at 2010. This same approach was used by the European Commission (EC) in 2009 to ascertain the level of variability in the price of wheat and maize in the Unites States of America (US) in comparison with that of the prices in EU with Germany as the proxy country. They realized from the study that wheat and maize prices in the USA were less volatile compared to same in the EU. Also, mean-variance approach was adapted by Mishra et al. (2004) to the random utility assumption in determining the factors that influenced the choice of diversification by farmers. This was used to take care of price and output variability that were likely going to influence the choice of diversification. Under the assumptions of the meanvariance approach, an individual's preference ordering depends solely on the mean and variance of returns—an uncertain prospect can be represented fully by its mean and variance.

The decision rule used by a farmer to choose the appropriate enterprise mix from among virtually unlimited possibilities is to maximize the utility of income derived from the possible enterprise portfolios, where utility depends only on the mean and variance of returns. The general formula for the calculation of both the mean-variance and mean-standard deviation are stated below.

$$S^2 = \frac{\sum (X_i - \mu)_2}{n-1}$$

$$\sigma = \sqrt{S^2}$$

S^2 = Variance; X_i = observation recorded for each sample; μ =Sample mean; n= Sample size;

σ = Standard deviation

The mean-standard deviation approach was used by taking the square root of the mean variance formula. These measures estimate the level of dispersion of a sample mean in relation to the risk parameters under consideration and which is a measure of how risky the said enterprise is in the period under consideration. These measures were acknowledged by Mathia (1976) but further suggested that an index can be calculated from these variables called Random Variability Index (RVI) and Total Variability Index (TVI) depending on which aspect of risk is being looked at or dealt with. Four sources of variation in the analysis of data categorized as secular trends, cyclical movements, seasonal fluctuations and a component which remains after the first three have been taken into account was identified. The first three are systematic in nature whilst the last component is referred to as the random component of the total variation. The index expresses the standard deviation relative to the recent average levels of the risk parameters under consideration over the said period. Mathia (1976) therefore used both the TVI and RVI to measure total sales and price and yield risks respectively for some major field and horticultural crops in North Carolina. The RVI was then used to determine the level of predictability of these crops in terms of yield, price and sales. The use of the RVI requires the use of serial data so that the deviation from the norm for the period or cycles operated could be tracked in order to appropriately predict how risky the said enterprise could be in terms of any of the risk parameters. A flaw to this method of risk measurement is its inability to properly predict human related risk and for that matter events of discrete or discontinuous nature unless a quantitative definition is apportioned. In such situations arithmetic means are difficult to calculate without such adjustments and subsequently the estimation of the standard deviation. Notwithstanding this flaw, its greatest advantage is the use of relative figure which makes it easier to predict and interpret compared to the other measures stated.

$$RVI = \frac{\sqrt{Variance}}{Average(\mathrm{r})}$$

Where;

RVI is the Random Variability Index which is a ratio of standard deviation for the average of the risk variable (output risk, price risk etc.) being considered over a period or trip or cycle *r*.

Returning to the task of econometrically estimating risk structures, Antle (1985) expressed the optimality conditions for EU maximizing choices in terms of a given individual's absolute risk aversion and downside risk aversion coefficients. The Generalized Method of Moments

(GMM) procedure was then applied to identify means, variances, and covariance of risk parameter calculated using primary data obtained from the field.

2.3.3 Sources of Risk along the Agricultural Commodity Value Chains

The agribusiness environment in Ghana is full of risks and uncertainties emanating from numerous factors. Some of these dynamics which combine or independently act to complicate the practice of agriculture and agribusinesses are variability, instability and unpredictability of climate, biological constraint and soil, cost of inputs, inefficient channel of technology dissemination, poor extension services/contacts, lack of suitable credit facilities, general man power (labour) shortage , land tenure problems which make land acquisition for commercial farming difficult, poor inter and intra-state food trade, political interference and biases in the business accomplishment and marketing services. These risks effectively culminate to affect the efficiency and smooth running of agricultural value chains (Bauer and Bushe, 2003).

Dercon, (2002), Mikhayloa, (2005) and Njavro, (2009) all stated that risk sources in agribusiness enterprise can be categorized into social, market, political, financial, production and foreign exchange risks. Social risk is indicative of the fact that the risk or hazard has their roots from human beings. The risk could be due to fire outbreak, burglary or theft, physical injury to the actor, embezzlement of the agribusiness funds, strike, civic commotion and changes in social structure of an actor. For instance, the dissolution of partnership can lead to unexpected decline in efficient operation of the enterprise. Market risk arises due to variation or fluctuations in input and output prices. Political risk is due to government interference in the market system through policies. The use of debt in financing agribusiness investment and unreliable profit levels exposes the firm to financial risk. Foreign exchange risk originates from the firm's over reliance on foreign currency for operations such as the heavy dependence on importation of raw materials. Production risk occurs because the agribusiness enterprise is affected by many uncontrollable events that are often related to weather, drought, physical hazard to the agribusiness site and technological failure of the firm which mostly makes predictability of output difficult.

According to Alimi and Ayanwale (2005), the most important sources of risk are technical (example drought) which has an impact on output, market and financial risk which ultimately has effect on the overall profit of any agribusiness venture.

Ali and Kapoor (2008) identified the various types of risks to be socioeconomic, environmental, production and market risks but however stated that the most important risk of necessity to the agribusiness investor is price and production risks.

Steven et al. (2008) however found that risks faced by agribusiness ventures have their source from factors such as inherent commodity characteristics resulting from product perishability which has an effect on the quality of such products. Inherent production characteristics resulting from technical sophistication emanating from production process, geography and agro-ecological source having its roots from the difficult terrain due to agro-climatic condition were other sources identified. Also, political sources, transaction points risk and infrastructural conditions were the other sources of risks hampering the smooth running of agribusinesses.

Notwithstanding all these risks identified by researchers to be pertinent in agricultural related ventures such as the sweet potato value chain, they seem to be general risk with no specific risk faced by individual actors along a particular food commodity value chain. Richard (2010) however studied the specific risk and risk management strategies of cassava value chain actors. The study revealed that sudden changes in the output price, prolonged decline in output price, changes in the operation of domestic output markets and changes in final consumer demand were the major market (price) related risks faced by cassava producers. The main production risk faced by farmers in the cultivation of cassava was pest attack and output level fluctuations. He further stated that traders along the cassava value chain were also faced with the risks of changes in market cost, post-harvest handling (losses) and changes in the demand of produce. Finally, processors were also identified to be affected by sudden changes in input prices such as cassava and fuel, changes in final consumer demand and changes in the operation of the domestic output market particularly. Following these risks identified along the cassava value chin by Richard (2010), he further recommended an improvement in value chain coordination through the formation and strengthening of marking groups/ associations and the engagement in production and marketing contracts to help in risk sharing along the chain.

2.3.4 Types of Risk in the Agricultural Commodity Value Chain

Howell and Hazzard (2012) identified and maintained that there are different tools and strategies used either in isolation or in combination to manage risks and these risks have been classified into five particular types of as follows:

Production risks which relate to weather, drought, physical hazard to factory site and technological failure of firm. These production-related risks are mostly associated with yield variation (fluctuations), but also can affect the quality of products (especially drought and wind damage and high humidity/excess rain leading to pests/diseases), and consequently disrupt the flow of goods and services along food commodity value chains.

Secondly, market/price risks relate to the possibility that you will lose the market for your products or that the price received will be less than expected. This also includes lower prices due to increased supply or decreased consumer demand, loss of market access due to relocation or closing of a processor or other buyer, and lack of marketing power due to the small size of produce sellers and/or buyers relative to others in the market. Generally, market risks are related to issues which affect price, quality, availability, and access to necessary products and services. Of these, price risks are typically the most volatile, particularly in commodity markets where both local and global supply and demand conditions are constantly changing. Market-related risks vary constantly and are rarely associated with only one specific geographic location. Aspects of market risk may directly impact individual actors in a supply chain, and differentially affect producers in a single community and/or producer group.

Also, the possibility of having insufficient cash to meet expected obligations, lower than expected profits, and loss of network in the chain thus lead to the occurrence of financial risk. In addition, financial risk may be caused by increases in interest rates, excessive borrowing, lack of adequate cash or credit reserves and changes in exchange rates.

Furthermore, legal and environment risks which he identified relate to fulfilling business agreements and contracts. Another source of legal risk is misdeed liability which means causing injury to another person or property due to negligence. Legal risk is also related to environmental liability and concerns about produce quality, erosion and pesticide use. These risks also have a major impact on the structure of the agricultural value chain and relationships among individual actors and the distribution of rewards and risks within the supply chain and with support service providers and government. These risks have systemic impacts on decision-making and productivity, and market options. Because incentives can change (including the distribution of rewards and risks in the supply chain), these risks can result in changes in yield

quantity and quality, and even lead to disruptions in the flow of goods, services, information and cash.

Finally, he states that, human resources management/operational risk is one of the pertinent risks in value chain management. This pertains to risks associated with individuals and their relationships to each other, their families and the farm business. Sources of human resource risk include divorce, death or disability of a business owner, manager employee or family member. It also includes risks arising from poor communications and poor management practices. These risks usually directly affect a single chain actor, but can then be transmitted along the value chain. These risks are mostly associated with productivity reductions, and low quality of products, and unreliable delivery (of inputs and outputs, and support services).

2.3.5 Decision Making Under Risk Conditions

Risk and uncertainty as seen in every business are also a core part of agribusinesses which adds up to the complexity of many problems and to the decision making process. Capturing the potential or opportunities from a strategic uncertainty and simultaneously mitigating the exposures is not easily accomplished. Raynor (2007) argues that for firms to thrive successfully in an unpredictable future, they must develop practical strategies based on multiple choices that respond to the requirements of different possible futures rather than on a single strategic commitment.

However, decision must still be made and the actor is faced with making the best given the uncertainty associated with the available information (Kay, 1986). Understanding, identifying and assessing the risks based on probability of occurrence and severity of impact is a starting point to develop effective risk management strategies (Vanany *et al.*, 2009). Apgar (2007) argues that value chain partners are critical sources of risk and uncertainty, and they can also provide important opportunities to mitigate risks and capture opportunities that result from uncertainty.

Howell and Hazzard (2012) maintained that for proper decision in managing risk, one has to start with identifying the most crucial risk the actor faces, understand the possible impacts and likelihood of desirable outcomes and identifying and taking appropriate steps to mitigate or lessen its impact. Decisions could be made to deal with risk at both the individual (actor) level or at the various levels of the value chain depending on the kind of risk faced. Idiosyncratic

risk which is usually actor specific is peculiar and so decisions under such circumstances could be made through self-insurance, decision to diversify into other ventures etc. However, decision making under risk conditions that are systematic (covariate) along the value chain may be through risk pooling or risk sharing approach to reduce the impact of such risk at all the levels rather than at specific levels (Ramaswami *et al.*, 2004).

Given the difficulty of establishing sustainable risk/reward sharing arrangements, it is not uncommon for one firm in the chain to become the chain "captain". The chain manager or "captain" may choose to become the residual claimant of profits from the chain as well as assuming a major share of the risk, or to share a greater fraction of the profits whilst shifting more of the risk to the other participants.

Value chain actors in all spheres of the industry (agriculture) take some measures or precautions against risk in an attempt to eliminate the risk entirely or mitigate its impact should it occur since it may limit their total output, increase their total cost or even affect the performance/efficiency of an entire value chain such as that of sweet potato over time. In the face of multiple potential risks, the resilience of primary producers, agribusiness entities, and institutions for collective action and value chain coordination is a critical consideration. Understanding current competitiveness and future potential of a sector without understanding the ability of the players (actors) to anticipate and respond to shocks which is primarily the key to any effective risk management can be a recipe for failure in the management of such risks (Steven *et al.*, 2008).

A *sine qua non* of effective risk management is that "One cannot protect against every risk --- nor should one try. But, the actor can be quick or proactive to identify a potential problem, and have thought about the risk and possible risk responses -- in advance after which he can mobilize available resources if it makes sense. The essence of risk management boils down to adequately appreciating the risks that a farm or firm is exposed to for different activities, and identifying the key "choke points" along the value chain that would completely harm the business and the value chain if disruption occurs. Identify the correct set of *ex-ante* measures to allow for protection, remembering to periodically review and assess what's happening" (Wharton School, 2006).

Heitzmann *et al.*, (2002) classified the approach to risk management into two according to the period in which measures are actually taken as *ex ante* or *ex post* strategies. *Ex ante* actions are taken before a risky event occurs, and *ex post* management takes place after its realization. *Ex ante* risk management includes:

- Risk Prevention or Reduction – actions taken to eliminate or reduce risky events from occurring,
- Reducing Exposure to Risk – given the existence of risks, there are actions to reduce exposure to such risks, and
- Risk Mitigation – actions that will trigger compensation in the case of a risk generated loss (e.g., social contracts, holding of savings, purchasing insurance).

Ex ante actions can reduce risk (e.g., eradication of pests) or lower exposure to risks (e.g., pest resistant varieties, crop diversification). *Ex ante* risk mitigation can also be realized through the purchase of insurance, and by other responses to expected losses such as selfinsurance (e.g. precautionary savings). In most cases, mitigation will only partially compensate for actual losses. In addition, *ex-ante* risk management actions have a component of real and/or opportunity costs related with them since decision on the utilization of funds may involve a choice among competing mutually exclusive alternatives.

However, *ex post* actions cope with realized (actual) losses by e.g. selling assets, seeking temporary employment, and migration. Additionally, in well-developed economies governments sometimes forgive debts as a form of bailout, or provide formal safety nets, such as subsidies, rural works programs and food aid to assist agricultural actors (and their laborers) cope with the negative impacts associated with risky events. Some short-term risk coping strategies often have longer-term negative impacts on assets, livelihood/enterprise strategies and achieving the overall firm objectives. Thus, some coping strategies result in selling or degradation of valuable assets and increased debt. This in turn results in negative dynamics (that can lead to a fall out of a major actor in the value chain). It is therefore worth noting that whatever strategies are taken to respond to anticipated risky events, a variety of different instruments is available within each strategy, and all have different private and public costs and benefits, which might either increase or decrease vulnerability of individual actors along the value chain.

2.3.6 Risk Management Strategies Adopted by Value Chain Actors

Richard (2010) identified that the risk management strategies most used by producers were the following of recommended agronomic practices, diversification and use of multiple market outlet to deal with risks at that level. He also added that traders are more likely to adopt enterprise diversification, trading in multiple markets and the maintenance of procurement flexibility to deal with the risk they are faced with. Finally, he stressed that processors also adopted the use of multiple markets, temporal changes in production mix of inputs and diversification. Decision for managing risk, mitigating its impact or increasing the business's ability to survive under unfavourable conditions are identified unanimously by different authors as seen below even though they maintained that the type of decision to take is dependent on the circumstances the actor finds himself and the key to such decisions is strategic flexibility (Mulcahy, 2003; Ramaswami *et al.*, 2004; Ahland and Arshad, 2012). A number of risk management strategies have been outlined by a number of authors to be adapted by actors in dealing with the various risks they are faced with.

i. **Choice of reliable enterprise (planting of resistant varieties):** Varieties of crops and livestock may be chosen in preference to the one with variable yields even when the other gives a higher return on average (Siegel, 2005). Here, decisions under such conditions are taken with priority to the ability of the variety to survive in the condition it is to be planted rather than the potential yield of the crop. For instance, a variety of a high yielding potential but susceptible to a disease prevalent in the area of cultivation may not be selected rather, a variety with average yield but a high resistant crop may be selected.

ii. **Insurance**: The choice between profit maximization and security is particularly obvious where it is possible to insure against risks. According to Ramiro (2009), insurance is a form of risk management used to hedge against a contingent loss. The conventional definition is the equitable transfer of a risk of loss from one entity to another in exchange for a premium or a guaranteed and quantifiable small loss to prevent a large and possibly devastating loss (Swiss Re., 2007).Insurance may cover major risks such as the death of the farmer or some members of his family or it may be used for sickness and accidents which disable the farmer, and for fires or other hazards which can destroy capital items such as buildings, breeding and fattening stock, cars, lorries and other machines. Crops may also be insured against drought, output levels and low output price etc. Risk mitigation may be done by actors either with the

help of self-insurances for crops or risk pooling and mutual insurance at the community level (Ramaswami *et al.*, 2004).

iii. **Production expansion (Excess capacity):** This means producing more than the economic optimum level of output every year in order to take care of possible losses and unanticipated price drop particularly for easily perishable commodities. This means that in bad years the actor still makes some gains. Production risk can also be reduced by maintaining excess production capacity. For example, in areas where weather conditions commonly postpone planting, a farmer with excess machinery or labor capacity will be able to catch up on planting to avoid that risk of production loss. Similarly, livestock producers with excess feeding capacity can reduce the risk of loss if there is a drought, fire or some other event that makes feed unavailable. However, Sarah (2009) states that, as seen for diversification, the cost of maintaining excess capacity should be weighed against the benefits of lowering production level risk when making management decisions.

iv. **Stock reserves:** This also provides some security against risk of crop failure, but stocks are liable to deterioration and losses particularly when it comes to perishable commodities such as root and tuber crops (eg. sweet potato). Sweet potato has the particular advantage that it can be left in the ground for up to three months without deterioration; indeed it continues growing. This is one of the National Economic Empowerment and Development Strategies (NEEDS) for most developing countries of which Ghana is no exception particularly when it comes to root and tuber crops which record a lot of post-harvest losses. It is an embracing strategy targeted towards poverty reduction, food security and increased industrial capacity utilizations. One of its principal roles is to vigorously increase strategy on the production level of the value chain.

v. **Maintaining flexibility:** This refers to the ability to make adjustments in the operations of an actor in response to changing conditions in order to reduce disruption and fluctuation in income (Howell and Hazzard, 2012). This is because agricultural risk management is a proactive approach rather than reactive approach since decision making in risk management has to be made *ex-ante*. The actor does not have to make firm plan at the start of the production or financial year and stick to it rigidly. Thus, if an early planted stable food crop fails, he may re-plant with a more resistant (drought, disease, soil etc.) variety as quickly as possible to meet the demand of customers who may be scheduled for the produce at predetermined time.

Alternatively, the producer may decide to increase the area of farming to make room for reserve crop to take care of anticipated losses. Likewise the trader in the chain may also have to quickly change his supply source or quantity demanded when there is a either a shortage or a glut at a production or market center in order to meet the demand of the final consumers.

vi. **Contracting price in advance:** This is another method of guarding against uncertainty of price fluctuation of agricultural products by actors along most food commodity chains. It is an arrangement between a trader, processor, contractor, manufacturer and a producer or group of producers to supply a specified grade and quantity of the said agricultural produce at an agreed (pre-determined) price at a stipulated future date. Contract of this nature has a lot of advantages (Howell and Hazzard, 2012) not only to the producers but to all actors along the chain. Apart from facilitating the reduction in variability in prices, the actor could give precise information about his needs and thus, actors along the value chain could more efficiently mobilize all available resources which give an assurance of efficient demand and supply system. The assurance of market enable the actors to take advantage of economies of scale and reduced transaction cost at both ends of the chain which lower the unit cost of production and transaction of the produce along the value chain.

vii. **Use of improved technology (recommended agronomic practices):** It has been found that technological changes disrupt the suppliers stand in supply and value chains (Zsidisin and Ritchie, 2008). This technological letdown affects the efficient running of the value addition (Bauer and Bushe, 2003). For this reason, the use of improved technology such as tractors, spraying machines for weed control, pesticide, irrigation, storage and processing facilities as well as improved transportation, communication devices etc. would guard against the risk of poor harvest, spoilage and unnecessary crop failure resulting in unreliable output levels. Change of conservative attitudes by some actors in adopting new innovations in management (technical, financial etc.) will ensure speedy agricultural growth and development and consequently the efficiency of agricultural value chains. According to Sarah (2009) adopting new technologies can also help reduce production risk at the production level. For example, a crop producer who invests in new machinery or irrigation equipment may lower the risk of equipment or water problems reducing his yield. Similarly, biotechnology and the focus of genetic research on improving yield have produced seed varieties that are more resistant to drought and disease and can reduce production risk for farmers.

viii. **Diversification:** Product diversification can help lower both production and market risk for agricultural value chain actors. However, Richard (2010) stressed that enterprise diversification is the best risk management strategy for dealing with market risk. By producing more than one crop or trading in more than one commodity or product, actors can reduce the risk of price variability (Sarah, 2009). For example, a producer who cultivates sweet potato, yam and maize is not completely dependent on one product. Thus, his risk of a complete loss emanating from an unexpected price drop and consequently a drop in income is either minimized or eradicated. With diversification, choosing low-risk enterprises can also help reduce overall production risk. Given a farmer's specific location, some crops may have lower yield variability in general reducing the risk of production loss compared to a crop with high yield variability. When making diversification choice, choosing those enterprises with lower risk given the farmer's specific situation can help lower risk at the production level overall (both output and market risk).

It is also important to choose efficient and profitable enterprises. While diversification may reduce risk, it may also reduce possible gains from specialization (Sarah, 2009). For example, a sweet potato producer who adds a yam enterprise must shift time from managing his sweet potato enterprise to manage his yam enterprise. Different machinery may be needed, learning time must be spent, and the new enterprise may increase profits by less than the decrease of profits in the latter enterprise because of the shift of energy.

It is, therefore, important to understand whether the added enterprise is efficient and profitable. While the yield may have very little variability and low production risk, if that yield is consistently lower than what is needed to cover costs, the whole farm is not being helped by the diversification.

2.4 Review of Empirical Studies

2.4.1 Value chain approach

A number of studies have been conducted using the value chain approach in Ghana and Africa as a whole. This approach has been used to analyze value chains from different angels and for different food commodity value chains.

Fitter and Kaplinsky in 2001 utilized the value chain analysis to examine inter-country distributional outcomes of the global coffee sector by mapping input-output relations and

identifying power asymmetries along the coffee value chain. Their study revealed that returns on product differentiation taking place in the face of globalization do not accrue to the coffee producers. They also concluded there was power asymmetrical with the most disadvantaged being producers due to the buyer driven nature of the chain. Importers, roasters and retailers compete with each other for a share of value chain rents but combine to ensure that few of the rents return to the farmer or the producer country. Ponte (2002) also used a value chain analysis to examine the impact of deregulation, new consumption patterns and evolving corporate strategies in the global coffee chain of countries exporting coffee in the developing world. The study concluded that the coffee chain was increasingly becoming buyer-driven and the coffee farmers in producing countries and for that matter changes in the governance structure and the institutional framework were challenges facing the coffee value chain.

The United States Agency for International Development (USAID) in 2011 conducted a value chain study for off-season vegetable in Nepal and identified some critical challenges affecting effective performance as unavailability of quality planting materials, inadequate knowledge among the producers on the proper usage of fertilizers and pesticides as well as poor soil fertility management, lack of irrigation facilities, shortage of labour, postharvest loss due to the perishable nature of vegetables, limited access to reliable market information, unorganized market center, limited collection centers, and lack of proper packaging and transportation facilities. The study recommended infrastructural reforms and institutional innovation both in the short and long term as tools to reduce these constraints looking at the vulnerable state of vegetables when it comes to perishability.

Bezabih (2008) conducted a value chain analysis for horticultural crops in Eastern parts of Ethiopia and identified a variety of challenges associated with the value chain. Prominent among the constraints identified included lack of markets to absorb the production, low price for the products, large number of middlemen in the marketing system, lack of marketing institutions safeguarding farmers' interest and rights over their marketable produces (e.g. cooperatives), lack of coordination among producers to increase their bargaining power, poor product handling and packaging, imperfect pricing system and lack of transparency in market information communications.

2.5 Determinants of Choice of Risk Management Strategies by Sweet Potato Producers

Following from the random utility theory, the choice of any risk management strategy comes with accompanying costs. Thus the prime aim of every rational being is to minimize as much as possible the opportunity cost associated with the kind of choice made. Since a producer's utility cannot be directly observed in practice. Factors influencing the producer's utility such as household and personal characteristics and attributes of the choice set experienced by the producer as well as.other factors that affect the choice of production and price risk management strategies by sweet potato producers are reviewed in this section.

2.5.1 Age

Aged producers are believed to be wise in resource use, on the other hand young producers have long investment horizon and so young producer are more likely to use crop diversification to avoid price risk (Pope and Prescott 1980). One possible explanation given is that older farm operators have more wealth, and wealthier farm operators are less risk averse and less diversified. This is also consistent with the findings of McNamara and Weiss (2005) who found that young farmers are more willing to try different crops compared to the old due to health and physical strength of such producers since agriculture generally is labour intensive. Bongiwe and Masuku (2012) also found that age of the farmer was a significant determinant of the choice to use diversification over other risk strategies in terms of dealing with price risk. He further stated that the young had the capacity, time and the motivation to take advantage of any opportunity that would increase net household income. Older farmers however may have gotten all they need in life and so tend to specialize particularly in crops they consider to be less demanding in terms of labour requirement. Also, Emah (1995) reported age as a factor that elderly farmers are less inclined to adopt new/recommended agronomic practice than younger ones since they mostly would rely on their experience gathered over the years. Davis *et al*. (2008) however found that farmers who were young had high aspirations and were willing to participate actively in adopting recommended agricultural practices/techniques to be assured of output levels. It is therefore hypothesized that age would negatively affect the choice of producers selection of diversification and the use of recommended agronomic practices as either price or production risk management strategy.

2.5.2 Sex of Sweet Potato Producer

Tshiunza *et al* (2001) determined that male farmers tend to produce more diverse crops due to their role mostly as household heads. This make them control against price risk by cultivating more than one crop in that in an event of an unexpected price drop from one they could still rely on other crops cultivated to cater for their households in terms of income generation. Also, males are physically strong to handle more than one crop compared to females.

However, Huang *et al* (2014) found using OLS estimation that on average, there is no difference in crop diversification between men and women but a significant negative relation between crop diversification and gender after using the Fixed Effect (FE) estimation. They noted that after experience with extreme weather events, women tended to plant 0.081 more hectares of crops than men. This may be because women tend to be more risk averse than men and are therefore more likely to plant more crops in the quest of any anticipation of averting price risk rather than diversifying into other crop production. Also, use of recommended agronomic practices comes with cost and availability of inputs which has been reported by Dey (1981) of a possible discrimination against females particularly in Africa due to cultural patterns and the role of women in handling household income. He therefore concludes that female farmers are less likely to follow recommended practices to the fullest. However, females who are more risk averse are more likely to follow recommended agronomic practices religiously compared to their male counterparts in averting output level variability.

2.5.3 Access to Market Information

It is hypothesized that market information is positively related to the choice producer either choosing to follow recommended practices or diversification respectively for production and price risk. Farmers' choice of risk management decisions are based on market (sweet potato) price information, and poorly integrated markets may convey inaccurate price information, leading to inefficient product movement. Again, business decisions are based on dynamic information such as consumer needs and market trends (CIAT, 2004). Therefore those who have access to dynamic information will have an upper hand to the selection of the best risk management tools. Muhammed (2011) also found that if producers get market information, their managerial abilities are enhanced which can also influence their decision of the risk management strategy they adopt in mitigating the risk of production and price.

2.5.4 Credit Access

Access to credit would enhance the financial capacity of the producer since the decision involves some private cost which involve the purchase of inputs and other transaction cost, thereby increasing the likelihood of a farmer deciding to adopt either to use recommended practices or crop diversification as a risk management tool ahead of other tools for production and price risks respectively. Therefore, it is hypothesized that access to credit would have positive influence on the choice of diversification and recommended agronomic practices.

Other studies have concluded that receiving assistance in the form of credit or subsidy from any source (government programs and/or private) is a primary risk-reducing catalyst (Kramer and Pope, 1981; Musser and Stamoulis, 1981) which aid in the finance of risk. As Goodwin and Schroeder (1994) noted, these supports are intended to decrease agricultural risks through effective financial management of these resources in choosing appropriate tools to mitigate risk. In addition, Robison and Barry (1987) points out that government programs emphasize the provision of risk-reducing opportunities for the farm through the advancement of credit facilities.

2.5.5 Income from Non/Off Farm Activities

Off Farm income may strengthen farming activity on one side and may weaken it on the other side. But for this study it is assumed to have inverse relation with the choice of risk management strategy adopted. Farm operators (producers) who have work off the farm to increase their total household income have the advantage to reduce the variability in household income associated with fluctuations in farm income (Mishra and Goodwin, 1997). If the producers receive income from off farm work, they are less likely to pursue farm diversification as a method of reducing price risk associated with farming. However, such farmers are more likely to adopt the use of recommended practices since they mainly have some financial resources to be able to expend on the use of these practices. Therefore, it is hypothesized that the relationship is a positive one. This therefore implies that as one gets a higher return from non-farm activities, their investment in sweet potato production is likely to increase and consequently the decision to follow recommended practices to the later. In other words, the higher non-farm income, the more likely a farmer will invest in sweet potato production. For instance, Mishra and Goodwin (1997) found a positive relationship between the coefficient of variation for farm income and off-farm work. Specifically, increased farm income variability increases the farm operator's

off-farm labor participation rate. Off-farm income diversifies a farm operator's income portfolio and reduces the need for enterprise (crop) diversification.

2.5.6 Access to Extension Service

Extension contacts received by a producer during a season are very vital for information on managerial capacity building of which risk management is a key part. It is expected that extension service widens the producer's knowledge with regard to the use of improved managerial skills and decision making ability such as management of risk on the farm and has positive impact on the likelihood of choosing recommended practices and crop diversification ahead of any other risk management strategies for production and price risk respectively. Therefore, this variable is hypothesized to influence the choice of risk management strategy positively. Ayelech (2011) found that if producers get extension, the decision to increase their knowledge in managerial decision making and the use of technological advancement in following appropriate agronomic practices in their production. Also, farmers who have access to extension contacts are more likely to diversify their production to avert price risk since they usually have access to agronomic information regarding other crops. This propels such farmers to try their hands on other crops they anticipate may have better price should they be skeptical about the price of sweet potato.

2.5.7 Level of Education

Education broadens farmers' intelligence and enables them to perform their activities intelligently, accurately and efficiently. Moreover, better educated farmers tend to be more innovative and are therefore more likely to adopt risk management strategies that would optimize their entire utility. Thus the choice of diversification and use of recommended agronomic practices to deal with price and output risk respectively since they are seen to be the most effective risk management at the producer level. Formal education enhances the information acquisition and adjustment abilities of farmers, thereby improving the quality of decision making (Fakoya *et al*., 2007). Also, because education enhances one's ability to receive, decode and understand information, Schultz (1964) and Nelson and Phelps (1966) all hypothesized that education may facilitate the decision making ability of farmers. Therefore, this variable is hypothesized to influence the choice of risk management strategy adopted by actors positively. Astewel (2010) found that education facilitated the choice of decision making by farmers positively. This means that farmers with higher years of formal education will more

likely choose a risk management strategy that maximizes their private benefit since his ability to analyze and make better decisions has been enhanced.

2.5.8 Experience of Farmer

A producer with better experience in sweet potato production is expected to be better positioned in the management of his business risk (production and price) than a new entrant in the business. As a result, he is expected to select a risk management strategy which he has tried and tested due to his dealings in the business over the period. Ayelech (2011) reported that, farmers with longer farming experience are expected to be more knowledgeable and skillful and less likely to follow new/recommended practices than farmer with less sweet potato experience since they tend to rely most on their experience. However, it is less likely for such experienced farmers to diversify their production to avert risk. This is mainly because new entrance usually may not be used to the field and so tend to specialize in sweet potato production for some time. Therefore, this variable was hypothesized to negatively influence the use of both recommended practice and on the choice of diversification.

2.5.9 Farm Size

It is hypothesized to have a significant negative and positive influence on the decision to select the use of recommended agronomic practices and diversification respectively ahead of other risk management strategies. (Mishra *et al.*, 2004; White and Irwin, 1972) all observed a significant negative relation between the farm size of households and their quest to diversify or use new/recommended agronomic practices since they have the luxury of land. This, they allude to the fact that larger farms may be more specialized due to economies of scale enjoyed by larger farms—i.e., if there are large-scale economies in an enterprise, then one might expect large farms to be more specialized. Another possible explanation is that since farm size and wealth tend to be positively correlated, one can deduce that wealthier farmers are less risk averse (i.e. they are risk takers) and less diversified—all other things being equal since wealth has been seen to have a negative relation with diversification (Pope and Prescott, 1980). However, other researchers all found positive relation between farm size and the choice of diversification with the argument that diversification activity is more concentrated and flexible with bigger ventures (Pope and Prescott, 1980; Gasson, 1988; Ilbery, 1991; Shucksmith and Smith, 1991).

2.5.10 Household size

As the operations of sweet potato seem to be delicate due to its handling issues, it is seen to be a labour intensive venture. Due to this sweet potato production is said to be a function of labour in terms of land clearing and preparation (mounding and/ridging). Accordingly, families with more household members of workable age tend to have more labour access which in turn increases their participation in sweet potato production activities. Baltenweck *et al* (2006) found that the higher the number of adults in the household, the more likely the producer tends to be flexible in terms of following recommended practices and also has enough workforces to diversify his activities on the farm. Also, Bowler *et al* (1996), among others, report that the need to create employment for family members is one of the important factors motivating farm diversification. Damianos and Skuras (1996); Bowler *et al* (1996); and McNally (2001) all found positive relation between household size crop enterprise diversification and recommended agronomic practices. It is therefore hypothesized that the relation household size and choice of risk management strategy is positive.

2.5.11 Membership of a Farmer Based Organization (FBO)

Cooperatives/farmer associations improve understanding of members about risk and its management strategies for effective mitigation when faced. Therefore, it is expected to be associated with choice of risk management strategy decision of sweet potato farmers along the value chain. Farmers within a group learn from each other either directly during meeting or indirectly through informal interactions with each other. The information sharing is seen mainly in the form of production and marketing of crop varieties. As discussed, the evidence suggests that network effects are important for individual decisions, and that, in the particular context of agricultural innovations, farmers share information and learn from each other (Foster and Rosenzweig 1995). The expected sign on the coefficient of the choice of the use of recommended agronomic practices and diversification as production and price risk management strategy respectively is positive. According to Montgomery (1994), diversification is the most efficient tool that can be used by farmers in dealing with price risk and so producers belonging to sweet potato cooperative societies are more likely to be trained on product diversification and recommended agronomic practices to dealing with producer level risk.

2.5.12 Land Tenure System

Ownership of land has a significant influence on the use of recommended practices and diversification. Oscar *et al* (2011) reported a positive relation between land tenure and the adoption of recommended practices since the producer has a free hand to experiment innovations. They argued that if one has overall rights to his land, he will be willing to invest for the betterment of his land in order to make optimal returns from it. Producers who have limited or no permanent rights to the land they work on are more likely to adopt the planting of resistant sweet potato variety. Also such producers are mainly into the specialization due to the role availability of land and farm size in general play the choice of diversification as a price risk management strategy. Tenants are therefore more likely to adopt the sale of their produce through multiple channels through a careful think-through on which channel his utility in terms of pricing may be fulfilled.

2.5.13 Income from Sweet Potato

According to Rees (2009), low income households do not respond to shocks in the same way as higher farm income groups due to the fact that they do not afford the mechanisms provided by the market to help them deal with shocks. Producers with high income levels from their sweet potato venture tend to have a lot of resources to invest in their business giving them the extra capacity to fully implement new and recommended agronomic practices which come with additional cost to the producer but with some assured output levels. Mishra and Goodwin (1997) however disagree with this position stating that producers with low income are more risk adverse and so tend to follow strictly recommended practices to reduce the risk of uncertainty in terms of their output. He further states that producers with high income levels are mostly into diverse enterprises and would mostly pay attention and invest more in the enterprise with the highest possible return. He further stated that producers with high income levels are mostly risk takers who would like to rather explore other opportunities and would tend to diversify into other crops rather than stay with one particular crop and follow recommended practices.

CHAPTER THREE

STUDY AREA AND RESEARCH METHODOLOGY

3.1 Study Area

The study was conducted in the Fanteakwa and West Mamprusi districts of the Eastern and Northern regions of Ghana respectively due to their prominence when it comes to the production of the target commodity (sweet potato) and its entire diverse nature in terms of agro climatic conditions. These districts were purposively selected to suit the purpose of the study. By this, it will help bring out clearly the diversity in the risks and constraints faced by actors across the country.

3.1.1 Description of the West Mamprusi District

The West Mamprusi district is located in the North-Western part of the Northern Region between latitude 09^0 55ˈand 10^0 35"N and longitude $32^0$5'W and 01^0 45ˈW. It shares boundaries with Builsa, Kasena Nankana and Bolgatanga Districts to the North, Sissala East and Wa East Districts to the West, North Gonja, Karaga, Kumbugu and Suvelugu Districts to the South, and Mamprusi East District to the East. It has a population of about 168,011 (Population census, 2010), with a total land area of 5,013 square kilometres. The population is ethnically diverse with migrants who are there to take advantage of the economic activities. Indigenous population consists of the Mamprusis who co-exist with other ethnic groups such as Frafras, Kassinas, Bimobas, Fulanis and Ewes. Out of this population, the number of registered farmers in the District is 43,562 with sweet potato farmers consisting 440 of the total farmer population (District Agric. Development Unit, 2011). These farmers are predominantly small holders growing a range of rain-fed food crops. The main food crops are cereals (maize, rice, sorghum, and millet), pulses (cowpea and groundnuts) and root and tuber crops (yam and sweet potato). However, a small fraction of the people is also engaged in livestock and poultry production.

3.1.2 Description of the Fanteakwa District

The Fanteakwa district is located at the center of the Eastern Region between latitude 06^0 15'Nand 06^0 40'N and longitude $0^0$33'W and $0^0$10'W. It shares boundaries with Volta Lake to the North, Kwahu South District to the North West, to the South West by the East Akim Municipality, Lower Menya Krobo to the east and Yilo Krobo. It has a population of about 108614 (Population census, 2010), with a total land area of 18310 square kilometers. The

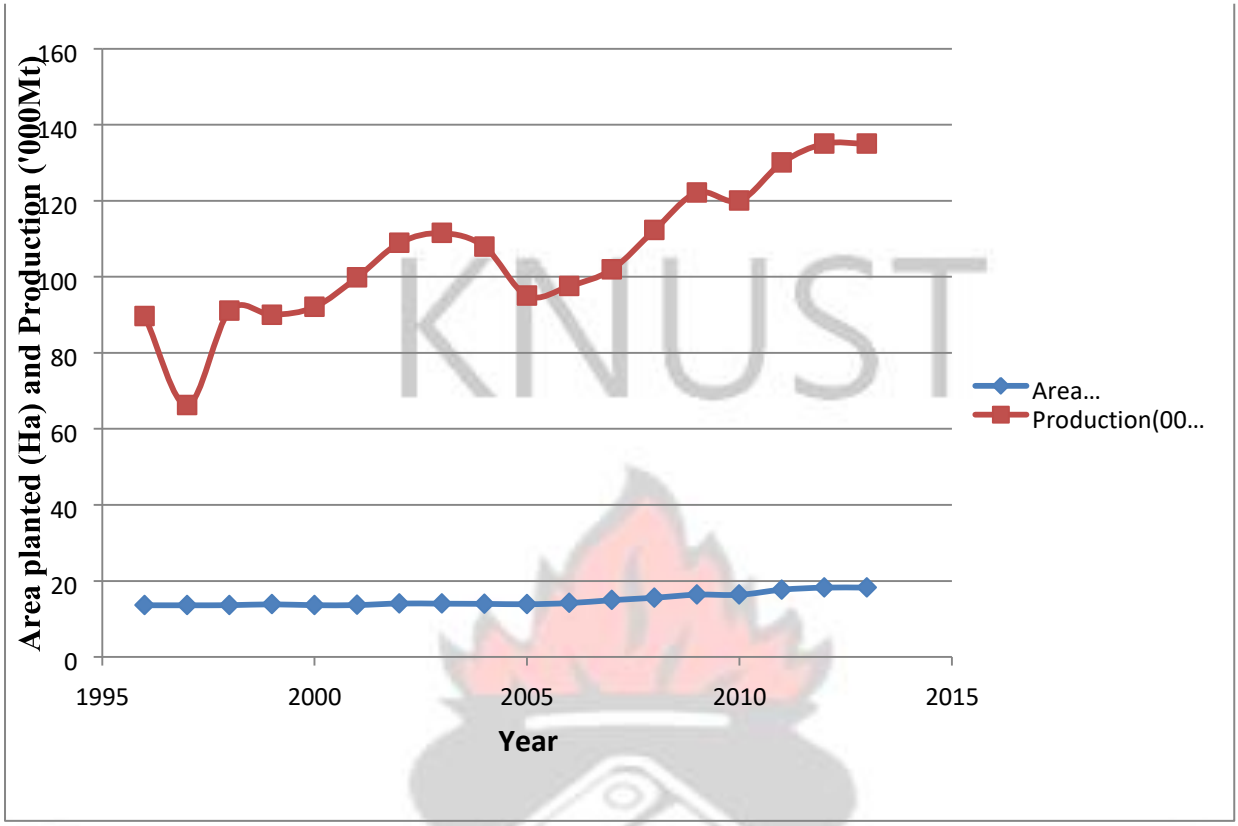
population is ethnically diverse; the migrant population contributes only partially. Indigenous population consists of the Akyems who co-exist which other ethnic groups such as Fantes, Krobos, Ashantis, Ewes and Northerners. Out of this population, the population of registered farmers in the District is 40,120 with sweet potato farmers constituting 350 of the entire farmer population (District Agric. Development Unit, 2011). Agricultural production is mainly at subsistence level although considered to be the main occupation of the people with an average farm size of 2.5acres. The main crops cultivated in the district are cassava, maize, yam, cocoyam, plantain, cocoa, sweet potato and vegetables.

3.1.3 Sweet Potato Production in Ghana

Figure 3.1 provides sweet potato area of cultivation and production in Ghana from 19962013. It can be seen from the figure that much of the increase in production levels may be as a result of steady increases in the area cultivated. It is also important to note that sweet potato production levels over the period are seen to be generally fluctuating. Notwithstanding this general trend, it is worth noting that from 2006-2013, there is a continuous increase in production although a slight decline in 2010.

However in 2012 MoFA through the collaboration with West Africa Agricultural Productivity Programme (WAAPP) conducted a survey on regional basis to ascertain the levels of sweet potato production for a proper need assessment of the crop in Ghana. Table 3.1 provides information on the area cultivated and the production levels of sweet potato by region. It may be evident from the table that, majority (54.3%) of sweet potato produced in the country came from the Northern sector with the Upper East region contributing the chunk of production. However, the Eastern region produced majority of sweet potato in the southern sector.

Figure 3.1 Sweet Potato Production Trend in Ghana



Source: Generated from Author's own computation obtained from FAO Stats, 2015.

Table 3.1 Sweet Potato Production in Ghana (2012)

Region	Area (Ha)	%Contribution	Production (Mt)	%Contribution
Central	371	3.9	6,490	4.9
Volta	880	9.1	15340	11.6
Eastern	1030	10.7	34910	26.4
Gt. Accra	38	0.4	640	0.5
Ashanti	37	0.4	620	0.5
Brong Ahafo	145	1.5	2390	1.8
Northern	414	4.3	6070	4.6
Upper East	5550	57.7	46000	34.9
Upper West	1157	12	19530	14.8
Total	**9622**	**100**	**131990**	**100**

Source: MoFA Field Survey, 2012.

3.2 Methodology of the study

3.2.1 Type and source of data

The formal survey was preceded by an informal survey to obtain qualitative data on actors along the sweet potato value chain through Focus Group Discussions (FGDs) to enquire practices and circumstances that helped in the development of the survey instrument (questionnaire).

Primary data formed the core of the data used for this study. The data was obtained from farmers, processors and marketers (traders) within the study areas. The study used information on sweet potato production, sweet potato marketing, prices of sweet potato supplied, and distance to sweet potato markets, risk associated with activities along the chain and their respective risk management strategies. Other socio-economic information was obtained from the key actors along the sweet potato value chain. Primary data from these actors were however supplemented with secondary data from the District Agricultural Development Units (DADU) of the study areas (West Mamprusi and Fanteakwa), Root and Tuber Improvement and Marketing Programme (RTIMP), journals articles and other publications.

3.2.2 Sample Size and Sampling Procedure

The population of the study was all sweet potato farmers, processors and traders in the Fanteakwa and West Mamprusi districts. A total of Three Hundred and Eighty (380) respondents were selected for the study comprising Two Hundred (200) sweet potato farmers, Eighty (80) processors and one hundred (100) traders. With the aid of Agricultural Extension Agents (AEAs), a list of major producing communities was prepared, after which a simple random sampling technique was used to select four (4) communities from each district for producer respondents through balloting. Farmers in the selected communities were then selected by way of simple random sampling approach using the village farmers list from the AEAs and the random number table approach which tends to reduce selection biases significantly. A sample size of one hundred (100) farmers from each of the two districts (West Mamprusi and Fanteakwa) were used for the study comprising twenty-five (25) farmers from each of the communities. Communities selected from the Fanteakwa districts were Asadja, Asadja Proper, Akonta No. 2 and Asetey. With regards to the West Mamprusi district, farmers were selected from Gabgini, Katabanawa, Nayoko and Tinguri.

Markets and communities selected for trader and processor respondents were purposively selected with areas of high concentration of the targets (processors and traders) given highest priority. A combination of accidental and Snowballing techniques was used to select fifty (50) marketers/traders based on referrals from initial subjects i.e. producers to assemblers/collectors, collectors to wholesalers and so on. This was done because of the seasonality of the crop in question and its delicate nature in terms of identification of these traders and processors. Also, this approach was used due to the difficulty in getting a sampling frame at this level since initial survey conducted indicated that traders had weak or non-existent associations where such information could easily be acquired. Traders were therefore selected from both communities and markets (Table 3.2) based on their availability.

Processors were also selected using the accidental and snowballing sampling approach since there are no official and formal institutions where a list of the target (processors) could be obtained. With this, respondents were interviewed as and when they were identified and willing to participate in the survey after which they referred enumerators to another processor within that vicinity of which they know.

Table 3.2 Sample Distribution of Traders by Community/Market

District	Community/Market	Sample Size
Fanteakwa	Agomanya	12
	Ashongmang	10
	Begoro	15
	Ehiamanhyene	13
	Total	50
Mamprusi West	Katabanawa	10
	Nayoko	13
	Tinguri	12
	Walewale	15
	Total	50

Source: Field survey, 2015.

Finally, forty (40) processors were also selected from each of the areas of study and the target processors were those who were into traditional processing by frying sweet potato for sale since boiling and roasting activities were virtually non-existent in these areas. Processors were however selected from communities and markets within the study area for which they could be found. Table 3.3 shows the various communities from which processor respondents were selected and their distributions.

Table 3.3 Sample Distribution of Processors by Community

District	Community/Market	Sample Size
Fanteakwa	Ehiamanhyene	10
	Begoro	10
	Agomenya	10
	Ashongmang	10
	Total	40
Mamprusi West	Katabanawa	10
	Nayoko	10
	Tinguri	10
	Walewale	10
	Total	40

Source: Field survey, 2015.

3.2.3 Methods of Data Collection.

The preparatory phase of the study involved introductory visits to the District Agricultural Units where discussions were held with the District Agric. Development Officers (D. D. Os). Also, visits were made to research institutions (i.e. CRI and SARI) to find out available varieties of sweet potato cultivated and the prominent areas of production. Through these consultations, areas for the study were identified. At the same time, discussions were held with market leaders in these areas to understand sweet potato marketing activities in these markets. These visits contributed tremendously in the design of the questionnaire, sampling strategy and the subsequent administration of questionnaires.

The draft questionnaire was pretested in one community (Asadja) and the Begoro market in the Fanteakwa district for the necessary inputs to be made to make up a final complete structured questionnaire for the main survey.

The final/modified structured questionnaire was used to collect the primary data needed for the study through personal interviews. Under this approach of data collection, respondents were asked to recollect a series of events that took place in their ventures both in present terms and retrospectively which in most cases demanded some time and keen attention by respondents. Enumerators were trained to be extra careful particularly when trying to elicit these recall information from respondents. In addition Focus Group Discussions (FGDs) were also held in each community particularly with farmers with a minimum of five (5) farmers participating. Focus group discussion guides were used as a tool for collecting primary data regarding the general nature of sweet potato production and marketing since farmers also sold their produce.

Enumerators were however dropped in groups at vantage market places and communities for them to identify traders and processors in no systematic format given the delicate nature and the difficult nature of getting these actors. Enumerators therefore interviewed traders and processors who were willing and ready to cooperate and partake in the study.

3.3 Method of Data Analysis

A combination of descriptive statistics, inferential statistics and econometric analysis were conducted on the data collected from the sweet potato value chain actors.

3.3.1 Descriptive Statistics and Inferential Statistics

The study employed frequency distribution tables, proportions, simple arithmetic mean, standard deviation to organize and summarize the characteristics of the respondents as well as to identify risks and constraints faced and risk management strategies adopted. The value chain map was used to show the distribution channels for sweet potato and the interrelationship among the actors in the chain.

3.3.2 Analysis of Sweet Potato Value Chain

As agricultural commodities or products (including sweet potato) move continuously through various phases, transactions occur between multiple chain actors, cost are incurred, money and information are exchanged and value is progressively added.

To identify the key players in the chain and their interrelation, a value chain map was generated from the field data. Mapping value chain helps to get a better understanding of connections between actors and processes and interdependency between actors and processes in a value chain. A value chain map allows one to depict all activities, actors, and relationships among segments of the chain, and the interactions between producers and intermediaries. This exercise was carried out in qualitative and quantitative terms through graphs presenting the various chain actors, their linkages and all the operations of the chain from production level through the trader (collectors, wholesalers and retailers) level to the processor level and finally to the consumer. Also, the value chain governance approach was used to determine the level of integration, relationship, coordination and the power structure of the sweet potato value chain.

3.3.3 Sweet Potato Value Chain Risk Analysis

Risk was first identified through FGDs during the preparatory phase of the survey. These risks were therefore presented to actors for them to rank by the use of a five point Likert scale which

was on a scale of one (1) indicating a strong agreement to five (5) on the other end indicating a strong disagreement. The risks dominantly agreed upon by actors were sorted using the mean ranks estimated for the various risks after which risk was calculated at each level of the value chain (producer, trader and processor) using a combination of the meanvariation (Swiss Re., 2007; Raustan et al., 2006), the mean-standard deviation (Kuyrah et al., 2006; Schweigman et al., 1985) and the Random Variability Index (RVI) proposed by Gene Mathia (1976). The mean-variance approach was calculated by the formula below;

$$S^2 = \frac{\sum (X_i - \mu)^2}{n - 1}$$

Where;

S^2 = Variance; X_i = observation recorded for each sample; μ =Sample mean; n= Sample

Also the mean-standard deviation is calculated by taking the square root of the formula of the mean-variance as stated below;

$$\sigma = \sqrt{S^2}$$

Where; σ = Standard deviation and S^2 = Variance.

The Random Variability Index (RVI) which is a ratio of standard deviation to the average (mean score) of the risk parameter being measured over the period under consideration. For instance, if output risk is being calculated, actual output of sweet potato harvested for the past three (3) years is obtained and the average of the three year output together with its variance and standard deviation calculated. Same approach was then used for the other risks identified along the chain but for trader and processors, the duration was for the number of trips and cycles respectively and not three years as the case of farmers. The RVI therefore is a combination of the first two approaches discussed (i.e. variance and standard deviation) in relative terms. The approach for the mean-variance and mean-standard deviation methods in the measurement of risk is not different from this method. However, after the estimation has been done, because the RVI is a relative measure, the standard deviation obtained is then divided by the mean score over the three year period or number of trips or cycles already estimated. The formula is provided below:

$$RVI = \frac{\sqrt{Variance}}{Average(r)}$$

The RVI was selected ahead of the use of both the mean-variance and the mean-standard deviation methods as the final decision making rule because of its convenience since it takes into account relative figures compared to the absolute figures of the former measures. Also, the probability method which was proposed by Howell and Hazard (2012) was not used although could have been the most appropriate measure in terms of precision and the estimation of losses due to the fact that its usage requires an extensive use of time series data through proper record keeping at the individual actor level to be able to predict the best probability and expected losses in order to estimate the risk. Actors involved in value chain activities in developing countries have been found to keep very little or no records to warrant the use of the probability approach.

The type of risk management strategy adopted by actors to mitigate risks they are faced with was also analyzed using descriptive statistical tools such as frequencies and percentages.

3.3.4 Choice Model for Risk Management Strategies

The choice of producers along the sweet potato value chain of a particular risk management strategy was analyzed using the Multinomial Logistic Regression Model (MNL).

A multinomial logit (MNL) explains inter-producer variation in the choice of a specific risk management strategy. This study assumes that producers in the sweet potato value chain make decision to generate the maximum possible utility. This indicates that each alternative risk management strategy adopted necessitates different private costs and benefits, and hence different levels of satisfaction to producers along the sweet potato value chain. Since producers along the sweet potato value chain are basically faced with two types of risks namely production and price, they tend to adopt different risk management strategies to deal with them. The factors which influence the type of risk management strategy for each of the risks vary. Producers along the sweet potato value chain have three options in terms of risk management strategies to choose from in dealing with production risk. These risk management from which a producer will ultimately choose from are; following of recommended agronomic practices (herbicide application before land clearing, no pesticide application, weeding twice before harvest, timely harvest etc.), Expansion of production (acreage) and planting of resistant sweet potato varieties). The analytical model is constructed as follows for the choice of production risk management strategy;

Assume that the utility of a producer *i* of alternative *j* is U_{ij}, where *j* = 0, 1, 2…. From the decision maker's standpoint, the best alternative is simply the one that maximizes net private benefit at the margin. In other words, a producer *i* will choose a risk management strategy *k* to deal with a risk if and only if $U_{ik} > U_{ij}, \forall j \neq k$. It is important to note that a producer's utility cannot be directly observed in practice. What a researcher observes are the factors influencing the producer's utility such as household and personal characteristics and attributes of the choice set experienced by the producer. Based on McFadden (1978), a producer's production risk utility function from using alternative *j* can then be expressed as follows:

$$U(\text{Choice of j for producer i}) = U_{ik} = V_{ij} + \varepsilon_{ij} \quad (1)$$

Where;

U_{ik} represents the overall utility,

V_{ij} represents an indirect utility function and

ε_{ij} represents the random error term

The probability that a producer *i* will select an alternative *j* can therefore be specified as:

$$P_{ij} = \Pr(V_{ij} + \varepsilon_{ij} > V_{ik} + \varepsilon_{ik})$$

$$(2)\ P_{ij} = \Pr(\varepsilon_{ik} < V_{ij} - V_{ik} + \varepsilon_{ij}) \quad \forall k \neq j$$

With the assumption that, the error terms are identical and independently distributed, the probability that a producer chooses alternative *j* can be explained by a multinomial logit model (Greene, 2000) as specified below:

$$P_{ij} = \frac{\exp(\beta_j X_{ij})}{\sum_{j=0}^{J} \exp(\beta_j X_{ij})} \quad (3)$$

Where;

X_{ij} is a vector of variable of a producer i^{th} facing alternative *j*

β_j is a vector of the regression parameter estimators associated with alternative *j* The

MNL model is therefore adapted to suit this study as follows:

$$P\ CHOICE(_{ij} \square \square j) \qquad \frac{Exp(\square_j X^i)}{Exp_{jj\square 1} Exp(\square_j X_i)} \qquad (4)$$

i represents i^{th} producer, and *i*=1,2,3,…200.

j represents different production risk management strategies (*j*=0 if farmer follows recommended agronomic practices, *j*=1 if farmer adopts acreage expansion and *j*=2 if farmer adopts planting of resistant sweet potato varieties).

P represents the probability of a risk management strategy j to be chosen by producer i;

$CHOICE_{ij}$ = means that the risk management strategy *j* is chosen by producer *i*;

X_i represents the set of independent variables influencing the choice of alternative *j*

As often/commonly done in econometric specification involving MNL model to normalize equation (4) by one of the response categories such that $\beta_j = 0$. In this regard, the MNL model can alternatively be specified as seen in equation (5) below:

$$P_{ij} \square \frac{\exp(\square_j X_{ij})}{\square \exp(\square_j X_{ij})}_{j\square 0}^{J\square 1} \qquad (5)$$

The coefficients of the explanatory variables on the omitted or base category are assumed to be zero. The probability that the base category is chosen can be calculated as follows:

$$P_{ij} \square \frac{1}{1\square \square \exp(\square_j X_{ij})}_{j\square 1}^{J\square 1} \qquad (6)$$

The marginal effects of the attributes on probability of choice are determined by differentiating equation (5):

$$\square_j \square \frac{\square P_j}{\square X_{\square}} \square P_j \square_{j\square} \square_j \square \square_{\square} \square P_j \square \square \square_j \square \square \qquad (7)$$

Where;

P_j is the probability that an actor selects risk management strategy *j*.

β_j is a vector of regression parameter estimates associated with the risk management strategy adopted *j*.

As stated earlier, the producer is also faced with price risk of which the type of risk management strategy adopted varies. It is in the same way the factors that influence their choice of a particular risk management strategy also vary. The analytical model is exactly the same as the one presented for the production risk except that the management strategies are different.

The different price risk management strategies used in the price risk model are (*l*=0 if farmer adopts crop diversification, *l*=1 if farmer adopts marketing through multiple channels and *l*=2 if farmer adopts expansion of production).

In the case of this study, producers have three risk management strategies to deal with production risk J=3 and that of price risk is also three with L=3.The dependent variables (the risk management strategy (CHOICE) chosen) in both analyses are measured by the probability of selecting either of these risk management strategies by producers along the chain to deal with production and price risk.

The model predicts the relative probability that a producer would choose one of the three categories based on the nature of the explanatory variables. For this analysis, the risk management strategies following recommended agronomic practices and crop diversification were used as the base categories for both production and price risk at the producer level respectively. This was done because ample evidence suggests that the best risk management tool for both production (output) and price risks at the production level are the above mentioned. Econometric analysis of the data was done using the stata software version 12.

Multicollinearity problem arises due to a linear relationship among explanatory variables; and makes it difficult to identify the separate effect of independent variables on the dependent variable (Gujarati, 2003). Variance Inflation Factors (VIF) technique was employed to detect multicollinearity in explanatory variable. According to Gujarati (2003) VIF (Xj) can be defined as:

1

$$VIF\ X(_j) = \frac{1}{1 - R_{j2}}$$

Where;

R_j is the multiple correlation coefficient between X_j or X_l and other explanatory variables. If the value of VIF is 10 and above, the variables are said to be collinear.

3.5 Variable Selection and Description

In the course of identifying factors that influence the choice of agricultural risk management strategies of producers along the sweet potato value chain the main task is exploring which factors potentially influence actors and how (the direction and magnitude of the relationship) these factors are correlated with the dependent variable.

3.5.1 Dependent Variable Used for Output Model

Output Risk Management Strategy (RMS): In the analysis it is measured by the probability of choosing/selecting any of the risk management strategies. The choice of strategy will be decision involving three alternative strategies each of production and price risk at the production level. For production risk alternatives, it is represented in the model as Y_0 for producers who choose to select following mainly recommended agronomic practices, Y_1 for producers who select mainly the expansion of acreage (farm size) and Y_2 for producers who select mainly the planting of resistant sweet potato varieties. Y_0 which is the use of recommended agronomic practices has therefore been set as the base category and explanations of the others categories (i.e. Y_1 and Y_2) would be done relative to this category.

3.5.1.1 Independent Variable Description for Output Risk Model

Table 3.4 below shows the independent variable used for the output model, their description, how the variables were measured and finally their respective *a priori* expectations. **Table 3.4 Independent Variable Description of the output Risk Model**

Variable	Definition/Description	Measurement	*A Priori* Expectation
Sex	The sex of the farmer	Dummy (1 if the farmer is a male and 0 if female)	-
Age	Actual age of the farmer	Years of the farmer	+/-
Education	Level of formal education attained by the farmer	Actual year of schooling	+

Farm size	It is the size of farm used by the farmer for sweet potato cultivation	Actual acres used for cultivation	-
Income	Amount obtained from sweet potato sales	Total amount in GH¢	+
Savings	Amount saved from sweet potato sold the previous season	Actual amount saved in GH¢	+
Output	Total output of sweet potato from the previous season	Actual output harvested in kilograms	+/-
Credit	Amount borrowed for sweet potato production the previous season (2014)	Actual amount borrowed in GH¢	+
Off-farm income	Income obtained from other sources rather than farming for the previous year	Actual amount obtained in GH¢	+/-
Farm experience	Length of time for which farmer has been farming sweet potato	Actual years of sweet potato cultivation	+
Extension	Farmer's access to extension services	Number of extension contacts obtained the previous season	+
Market Information	Farmer's access to market information	Dummy(1 if farmer has access and 0 if otherwise)	+

3.5.2 Dependent Variable Used for Price Model

Price Risk Management Strategy (RMS): Also in the model it is measured by the probability of choosing/selecting any of the price risk management strategies selected by farmers. The choice of strategy will be decision involving the three alternative strategies outlined for price risk management at the production level. For the price risk alternatives, it is represented in the model as Y_0 for producers who selected diversification, Y_1 for producers who selected mainly the choice of marketing through multiple channels (farm size) and Y_2 for producers who selected the alternative of expansion of production. Y_0 which is the use of diversification has therefore been set as the base category of which explanations of the others categories (i.e. Y_1 and Y_2) would be done relative to.

3.5.2.1 Independent Variable Description for Price Model

Table 3.5 below shows the independent variable used for the price model, their description, how the variables were measured and finally their respective *a priori* expectations. **Table 3.5 Independent Variable Description of the Price Risk Model**

Variable	Definition/Description	Measurement	*A Priori* Expectation
Household size	Members of a sweet potato farm household	Actual number of household members	+
Output	Total output from sweet potato the previous season	Actual output harvested in kilograms	-
Credit	Amount borrowed for sweet potato production the previous season (2014)	Actual amount borrowed in GH¢	+

Farm size	It is the size of farm used by the farmer for sweet potato cultivation	Actual acres used for cultivation	+
Buyer type	Type of buyer farmer mainly sells sweet potato to.	Dummy(1if buyer is a collector and 0 if otherwise)	-
Savings	Amount saved from sweet potato cultivation the previous season	Actual amount saved in GH¢	+
Point of sale	Place where sweet potato was mainly sold	Dummy (1 if farmer sold at the farm gate and 0 if otherwise)	+
Farm experience	Length of time for which farmer has been producing sweet potato	Actual years of sweet potato cultivation	+
Extension	Farmer's access to extension services	Number of extension contact obtained the previous season	+
Market Information	Farmer's access to market information	Dummy(1 if farmer has access and 0 if otherwise)	+

3.6 Estimation of Value Chain Constraints

Actors along the sweet potato value chain were asked to rank a number of constraints presented to them by using a five point likert scale (1= strongly agree and 5= strongly disagree).The constraints faced by the various chain actors was then analyzed as ranked by actors using the Kendall's Coefficient of Concordance (***W***). Kendall's coefficient of concordance (***W***) is a measure of agreement among raters (judges).

This statistic is the best suit for analyzing constraints particularly those of an entire value chain since it tend to give an estimation of the level of agreement in the opinions of the respondents (judges). Constraints which were sought from value chain actors included those in relation to production, marketing and processing since these are major activities on which the value chain is anchored. The Kendall's Coefficient of Concordance was estimated as follows;

$$W = \frac{12(T T^{3})}{m_2 (n_3 n)}$$

Where;

T= Sum of ranks for each constraints been ranked m= Number

of respondents passing judgment on the constraints n= Number

of rankings

Then test of significance of the Kendall's Coefficient of Concordance is given by: z□

0.15log*e* *m*□(□1)*w*□□1□*w*□□1

The Kendall's Concordance is hypothesized as;

H_0= There is no agreement among actors in their rankings of the constraint

H_1= There is agreement among actors in their rankings of the constraint

The test of significance of the Kendall's Concordance was done using the chi-square (χ^2) statistic which is computed using the formula;

□2 □*p n*□ □1□*W*

Where; n= Sample size; p=number of constraints; W= Kendall's Coefficient of Concordance

After the various constraints and the agreements have been elicited, the Cronbach's Alpha which is a statistic and is commonly used as an estimator of the internal consistency and reliability of psychometric score for a sample of examinees (judges) for a five (5) point likert scale was used to remove constraints that were not in-line (consistent) or measuring the same construct with the general outlook of constraints. The theoretical form of the Cronbach's Alpha is shown below;

□ *n* 2□

□□ $\overline{NN}$□1□□□1□$\overline{\square_{i\square}}$□1□$_{X\,2Y_i}$□□□

□□ □□ (13)

α= Coefficient that indicates the reliability of constraints.

N= Number of components (Items)

σ_X^2 = Variance of observed total test scores for the current sample of persons

$\sigma_{Y_i}^2$ = Variance of component i for the current sample of persons

The Cronbach's Alpha value indicates the level of consistency among the responses of the actors. A higher C-alpha value signifies high levels of consistency and reliability in the rankings of the actors' constraints whilst lower values indicate the contrary (i.e. lower consistency and reliability).

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Introduction

This chapter presents the key findings of the study. It has five main sections. The first section deals with descriptive and inferential statistics of the sampled actors. The second section presents value chain analysis of sweet potato which includes value chain map, actors and their roles, and value chain governance. The third section deals with the various risks identified and the respective risk management strategies adopted by actors. The fourth section presents results of econometric analysis and the discussion of the determinants of the choice of risk management strategies adopted by actors by using MNL model. The fifth section finally deals with the constraints along the sweet potato value chain which encompass those of producers, traders and processors.

4.1. Presentation of Descriptive Results of Actors

4.1.1. Demographic characteristics of Producers

Tables 4.1 and 4.2 present demographic and socioeconomic characteristics of producer respondents. The total sample size of producers was 200 out of which 79% were males and 21% were females. The male dominance could be the result of the labour intensive nature of sweet potato production which is mostly in small sized mounds and sometimes on beds or ridges. The average age of farmers from the pooled sample was 40 years with the respective average age for the Fanteakwa and West Mamprusi districts being 43 and 38 years. The relatively younger farmer population in the West Mamprusi district is not surprising since sweet potato is the main cash crop for the inhabitants in the area and so attracts young and energetic individuals. In the Fanteakwa district, there are other cash and food crops such as cocoa, cocoyam and plantain which are also cultivated. With regards to educational status of the farmers, it was realized that majority of farmers (pooled) had never been to school (44.5%) followed by farmers with basic level of education (43.5%) which is not very far from the national average. As indicated by the 2010 Population and Housing Census, the Ghana Statistical Service (GSS) reports that at the national level, an average of 33.1% of the population in rural areas has never attended school. The average years of formal schooling was about 9 years for the West Mamprusi district and 7 years for the Fanteakwa district. This is an indication that those who went to school attained the basic level of education only. This may

in turn have serious consequences for technology transfer particularly when it comes to that of managing risk since innovation transfer programs have to be carefully understood and implemented to attain the required impact. Majority (83%) of the farmers from the study were married with an average household size of 7 people (pooled) which is an indication of an additional source of labour for farming. However, household size for West Mamprusi (8) was higher than that Fanteakwa (6).

Land ownership and tenure issues have very serious implications for the size of a household's farm and to a large extent the type of crops cultivated. Majority (54%) of farmers from the pooled sample indicated they owned their lands for sweet potato cultivation with an average farm size of about two (2) acres and above 15 years of farming experience. A large proportion (75%) of these farmers who owned lands were those in the West Mamprusi district. Sweet potato farmers from the Fanteakwa district mainly acquired their lands through the sharecropping system which is common in settler communities where migrant farmers usually have no cultural or legal custody of lands. Majority (53%) of farmers in the Fanteakwa district were seen to practice sharecropping system of land acquisition due to the fact that they are farmers from Krobo land who have come to settle in the Fanteakwa district. Output was also seen not to significantly differ across the two districts with an average output of about 25 bags (2725kg) per 2 acre sweet potato farm with the average output from the West Mamprusi district being slightly higher than that of the Fanteakwa district owing to the considerable use of fertilizer in the cultivation of the crop due to the general poor soil conditions in the Northern sector of the country.

Table 4.1 Demographic and socioeconomic characteristics of Producers

Variables		**Fanteakwa (n=100)**	**West Mamprusi (n=100)**	**Total (N=200)**	
		%	%	Freq	%
Sex	Male	71	87	158	79
	Female	29	13	42	21
Educational Level	Never been to school	26	63	89	44.5
	Basic	68	19	87	43.5
	Secondary	6	16	22	11
	Tertiary	0	2	2	1
Marital Status	Single	14	7	21	10.5
	Married	75	91	166	83

	Separated	2	0	2	1
	Widowed	9	2	11	5.5
Land Tenure Arrangement	Own land	27	80	107	53.5
	Family land	15	16	31	15.5
	Share cropping	53	0	53	26.5
	Renting	5	4	9	4.5
Access to Extension	Yes	32	74	106	53
	No	68	26	94	47
Membership of a Co-operative	Yes	0	52	52	26
	No	100	48	148	74
Record Keeping	Yes	6	35	41	20.5
	No	94	65	159	79.5
Access to Credit	Yes	14	17	31	15.5
	No	86	83	169	84.5
Source of Funding	Own funds	86	83	169	84.5
	Friends/Relative	10	7	17	8.5
	Financial institutions	3	10	13	6.5
	Private money lenders	1	0	1	0.5
Ownership of Bank Account	Yes	37	15	52	26
	No	63	85	148	74

Source; Field survey, 2015

It was realized from the study that majority (74%) of farmers in the West Mamprusi district compared to their counterparts in the Fanteakwa district (32%) had access to extension services. This was not very surprising revelation from the study since the study further revealed that 52% of farmers in the West Mamprusi district were members of Farmer Based Organizations (FBOs) whilst FBOs in the sweet potato sector are almost non-existent in the Fanteakwa district. This shows a relatively easy information dissemination for agents in the West Mamprusi district than those in the Fanteakwa district since farmers could easily be organized under the supervision of FBO leaders for training sessions to be offered to members. However, farmers have an average number of three (3) extension contacts a year which is not very bad particularly where cropping in both areas of the said crop (sweet potato) is done once a year. Record keeping is a very important element for a successful agriculture since farmers are able to track their progress in terms of both successes and failures over a period. Record keeping was seen to be on the low (41%) with the main reason of not keeping records by farmers being their inability of write. However, only 6% of farmers in the fanteakwa indicated they kept records as compared to about 35% farmers in the West Mamprusi district. This is not surprising since the former district had no FBOs where such trainings could be easily

transmitted. Source of funding farming activities is very vital in agriculture in terms of expansion of farm acreages, adoption of agricultural innovation and some managerial decisions such as the management of risk. From the study, access to credit was found to be very low since only 12% of farmers indicated they had access. Majority (84%) of farmers from the pooled sample indicated their main source of funding was their own income mostly from savings from previous season's sale of their farm produce. It is not surprising that farmers saved about 50% of their profit as shown in Table 4.2 for the two districts. It was however realized from the study that farmers in the Fanteakwa districts made an average income of GH¢ 1899.80 from the 2014 cropping season as against an average income of GH¢ 1274.00 for farmers in the West Mamprusi district. With regards to ownership of a bank account, majority (74%) of farmers from the pooled sample had no bank account which was not surprising looking at the proportion of farmers who indicated their main source of funding as financial institutions. Most financial institutions as a requirement for financial assistance demand that farmers own an account and if possible have some level of saving. Consequently, this makes it very difficult for farmers to access credit from financial institutions in order to aid their sweet potato farming activities particularly when it comes to the management of risk due to the cost it comes with.

Table 4.2 Summary statistics on characteristics of Producers

Variables	**Fanteakwa (n=100)**		**West Mamprusi (n=100)**		**Total (N=200)**	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Age (years)	42.99	14.34	37.82	11.69	40.41	13.31
Years of schooling	7.48	2.62	9.1842	3.42	8.053	3.0054
Household size	5.8	2.91	8.28	4.6	7.04	4.032
Distance to farm (km)	1.6	1.076	2.584	1.97	2.092	1.65
Years of SP farming	14.36	9.17	6.6	5.45	10.48	8.47
Farm size of SP (acres)	2.2825	1.77	1.2875	0.67	1.785	1.42
Output (109kg bag)	23.095	14.52	26.02	16.31	24.55	15.47
Extension Contact	2.1481	1.026	3.1067	1.58	2.8529	1.51
Amount saved last season (GH¢)	571.5556	469.029	241.1236	190.37	407.26	394.16
Credit received last season (GH¢)	576.42	517.32	286.47	75.74	417.41	374.89
Price of SP (109kg)	93.7	12.28	65.88	11.0034	79.79	18.15
Income from SP (GH¢)	1899.8	1398.44	1274.82	645.84	1587.31	1130.74

Profit for last season (GH¢)	1310.9	1362.44	567.27	611.5	939.085	1117.33

Source; Field survey, 2015

4.1.2 Demographic characteristics of Traders

The role of traders in the value chain cannot be over-emphasized. They serve as the main link between the lower part (production) and the upper stream (consumers) of the value chain. Raw materials from the production level are mostly conveyed by traders for onward delivery to processors and consumers and exports when the need be. Traders in the value chain also play a supporting role to producers in terms of financial assistance when it becomes necessary.

Tables 4.3 and 4.4 illustrate the characteristics and descriptive statistics for traders in the two districts studied. From the survey, it can be realized that majority of the traders (98%) from the pooled sample were females with only 2% of the respondents being males. It is however worth noting that majority (78%) of traders from the pooled sample was aged between 30 and 60 years with an average age of traders being 43 years. Majority (38%) of traders from the pooled sample was wholesalers with (29%) being collectors and 33% being retailers. This is not surprising since collectors as defined by their role usually would go to producing areas to purchase sweet potato from farmers for onward delivery to other traders, processors and in some instances to consumers. The task of collectors requires some sound financial stature to be able to accomplish their task compared to the other trader types (wholesalers and retailers).

Education level attained by traders is very eminent when it comes to the understanding of risk and subsequently its management. The study revealed that, majority (61%) of sweet potato traders had never been to school. Whilst majority (68%) of traders in the Fanteakwa district obtained basic education level, only 8% of traders in the West Mamprusi district had basic level education with the majority (92%) of traders who have never been to school. The average years of schooling for traders in the Fanteakwa and West Mamprusi districts were however seen to be 6 and 2 years respectively.

From the survey also, it was revealed that majority (51%) of traders had their main target customers for their sweet potato as fellow traders with 25% of traders targeting their produce directly to processors and 24% targeting consumers as seen from the pooled sample. It is however not surprising since it was realized that most traders in the sweet potato value chain

were either wholesalers who sold mainly to fellow traders. Collectors largely aggregated sweet potato for fellow traders (ie. selling directly to wholesalers and retailer). The main point of sale for sweet potato is very important when it comes to the risk, cost, profit and other vital economic implications for the trader. It was realized from the survey that the main point of sale for sweet potato in both districts was the main district market with 81% of traders from the pooled sample responding in the affirmative. It was however not surprising that no trader in the West Mamprusi district traded outside the district since traders from other parts of the country come to the main district market during market days to buy their produce. Also, it is worth nothing that the average distance covered by a trader in the West Mamprusi district was 4.53 kilometers as opposed to that of Fanteakwa district where traders travelled about which is 37.70 kilometers.

This is an indication that traders in the Fanteakwa district trade not mainly in the district market but also outside the district (16%). Trading in different root and tuber crops is a vital source of income security and risk management among traders. This is because most agricultural commodities are seasonal, traders in order not to stay idle mostly engage in trading of different root and tuber crops so as to take advantage of the different harvest periods of the various commodities. From the survey, it was realized that 48% traded in only sweet potato whilst majority (52%) of traders indicated they traded in other root and tuber crops. The survey further revealed that, majority (72%) of traders from the pooled sample was not members of any trader association. However, 42% of traders in the Fanteakwa district were members of a trader association as opposed to 14% of their counterpart traders in the West Mamprusi district being members of a trader association. Access to price information helps traders to be able to plan both short and long term particularly when planning against risk which needs to be anticipated in order to mitigate or completely eradicate its impact. Generally, access to price information was seen from the survey as high since majority (56%) of the traders from the pooled sample had access to price information.

Table 4.3 Demographic and socioeconomic characteristics of Traders

Variables		**Fanteakwa (n=50)**	**West Mamprusi (n=50)**	**Total (N=100)**	
		%	%	Freq	%
Sex	Male	4	0	2	2
	Female	96	100	98	98
Age	<30	16	14	15	15

	30-60	80	76	78	78
	>60	4	10	7	7
Type of Trader	Retailers	40	26	33	33
	Wholesalers	30	46	38	38
	Collectors	30	28	29	29
Educational Level	Never Been to School	30	92	61	61
	Basic	68	8	38	38
	Secondary	2	0	1	1
	Tertiary	0	0	0	0
Target Customer	Fellow Traders	54	48	51	51
	Processors	8	42	25	25
	Consumers	38	10	24	24
Main Point of Sale	Main District Market	74	88	81	81
	Market Within District	10	12	11	11
	Market Outside District	16	0	8	8
Trade in Other Commodities	Yes	52	44	48	48
	No	48	56	52	52
Membership of a Trader Association	Yes	42	14	28	28
	No	58	86	72	72
Record Keeping	Yes	20	0	10	10
	No	80	100	90	90
Awareness of SP Price Information	Yes	74	38	56	56
	No	26	62	44	44

Source; Field Survey, 2015

Table 4.4 Summary statistics characteristics of Traders

Variables	**Fanteakwa (n=50)**		**West Mamprusi (n=50)**		**Total (N=100)**	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Age (years)	42.12	10.63	42.5	12.57	42.31	11.58
Years of schooling	5.54	4.067	0.66	2.37	3.10	4.12
Household size	5.62	1.88	6.54	3.19	6.08	2.65
Total income (GH¢)	2336	1952.98	601	372.045	1468.50	1648.18
Distance Covered km	37.6795	80.58	4.525	2.19	20.044	57.28
Volumes of SP handled per week (109kg bag)	12.945	13.89	4.16	2.61	8.55	10.88
Minimum capital Requirement(GH¢)	1676.2	1533.89	411.6	163.61	1043.90	1257.62

Entrance Fee(GH¢)	65	46.17			65	46.17
Marketing cost	4188.74	4590.53	698.59	525.58	2443.664	3693.62
Unit Price(GH¢ /109kg)	130.294	26.77	67.63	10.12	97.222	37.13
Total revenue(GH¢)	4937.56	5072.10	877.65	683.029	2907.603	4138.41
Profit (GH¢/typical month)	748.82	982.021	179.058	190.35	463.939	759.75

Source; Field Survey, 2015

Notwithstanding, most (62%) of traders in the West Mamprusi district had no access to price information as opposed to 74% of traders in the Fanteakwa district who had access to price information. From Table 4.4, it can be realized from the pooled sample that traders handled about 9 bags (981kg) per week with traders in the Fanteakwa district handling more (1526kg) compared to traders in the West Mamprusi (436kg). Sweet potato trading was generally seen to be profitable across the two districts although there was a significant difference between the profits of traders in the two districts. On the average, a trader in the Fanteakwa district is able to make a profit of GH¢ 748.82 from the sale of sweet potato for the season compared to GH¢179.058 in the West Mamprusi partly owing to the disparity in the prices of the commodity in the two districts. The study revealed that the price of a bag (109kg) of sweet potato in the West Mamprusi district (GH¢ 67.63p) was about half the price bag (109kg) in the Fanteakwa district.

4.1.3. Demographic Characteristics of Sample Processors

Processors in the sweet potato value chain perform the transformational role by changing the produce into different products for a more convenient utilization by consumers. The main product processed from fresh sweet potato was found to be the fried form. Processors also play a role as major receptacle for the absorption of most of the sweet potato from traders compared to proportions channeled directly to consumers. This activity is basically performed by females as observed in the survey since all eighty (80) processors identified were female. This was not seen as surprising since women have been reported to be the majority in the informal sector of which sweet potato processing is a part. The International Labour Organization (ILO) estimated about 61% of females in the informal sector in developing counties (ILO, 2000). In Ghana however, this figure is estimated to be about 53.3% (GSS, 2005).

Tables 4.5 and 4.6 present the demographic and socioeconomic characteristics of processors. The study revealed that, majority (85%) of processors was within the age category of 30 and 60 years with an average age of a processor being about 36 years. This is an indication of youthful dominance of processors in the sweet potato value chain which suggests a rather bright prospect for the produce processing. With regards to the level of education of processors, it can be seen from the results that majority (83%) of processors in the Fanteakwa district at least attained the basic level education with eight years of schooling as opposed to the West Mamprusi district where majority (80%) of them had never been to school with the average years of schooling being two years. Also, majority (81%) of processors from the pooled sample were into the processing of other commodities, which is an indication of the risk conscious nature of these processors.

However, about 37% of processors particularly from the West Mamprusi district were seen to be reliant only on the processing of sweet potato. This was due to the limited alternative livelihood sources available to the processors. Membership of processor association is very eminent when it comes to the facilitation of training programs and innovation transfer. Processor associations were practically non-existent in the Fanteakwa district whilst about 23% of their counterparts in the West Mamprusi district were members of such associations.

Table 4.5 Demographic and socioeconomic characteristics of Processors

Variables		**Fanteakwa (n=40)**	**West Mamprusi (n=40)**	**Total (N=80)**	
		%	%	Freq	%
Age	<30	7.5	22.5	12	15
	30-60	92.5	77.5	68	85
Educational Level	Never been to school	12.5	80	37	46
	Basic	83	17.5	40	50
	Secondary	5	2.5	3	4
Processing more than one commodity	Yes	10	62.5	65	81
	No	0	37.5	15	19
Membership of a Trade Association	Yes	0	22.5	9	11
	No	100	77.5	48	89
Main Point of SP Procurement	Farm gate	10	10	8	10
	Collector	23	20	17	21
	Wholesaler	30	15	18	23

	Retailer	37	55	37	46
Mode of Marketing	Spot trade	100	100	80	100
	Contractual arrangement	0	0	0	0
Main Capital Source	Own equity	95	97.5	77	96
	Credit union	5	0	2	2.5
	Susu Scheme	0	2.5	1	1.5
Place of Savings	No savings	7	12.5	8	10
	At home	45	72.5	47	58
	Bank	28	0	11	14
	Credit union	10	0	4	5
	Susu scheme	10	15	10	13
Access to Credit	Yes	15	0	6	7
	No	85	100	74	93

Source; Field Survey, 2015

A typical processor is about about six (6) years of experience. Majority (46%) of processors indicated their reliance on retailers for fresh produce due to the convenience and/or proximity to these traders (retailers) with an average distance of three (3) kilometers covered per trip. The mode of marketing was also found to be the same across the two districts since all (100%) processors indicated their use of spot trade either for their produce or products. The source and type of capital used by processors was mainly own equity (96%) source. With regards to access to credit, majority (92.5%) of processors indicated they had limited access. They are left with no other option than to depend on their own income from processing of other root and tuber crops. It is however, worth noting that, the 7.5% of processors who have access to financial assistance from FIs obtained an average of GH¢1266.67 for sweet potato processing. Place of savings has been very critical in recent times in one's ability to access credit facilities from FIs. It was however realized from the survey that most (58%) of processors saved their proceeds from sweet potato in their homes which could be the reason for their seemingly difficulty in acquiring credit from FIs.

It can also be realized from table 4.6 that, processors in the Fanteakwa district had an average income from sweet potato processing of about GH¢1310.45 for a full monthly cycle of processing. This is about twice the total income obtained by processors in the West Mamprusi district since they make an average of GH¢683.75 which is not very surprising considering the unit cost per slice of the products for the two districts. However, costs incurred across both districts regarding processing of sweet potato was considerably lower for processors in the

West Mamprusi district for a typical cycle of processing sweet potato at a cost of GH¢57.90 compared to GH¢64.85in the Fanteakwa district. Nevertheless, the profit obtained for a typical processing cycle was not significantly different between the two districts with processors making an average of GH¢44.88.

Table 4.6 Summary Statistics of characteristics of Processors (continuous variables)

Variable	Fanteakwa (n=40)		West Mamprusi (n=40)		Total (N=80)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Age (years)	38	6.51	34.40	7.67	36.2	7.30
Years of schooling	7.53	3.29	1.53	3.40	4.53	4.49
Household size	4.88	1.67	6.25	2.26	5.56	2.092
Average distance (km)	3.91	4.59	2.77	1.26	3.32	3.33
Total income from SP (GH¢)	1310.45	846.44	683.75	212.85	997.10	689.56
Years of sweet potato processing	7.15	3.94	4.33	2.27	5.74	3.49
Unit Price/slice of fried SP (GH¢)	0.2	0	0.10	0.016	0.15	0.050
Credit received for SP processing (GH¢)	1266.67	1342.63			1266.67	1342.63
Average processing cost /cycle (GH¢)	64.85	22.83	57.90	11.57	61.37	18.32
Average Profit/cycle (GH¢)	46.99	63.14	42.77	34.17	44.88	50.49

Source; Field Survey, 2015

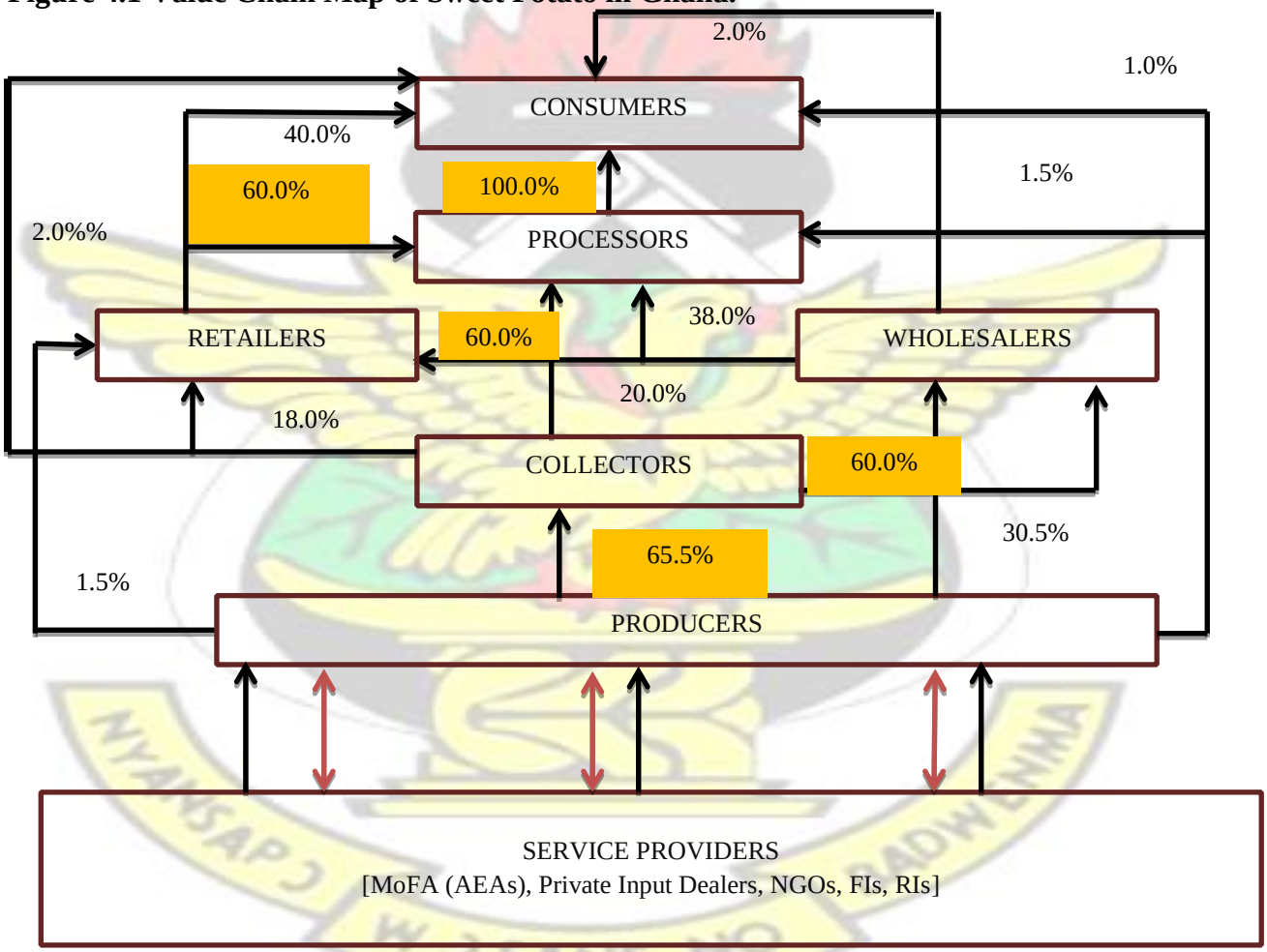
4.2 Value Chain Analysis

4.2.1. Value Chain Map of Sweet Potato in Ghana

The value chain map of sweet potato in Ghana generated from the study is depicted in Figure 4.1. The various actors in the value chain are depicted and the various distributional channels of the flow of sweet potato to the final consumer illustrated. From the map, it can be seen that producers mainly enjoy support services such as input supplies, financial assistance and educational programmes on innovative technology from service providers (MoFA, private input dealers, NGOs, FIs, RIs). Information flow is mainly a two way flow where service providers receive feedback from producers on whatever service is given. Producers after production of sweet potato have a number of alternative channels to sell their produce. It was realized from the study that, majority (65.5%) of producers sold their produce to collectors who mainly buy sweet potato from the farm gate with 30.5% of producers selling to wholesalers

and 1.5% selling to retailers. Only 1.5% and 1% of producers sold directly to processors and consumers respectively. Also, majority (60%) of collectors sold their produce to wholesalers, 20% selling to processors and 18% sold to retailers. Notwithstanding, 2% of collectors sold their produce directly to consumers. Wholesalers mainly sold their produce to retailers with 60% of them indicating their sale to retailers. It was also realized that whilst 38% of wholesalers sold to processors, only 2% of them sold to consumers. At the retailer level however, 60% and 40% of them sold their sweet potato to processors and consumers respectively. Finally, all processors (100%) sold their products directly to consumers in a more convenient and ready-to-eat forms.

Figure 4.1 Value Chain Map of Sweet Potato in Ghana.



Represents information and technology in a two way dimension

Represents the physical flow of inputs and produce/products

Source; Researcher's Own sketch from Field Survey, 2015

4.2.2. Actors and their Role in Sweet Potato Value Chain

The value chain map emphasized the involvement of diverse actors who participate directly or indirectly in the value chain of sweet potato in Ghana. According to KIT *et al.* (2006), the direct actors of a value chain are those involved in actual activities along the chain (input suppliers, producers, traders, processors and consumers) whilst the indirect actors can be said to be actors who provide financial or non-financial support services, such as credit agencies, government via MoFA, NGOs, cooperatives, researchers and extension agents.

4.2.2a Input Suppliers

Many actors are involved either directly or indirectly in the supply of agricultural inputs. Private input suppliers have been acknowledged by farmers as the main source of input supply (especially fertilizer, herbicides, pesticides and farm implements). Sweet potato growing farmers also participate in this stage of the value chain particularly when it comes to sweet potato planting materials (vines) supply to fellow farmers at a fee and/or gratis. Notwithstanding, it was also observed that the MoFA through its agents of technology transfer (AEAs) sometimes provide sweet potato vines in the form of vine multiplications programs. All such actors are responsible to supply agricultural inputs like improved sweet potato vines, fertilizers, herbicides, pesticides and farm implements which are essential inputs at the production stage. From the survey, it was realized that majority (65.5%) of the producers used their own vines usually through backyard nursery beds (Table 4.7). Regarding fertilizers, all (62%) of farmers who used fertilizer applied inorganic fertilizers on their sweet potato fields. No farmer used any form of organic fertilizer. Interactions with farmers indicated that use of organic fertilizers such as compost, cow dung increased the rate of deterioration of the crop on-field and also post-harvest losses. Pest attack is a very prevalent problem for sweet potato producers due to the sweet tubers it produces. The major pest identified to attack the crop most was termites which attack the tubers if matured tubers are not harvested promptly. Majority (53%) of farmers interviewed indicated that they did nothing to control or prevent pest due to the perception that use of pesticides has the tendency of killing micro-organisms in the soil after its use. However, 47% reported the use of pesticides when such pests (mainly termites) are observed on their fields. Most (79%) farmers acquired their chemical inputs from retail

shops (agro-chemical shops) in the nearest town (48%) where they could easily get access to these inputs.

Table 4.7 Farmers Sources of Input

Variable	Item	Frequency	Percentage
Source of Vines/Planting Materials	Own farm	131	65.5
	Friends/Fellow Farmer	52	26
	MoFA	17	8.5
	Total	200	100
Fertilizer Use	Yes	124	62
	No	76	38
	Total	200	100
Main Fertilizer Used	N:P:K 15:15:15	93	75
	Foliar fertilizer	4	3.2
	Sulphate of Ammonia	8	6.5
	Urea	19	15.3
	Total	124	100
Herbicide Use	Yes	173	86.5
	No	27	13.5
	Total	200	100
Main Herbicide Used	Adwumawura	80	46.2
	Gramozone	7	4
	Condemn	86	49.8
	Total	173	100
Main Source of Chemical Inputs	Wholesalers	9	5.2
	Retailers	158	91.3
	MoFA/Government	6	3.5
	Total	173	100
Main Location of Chemical Inputs	Within community	13	7.5
	Nearest town	96	55.5
	District capital	62	35.8
	Outside district	2	1.2
	Total	173	100

Source; Field Survey, 2015

4.2.2b Producers

Sweet potato farmers are the major actors who perform most of the value chain functions right from farm inputs preparation on their farms or procurement of the inputs from other sources to post harvest handling and marketing. Ploughing, planting, fertilization, irrigating, weeding, pest/disease control, harvesting and post-harvest handling are some of the major functions undertaken by sweet potato producers.

Mono cropping is the most popularly practiced production system in both areas due to the creeping nature of the crop which makes difficult the survival of other crops on the same parcel. Due to the resistant nature of the white fleshed variety, all (100%) farmers would grow as main/major variety and grow other varieties as the red or yellow fleshed as minor variety.

Post-harvest handling, which includes different activities like sorting, grading, packing, storing, transportation, loading and unloading, are mostly done by the farmers themselves if they send the produce (sweet potato) to the market or traders who go to the producing centers to buy at the farm gate. From the study (Table 4.8) it was realized that majority (85%) of farmers mainly sold their produce at the farm gate mostly to collectors. Rather intriguing was the fact that about 24% of farmers in the West Mamprusi district sent their produce to the main district market in Walewale for onward transfer to other actors in the chain. However, this could be as a result of the close nature (4.0070km) of these farming communities to the district market. It was realized that 72% and 89% of farmer in the Fanteakwa and West Mamprusi districts respectively had access to market information in different forms. Majority (76%) of farmers in the Fanteakwa district indicated their easy access to buyer information particularly in terms of the time these buyers would arrive in the various communities for purchase since harvesting of sweet potato there is heavily dependent on the time buyers would visit. This was however not the case with farmers of the West Mamprusi district owing to the fact that majority (58%) of them had access to price information. This was not surprising once again due to the proximity to the main district market by farmers. From the pooled sample had information on weekly basis which is a reflection of the weekly cycle for most food markets in the country. Buyers mostly visit producing communities a day or two prior to a major market day within or outside the district whilst price information is mainly obtained and easily during market days. The main source of market information by farmers in both districts friends and/or fellow farmers (92%). Rather fascinating was the number of farmers who had their market information from trader sources. It was realized from the study that, only 8% of farmers from both districts

accessed information from traders who are supposed to be playing a very strong role in terms of information flow from markets to farmers. This ultimately could have a telling effect on the efficient functioning of the value chain of the crop (sweet potato). Farmers revealed that traders mostly hid information from them since they perceive that awareness of certain vital information could lead to a narrow rather than the wide marketing margins presently enjoyed by traders.

Contract production was entirely absent in the sweet potato value chain in the two districts. The mode of trading/marketing of sweet potato by all (100%) farmers was by way of regular/spot trade. Here the farmers had no pre-arranged terms with any buyer and so when the produce is ready, farmers would either wait for whichever buyer comes to offer a better price or they take it to the nearest market themselves for sale. This once again has an impact on the level of coordination and integration (vertical) of these actors since it indicates signs of mistrust among them which mostly form the foundation for most coordination and integrations. Farmers mainly performed value addition in the form of grading and sorting of sweet potato by sizes since that is the main criterion mostly demanded by traders for purchase; as such, all (100%) farmers were found to grade and sort their produce before sale. Also packaging of sweet potato was seen to be important value addition performed at the farm level. The survey results showed that 92% and 55% of farmers in the Fanteakwa and West Mamprusi districts respectively packaged sweet potato by bagging them in sacs before sale. Value addition by way of storage is an activity which is not performed due to the high perishability of the crop. Farmers would usually wait for an assured day where buyers would be available before any harvest is done. Farmers reported that for every bag (109kg) of sweet potato harvested, an average of 5.3% is lost before final delivery to collectors. Most of the farmers use sacks, underground storage at the farm and ground floor in an open space around their residential houses as holding places for harvested produce pending trader arrival.

Table 4.8 Sweet Potato Handling by Producers

Variables		Fanteakwa (n=100)	West Mamprusi (n=100)	Total (N=200)	
		%	%	Freq	%
Packaging (bagging in sacs) of Sweet Potato	Yes	92	55	147	73.5
	No	8	45	53	26.5

Grading/Sorting of Sweet Potato	Yes	100	100	200	100
	No	0	0	0	0
Main Point of Sale	Fame gate	95	75	170	85
	Main District Market	1	24	25	12.5
	Market Within District	2	1	3	1.5
	Market Outside District	2	0	2	1
Access to Market Information	Yes	72	89	161	80.5
	No	28	11	39	19.5
Type of Market Information	Price Information	24	58	69	43
	Market Place	0	5	4	3
	Buyer Information	76	37	88	54
Frequency of Market Information	Daily	0	16.9	15	9.3
	Weekly	98.6	60.6	125	77.6
	Bi-Weekly	0	16.9	15	9.3
	Monthly	1.4	5.6	6	3.8
Source of Market Information	Radio	0	0	0	0
	Friends/Fellow farmers	91.7	92.1	148	91.9
	Traders	8.3	7.9	13	8.1
Mode of Marketing	Regular trade	100	100	200	100
	Contractual arrangement	0	0	0	0

Source; Field Survey, 2015

4.2.2c Traders

Traders in the value chain are those actors who basically ensure the movement of the physical sweet potato from the low part of the value chain to the upper part of the chain. These actors are of three types. These were identified as collectors, wholesalers and retailers.

Collectors/Assemblers

These are traders in assembly markets and/or farm gates who collect sweet potato from farmers in village markets and from farms for the purpose of reselling to wholesalers and retailers. They use their financial resources and their local knowledge to bulk sweet potato from the surrounding area. They play an important role and they do know areas of surplus well. Collectors are the key actors in the sweet potato value chain, responsible for the trading up to 65.5% (Figure 4.1) of sweet potato from production areas to wholesale and retail markets in

the study areas. The trading activities of collectors include buying and assembling at a central point, repacking, sorting/grading, transporting and selling mainly to wholesale markets. The minimum capital requirement needed to be able to engage in the sweet potato value chain as a collector was reported to be GH¢1043.90p. This value seem to be the highest in comparison with the other trader groups (wholesalers and retailers) which is not surprising since their work involves a lot more costs and risks due to their handling of large quantities of sweet potato at a given time. It is therefore not surprising that 20% of collectors (Table 4.9) have their main capital source from financial institutions. Post-harvest losses per trip of sweet potato delivered to either wholesale or retail market was reported to be 131.89kg. On the average, collectors undertake a trip per week usually a day-or-two to market days of the respective districts and sometimes districts outside the region of survey with an average volume of 1362.5kg (ie. 12.5bags) handled.

Wholesalers

Wholesalers are mainly involved in buying sweet potato from collectors and producers in larger volumes than any other actor and supply them to retailers, processors and consumers. They also store produce, usually for a maximum of four (4) days. Survey result indicates that wholesale markets are the main assembly centers for sweet potato in their respective surrounding areas where collectors from producing areas deliver the produce. They have better storage, transport and communication access than other traders. Almost all wholesalers have a warehouse in a market either self- owned or used on rental basis. The study also revealed that a wholesaler in the sweet potato value chain will require a minimum capital of GH¢1325.00p due to the considerably large volumes handled. Post-harvest losses are also experienced by wholesalers with an average of 68.13kg for every 904.70kg handled per week (trip). From Table 4.9, it was realized that 16% of the wholesalers have their main source of capital as financial institutions partly owing to the relatively high minimum capital requirement.

Retailers

Retailer involvement in the chain includes buying of sweet potato, transport to retail shops, grading, displaying and selling to processors and final consumers. Retailers are key actors in sweet potato value chain in the study areas. They are the last trader link between producers and consumers. They mostly buy from wholesalers and sell to urban processors and consumers. Sometimes they could also directly acquire volumes from the producers (1.5%) and collectors (18%) as seen in figure 4.1. Consumers and processors usually buy the produce from retailers

as they offer according to requirement and purchasing power of the buyers mostly through negotiations (36.4%) as seen in Table 4.9 below. Retailers can be divided into urban and rural in the case of sweet potato in Ghana because the crop is not traded on a large scale at this level of the chain. Rural retailers are based in village markets and mainly purchase sweet potato from farmers, and sell to consumers and sometimes urban retailers. Urban retailers purchase from framers who send their produce to urban markets, wholesalers and rural retailers in village market and sell to urban processors and consumers. Retailers are however seen to have a longer cycle in terms of turnover period than wholesalers since they have to depend mainly on unpredictable demand from consumers and thus tend to keep produce for longer periods. It was also realized that, for a typical cycle by retailers which is also on weekly basis, an average quantity of 36.41kg of sweet potato is lost for every 218kg transacted. Notwithstanding, it can be realized that a minimum capital of GH¢358.79p is required on the average for one to participate in the sweet potato value chain as a retailer. Considering the low capital requirement at this level, it was therefore not surprising that all (100%) of retailers financed their activities from their own resources without the use of borrowed funds of any sort. Processors and consumers mainly look out for availability as the major criteria for purchasing sweet potato from retailers since the sweet nature of the crop (all varieties) makes it a delicacy for consumers.

Table 4.9 Sweet Potato Handling Issues by Traders

Variables	Items	Retailers (n=33)		Wholesalers (n=38)		Collectors (n=29)		Total (N=100)	
		Freq	%	Freq	%	Freq	%	Freq	%
Main Capital Source	Own Equity	33	100	32	84	20	70	85	85
	Financial institutions	0	0	6	16	9	20	15	15
Access to Credit	Yes	5	15	10	26	8	28	23	23
	No	28	85	28	74	21	72	77	77
Barriers to Entry	Yes	5	15	10	26	9	31	24	24
	No	28	85	28	74	20	69	76	76
How SP Price is Determined	Trader determines price	9	27.2	6	15.8	6	20.7	21	21
	Parties Negotiate	12	36.4	23	60.5	16	55.2	51	51

	Based on Prevailing market price	12	36.4	9	23.7	7	24.1	28	28

Source; Field Survey, 2015

4.2.2d Processors

Processors in the value chain are very vital due to the role in changing the physical form of the produce whilst improving the shelf life of the crop. Processors of the sweet potato value chain in the study were found to mainly perform two type of value addition. The first activity performed is the addition of value to the produce itself in the form of storing, packaging (produce) and transporting the produce to the processing site. The second phase of value addition includes peeling, washing, frying and packaging (product) to consumers in such convenient ready-to-eat form. Processors mainly obtained sweet potato from retailers. The study revealed that, the minimum capital requirement for processors in the sweet potato value is GH¢416.25p and GH¢261.00p for processors in the Fanteakwa and West Mamprusi districts respectively. Items/equipment identified by processors which they used in undertaking their processing activity were tables, chairs, basins, sieve, utensils, bowls, frying pan and sacs. Processors are seen as price takers in the value chain since they would mostly enquire from markets around them to make a choice of which price will help in the maximization of their profit after processing. Therefore access to price information from different markets is a vital determinant of the point of purchase for sweet potato for processing. All (100%) processors in the West Mamprusi district had access to price information which is as a result of the close nature of markets as compared to that of the Fanteakwa district where markets are sparsely distributed. It is therefore not surprising that only 25% of processors in the Fanteakwa district had access to price information in other markets. They mainly relied on the nearest market for all their supplies. Processors mainly change the form of sweet potato (produce) into a convenient/ready-to-eat product and which activity has the purpose of a target market which is mostly location specific. Processors will fix both price and size of the product (fried) taking into consideration the income and age category of their target customers/consumers. Majority (80%) of processors in the West

Mamprusi district targeted those of the lower income group and so sold a unit of their product (fried) at GH¢0.10p as opposed to the Fanteakwa district where processors had no particular target income group for their product. A unit of product (fried) was sold at GH¢0.20p in the Fanteakwa district. Majority (61%) of processors targeted consumers who are less than twenty

(<20) years who are mainly students in the Junior and Senior high schools whilst 26% of processors targeted consumer aged between 21 and 30. This is an indication of the quest for sweet foods by these age groups.

Table 4.10 Price Information, Access and Consumer Target Group of Processors

Variables		Fanteakwa (n=40)		West Mamprusi(n=40)		Total (N=80)	
		Freq	%	Freq	%	Freq	%
Access to SP Price Information	Yes	10	25	40	100	50	62.5
	No	30	75	0	0	30	37.5
Target Consumer Income Group	Low income	10	25	32	80	42	52.5
	Middle income	0	0	6	15	6	7.5
	No particular income group	30	75	2	5	32	40
Target consumer age group	<20	27	67.5	22	55	49	61
	21-30	9	22.5	12	30	21	26
	31-40	2	5	3	7.5	5	6.5
	No particular age group	2	5	3	7.5	5	6.5

Source; Field Survey, 2015

4.2.2e Supporting actors

The provision of services such as training and extension, information, financial and research services are the reserve of these supporting actors. Access to information or knowledge, technology and finance determines the state of success of value chain actors (Martin *et al*., 2007). These supporting service providers in the sweet potato value chain were seen as MoFA, private input dealers, NGOS, FIs and RIs. Although co-operative societies are present in some communities, they mainly perform a facilitating role of mobilizing farmers for such services to be provided by the aforementioned institutions.

Training and Extension Services

Most of the trainings given were at the producer level of the chain and these trainings were mainly undertaken by MoFA through their AEAs in the various communities based on research activities conducted by both RIs and universities. Training was mostly on agronomic practices such as vine multiplication, fertilizer application, crop management, harvesting and post-harvest handling and marketing. These trainings are easily accessible by farmers who have

extension contacts on sweet potato in the study areas. Although training on agrochemical usage was occasionally given, the main source of such information and knowledge on usage of specific agro-chemicals was the agro-input dealers. Input price availability and price information was mainly obtained through fellow farmers particularly those of the same co-operative/association since such information is mostly shared when they call their meetings. Training services for the traders and processors was seen to be non-existent. This was mainly due to the sparsely distributed nature of these actors with very few of them being members of associations which could play such facilitating roles for training agencies (Universities, RIs and MoFA) to undertake such activities. With the few associations present, it was observed that they have weak structures since meetings were not promptly organized but for emergencies (eg. funerals and marriage ceremonies).

4.2.3. Governance of the Sweet Potato Value Chain

The facilitation role of value chain is performed mainly by dominant actors. This is done mainly through the movement of the commodities and pricing setting mechanism. They basically set the mode of operation and rules of marketing of the chain for which every chain actor subscribe. The study results indicate that the collectors and wholesalers supported by the producers are the main value chain governors. Markets (Walewale, Agomanya, Ehiamankyene and Achiaman) are heavily dependent on collectors, and therefore the sweet potato value chain is heavy dependent on the volumes supplied to these markets. In most instances, the level of relationship among the key actors is of free market exchange and not coordinated since all actors market their produce by the spot trade system. As a result of the proper information flow and ultimately the minimal bargaining power, farmers are left with very little options than to set their produce at the farm level particularly due to the high perishability of the crop coupled with poor storage systems. Actors along the sweet potato value chain mainly depend on the collectors for price fixation although final price determination is sometimes done through negotiations between the parties involved. Vertical linkage between value chain actors was virtually non-existent due to the mistrust among the actors leading virtually to no contractual arrangement along the chain but there is horizontal linkage between traders of the same type (ie. collectors linking up with fellow collectors in terms procurement and transportation and so on). In some cases, failure of either producers or traders to meet predetermined conditions and commitments results in conflicts.

Generally, the sweet potato value chain is one that is characterized with a governance structure which is buyer driven with little-to-no trust between chain actors. Whilst farmers blame traders for offering very low prices for their produce, traders also blame farmers for not providing adequate produce with the right specifications. Farmers are mainly smallholders and are not very organized when it comes to marketing of their produce and do not govern the value chain. Due to the fear of recording huge post-harvest losses, producers are price takers and hardly negotiate for improved prices. The governance structure of the sweet potato value chain was observed to be similar across the two districts.

4.3 Risk Identification and Risk Management Strategies Adopted by Actors.

Howell and Hazzard (2012) maintained that for proper decision in managing risk, one has to start with identifying the most crucial risks the actors face. Decisions could be made to deal with risk at both the individual (actor) level or cumulatively at the different stages of the chain depending on the kind of risks faced. This study however concentrated on idiosyncratic risk which is the risk at the individual actor level rather than systemic risk which has a covariate effect on all actors mostly to the same degree/extent. Top Five (5) risks with the highest mean ranks were therefore taken as the most important risks identified at that level.

4.3.1 Risk Identification at the Producer Level.

Risks at the producer level have been identified to be in two folds. The producer is faced with production risk stemming from unpredictable weather, pest and diseases which ultimately have an impact on the level of output realized from a particular season. Market (price) risk results from variation/fluctuation in prices of both inputs and output. Table 4.11 presents the various risks identified at the production level in order of severity as predicted by the mean scores of the ranks assigned by producers.

From the results, it was realized the first most important risk faced by producers was sudden changes in the output price of sweet potato mainly owing to the uncertain nature of the market in terms of demand at the time of sale. With a mean score of 1.09 from the pooled sample, farmers in both districts consider output price variability as the most important risk to sweet potato production. Sudden changes in output level came second in terms of importance to producers mainly due to the uncontrollable nature of the weather and other production variables. Whist farmers in the West Mamprusi district regarded output level variability as the second most important risk (1.30), farmers in the Fanteakwa district saw output level variability

as the third most important risk (1.13). This may be due to the comparably stable nature of weather conditions (mainly rains) in the South than in the Northern sector of the country.

Pest and disease related risk was identified to be the third most important risk faced by farmers. Sweet potato suffers from pests and disease attack on the field and after harvest. The mean score for pest and disease related risk was recorded as 1.25. Whereas pest and disease risk was ranked as the second most important risk in the Fanteakwa district, it came as the third most important risk farmers faced in the West Mamprusi district.

Table 4.11 Risks Faced by Sweet Potato Producers

Risks	Fanteakwa (N=100)		West Mamprusi (N=100)		Total(N=200)	
	Mean Rank*	Std. Dev	Mean Rank	Std. Dev	Mean Rank	Std. Dev
Sudden changes in output price	1.07	0.25643	1.11	0.3144	1.09	0.2869
Sudden change in output	1.19	0.39428	1.3	0.48	1.24	0.44267
Pest and disease risk	1.17	0.37753	1.34	0.49	1.25	0.44831
Sudden change in demand	1.36	0.48242	1.34	0.47	1.35	0.47817
Sudden change in input price	1.41	0.51434	1.6	0.5685	1.5	0.54907
Prolonged decline in output price	4.32	0.61759	4.26	0.6608	4.29	0.6387
Transport failure	4.4	0.71067	4.23	0.71	4.31	0.71296
Sudden change in wage rate	4.38	0.72167	4.58	0.5537	4.48	0.64939
Transport cost fluctuation	4.59	0.72607	4.39	0.6947	4.49	0.71586
Risk of fire outbreak	4.74	0.44084	4.63	0.5	4.68	0.47635

Ranking scale; 1=strongly agree; 2=agree; 3=neutral; 4=disagree; 5=strongly disagree.

Source; Field Survey, 2015

Farmers from the survey also identified changes in the demand of traders as the fourth most important risk that affect their enterprise since the main role of the producers in the value chain is to cultivate sweet potato for onward supply to traders. Demand changes and its sudden nature have the potential of affecting incomes and effective planning of producers in terms of what quantities to produce and when to harvest. From the pooled sample, it was realized that sudden changes in demand by traders was assigned a mean score of 1.35. Both districts however, ranked this risk as their fourth most important risk. Sudden change in input price was the fifth most important risk rank by farmers with mean rank of 1.50. Generally, farmers in the two districts disagreed that prolonged decline in output price, transport failure, sudden changes in wage (labour cost) rate, transport cost fluctuation and risk of fire outbreak are important risk at the production level.

4.3.1.1 Risk Management Strategies Adopted by Producers.

Producers have a number of options in terms of tools for managing the impact of risk since its occurrence can hardly be avoided. After the identification of the most important risks faced by farmers, the next stage was to find out how these risks are being managed by individual farmers at their levels. Table 4.12 below spells out the risk management strategies adopted by farmers for the identified risks.

Output price variability which was top on the list of risks identified, farmers had three (3) main risk management strategies which they mostly choose from. From the results, majority (65%) of farmers used crop diversification as their main tool to deal with the variations in prices of their output. Farmers used this tool mainly because of the impact of such fluctuations on their farm budget. The main crop enterprises farmers diversify into include yam, cocoyam and cereals (such as rice and maize). In the case of unexpected decline in price especially from the sales of sweet potato, the other crops which they cultivate would provide a cushion for their farm income. Also, about 12% of farmers indicated that expansion of their production was their main strategy or means of mitigating the impact of output price variations. In the case of an unexpected decline in the price of the commodity, total expected income from the sale of sweet potato would not be seriously hit since his total output would be high. This was however the case for farmers who had the luxury of having large acreages of land who could easily vary their land size based on anticipated low price in the coming season. Marketing of produce through different channels was also an option for farmers since these markets usually have their own established prices for the produce at various times of the season and so farmers tend to vary the kind of traders they sell to. About 23% of farmers reported that they adopt such a strategy although they admit a fair knowledge of the prices in the various markets may be essential.

With the variation in output levels obtained by farmers, it was realized from the study that 44% of farmers followed recommended agronomic practices to mitigate its impact. These recommended agronomic practices followed were practically shown them through field trials and demonstration farms by AEAs. These practices such as periods/times of weeding, pesticide application, maturity period for harvest, farm sanitation, etc. if followed are able to reduce this uncertainty so that the levels of output received is stable and close to the actuals expected by farmers. Also expansion of farm size was a tool that was used by about 36% of farmers to off-set such uncertainty at harvest. With this tool the farmer can be assured of a minimum, output

all other things being equal. The study also revealed that pest and disease related risk at the production level of the value chain was mainly dealt with by employing two management tools. Whilst majority (75%) of farmers from the study indicated their reliance on the use of resistant varieties to mitigate the impact of this risk, 25% of the farmers indicated that planting of pest and disease resistant varieties alone could not effectively deal with this risk; thus the adoption of recommended practices. Farm sanitation, if not properly checked could lead to pest and disease infestation although resistant varieties may have been planted.

Table 4.12 Risk Management Strategy for Identified Risk at Production Level

Risk	Risk Management Tool	Fanteakwa (n=100)	West Mamprusi (n=100)	Pooled (N=200)	
		%	%	Freq	%
Sudden Changes in Output Price	Diversification	62	69	131	65.5
	Expansion of Production	11	12	23	11.5
	Marketing through multiple Channels	27	19	46	23
Sudden Changes in Output Level	Follow recommended practices	44	44	88	44
	Expand production	38	35	73	36.5
	Plant resistant Varieties	18	21	39	19.5
Pest and Disease Risk	Follow recommended practices	28	22	50	25
	Plant resistant Varieties	72	78	150	75
Sudden Changes in Demand of Traders	Marketing through multiple Channels	100	100	200	100
Sudden Changes in input price	Follow recommended practices	28	22	50	25
	Plant resistant Varieties	72	78	150	75

Source; Field Survey, 2015

In dealing with the risk associated with sudden changes in demand by traders it was unanimous among all (100%) farmers that marketing through multiple channels is the most effective management strategy. Farmers have limited options since they do not go into production/marketing contract with traders and processors (mostly customers).

The fifth most important risk identified by farmers was the sudden changes in input price. This risk left farmers with two main options of either following recommended agronomic practices or relying on the use of resistant varieties. Due to the perishable nature of the crop and the fact that its sweet tubers attract pest which destroys the crops in the long run, majority (75%) of farmers plant resistant varieties so as not to rely so much on chemical inputs (particularly pesticides) since that is subject to the risk of input price variability. Notwithstanding, some

(25%) of farmers used recommended practices and not just relying on the planting of resistant varieties.

4.3.2 Risk Identification at the Trader Level.

Unlike producers who are faced with two main types of risk (production and market), traders are mainly faced with risks which are related to the price of the produce they handle. Notwithstanding, they may also be faced with the risk of variation in the quantity of sweet potato obtained from producers at a time. Table 4.13 shows the various risks faced by traders in sweet potato value chain as identified by them.

From the study it was realized that sudden changes in the produce price was the most important risk faced by traders with a mean score of 1.13. This is caused mainly by the imperfect knowledge of the demand and supply situation on the market since markets can be choked or deficient with sweet potato at any time which the trader may not readily anticipate. It was therefore not surprising that the second most important risk identified by traders was the sudden changes in the final consumer demand. This recorded a mean score of 1.36 (pooled) with both districts being unanimous about this risk.

The study also revealed that, the third most important risk faced by traders in the sweet potato value chain was post-harvest (losses) related risk which recorded a mean score of 1.5. Whilst, traders in the Fanteakwa district ranked the risk of post-harvest loss as fourth most important, traders in the West Mamprusi district rated it as the third most important. This was however not surprising since sweet potato in the West Mamprusi district is produced with heavy fertilizer application due to poor soil nature. This increases the rate of deterioration of root and tuber crops in general. This is coupled with the fact that traders would have to handle and move the produce for a considerable long period of time after harvest. Also, with a mean score of 1.52, sudden changes in produce/supply level was identified to be the fourth most important risk at the trader level. Whereas a sudden change in produce/supply level was ranked third by traders in the Fanteakwa district, it was ranked fourth by farmers in the West Mamprusi district. Finally, the fifth most important risk identified by traders was sudden changes in marketing cost with a mean score of 1.55.

Table 4.13 Risk Faced by Sweet Potato Traders

Risks	Fanteakwa (n=50)	West Mamprusi (n=50)	Pooled (N= 100)

	Mean Rank*	Std. Dev.	Mean Rank	Std. Dev.	Mean Rank	Std. Dev.
Sudden changes in produce prices	1.18	0.38809	1.08	0.27405	1.13	0.338
Sudden changes in final consumer demand	1.48	0.50467	1.24	0.47638	1.36	0.50292
Post-harvest related risk	1.62	1.04764	1.38	0.49031	1.5	0.82266
Changes in Output Level	1.4	0.49487	1.64	0.48487	1.52	0.50212
Sudden changes in marketing cost	1.7	0.8391	1.4	0.49487	1.55	0.70173
Transport failure	3.76	1.23817	4.1	0.8391	3.93	1.06605
Prolonged decline in commodity purchase price	4.24	0.65652	4.3	0.46291	4.27	0.56595
Sudden changes transport cost	4.52	0.57994	4.56	0.50143	4.54	0.53973
Sudden changes in wage rate	4.58	0.49857	4.74	0.44309	4.66	0.4761

Ranking scale; 1=strongly agree; 2=agree; 3=neutral; 4=disagree; 5=strongly disagree.

Source; Field Survey, 2015

4.3.2.1 Risk Management Strategy Adopted by Traders.

Traders also use a number of risk management strategies in dealing with the risk they are faced with. Table 4.14 below presents the various risk management strategies adopted by traders. The most important risk identified by traders was sudden changes in the produce price. Traders identified three (3) main management strategies in dealing with produce price risk. With the varying prices in different markets, majority (35%) of traders marketed through different markets by monitoring the prices in markets available so that whenever a particular market experiences unexpected change in the price which may not inure to their benefit, the trader then decides to send the produce to preferable market. Notwithstanding, 34% of traders indicated the use of diversification as a mitigating tool for price risk. Since sweet potato traders mostly trade in more than one commodity, quantities traded at a time for the different commodities depended on the variation between the expected price and the actual price of the commodity at the time of purchase. Traders' maintenance of flexibility in terms of their supplies was not left out as one of the risk management tools adopted by them since 31% of them used this tool as their main strategy to deal with the risk of produce price variability. Here traders actually make procurements for sale based on a carefully studied market trend of price of sweet potato and supply quantities based on that. Finally, risk of transport failure, prolonged decline in commodity purchase price, sudden changes in transport cost and sudden changes in wage rate were not regarded by traders as major risks they faced.

Table 4.14 Risk Management Strategies Adopted by Sweet Potato Traders

Risk	Risk Management Tool/strategy	Fanteakwa (n=50)	West Mamprusi (n=50)	Pooled(N=100)	
		%	%	Freq	%
Sudden Changes in Produce Price	Maintaining flexibility	40	22	31	31
	Market through multiple channels	30	40	35	35
	Diversification of product lines	30	34	34	34
Sudden Changes in Consumer Demand	Maintaining flexibility	60	44	52	52
	Market through multiple channels	40	48	44	44
	Spread purchase over season	0	8	4	4
Post-Harvest Related Risk (Losses)	Maintaining flexibility	40	30	35	35
	Spread purchase over season	60	70	65	65
Sudden Changes in Output Supply	Maintaining flexibility	52	48	50	50
	Market through multiple channels	16	40	28	28
	Spread sales over season	32	12	22	22
Sudden Changes in Marketing Cost	Maintaining flexibility	52	60	56	56
	Market in group	30	38	34	34
	Spread and sales over the season	18	2	10	10

Source; Field Survey, 2015

Majority (52%) of traders indicated maintaining of flexibility as their main strategy for dealing with the sudden changes in consumer demand. This is where traders monitor closely to know which quantities to bring to the market at a time to ensure a quick turnover whilst 44% of traders traded through multiple channels when consumer demand in a particular market changes unexpectedly. Also post-harvest related risk was the third most important risk that traders identified and with the two main options to dealing with this risk. Most (65%) of traders spread their purchases over the season. Traders buy same quantities on a weekly basis to ensure that they don't handle a lot of sweet potato at a time to incur such unexpected losses from storage. From the study, majority (50%) of traders maintained flexibility to deal with the risk of sudden changes in output level/supply in that the traders seek to monitor the market and supply specific quantities just to meet the said demand based on interactions with producers to know what quantities are available and to make provision for that subsequently.

Finally, with sudden changes in the marketing cost of traders, majority (56%) of them maintained flexibility to reduce cost since every procurement is specifically done and all the cost properly catered for before the initiative is taken. It is worth noting however that 34% of

traders mitigated this risk by marketing in groups. Here traders will go to production centers in groups and bearing an overall total cost and subsequently sharing the cost based on quantities procured. Although it is also a cost reduction technique, it is also seen by traders as a good tool used to off-set marketing cost in case of unexpected changes in the marketing cost since the change is born by the entire group.

4.3.3 Risk Identification at the Processor Level.

Since processors are at the final stage where sweet potato is handled before it gets to the final consumer in the value chain and mainly in a more convenient form, risks at the producer and trader levels have some ripple effects at the processor level. Tables 4.15 and 4.16 present the various risks identified and the risk management tools adopted by processors along the sweet potato value chain respectively. Four risks were identified to be pertinent at this level of the chain. Produce price variability was identified by processors as the most important risk with a mean score of 1.21. This is not surprising since this risk has been the most important risk from the producer and trader levels and so its ripple effect will also be felt at the final stage of transaction where majority of the produce is expected to be transformed for consumer utilization. Sudden changes in consumer demand was the second most important risk identified by processors recording a mean score of 1.21 from the pooled sample. This was due to the difficult and dynamic nature of consumers whose taste and preference can change at any given period but may be seldom anticipated by the processor.

Also, from the study, sudden change in the level of supply was identified as the third most important risk with a mean score of 1.29. Whereas the West Mamprusi district ranked this risk as the third most important risk, processors in the Fanteakwa district ranked this as the first most important risk they are faced with.

The fourth most important risk identified by processors in the sweet potato value chain was post-harvest related risk which was not really surprising since processing has a basic function of improving the shelf life of most commodities (including sweet potato). Post-harvest losses (rotten tubers) risk obtained a mean score of 1.43. It is however worth noting that processors from the two districts generally disagreed that transport failure, prolonged decline in product price and sudden changes in transport cost are major risks faced in the sweet potato processing stage of the value chain.

Table 4.15 Risk Faced by Sweet Potato Processors

Risks	Fanteakwa (n=40)		West Mamprusi (n=40)		Pooled (N=80)	
	Mean Rank*	Std. Dev.	Mean Rank	Std. Dev.	Mean Rank	Std. Dev.
Sudden changes in produce prices	1.25	0.43853	1.175	0.38481	1.2125	0.41166
Sudden changes final consumer demand	1.25	0.43853	1.175	0.38481	1.2125	0.41166
Sudden Changes in Supply levels	1.2	0.4051	1.375	0.49029	1.2875	0.45545
Post-Harvest related risk	1.25	0.43853	1.625	0.49029	1.4375	0.49921
Transport failure	4.35	0.69982	4.15	0.36162	4.25	0.56254
Prolonged decline in output prices	4.725	0.4522	4.325	0.47434	4.525	0.50253
Sudden changes transport cost	4.475	0.64001	4.575	0.50064	4.525	0.57313

Ranking scale; 1=strongly agree; 2=agree; 3=neutral; 4=disagree; 5=strongly disagree. Source; Field Survey, 2015

Notwithstanding the aforementioned risk as identified by processors, they adopt strategies to mitigate their impact or completely prevent their occurrence. Table 4.16 presents the results of the survey regarding the main strategies adopted by processors to deal with risks. It was realized from the study that majority (50%) of processors adopted product diversification as their main risk management tool to deal with the sudden change in the price of sweet potato which is their primary input. This is because, most of them processed more than one commodity at a time and so tend to consolidate quantities procured with price volatility of their produce on the market. However, about 58% of processors in the West Mamprusi district preferred the maintenance of flexibility of purchases since most of them mainly process only sweet potato during the season.

With regards to the sudden changes in consumer demand, majority (64%) of processors preferred to maintain flexibility in their purchases to mitigate its impact compared to the other risk management tools. It was therefore not surprising when majority (64%) of processors used the same tool in dealing with the variations in supply levels. Maintaining flexibility requires a considerable level of knowledge of the customer demand levels and also the quantities available on the market to be able to meet such demands and incur minimum losses.

Table 4.16 Risk Management Strategy for Identified Risk at Processor Level

Risk	Risk Management Tool	Fanteakwa (n=40)	West Mamprusi (n=40)	Pooled(N=80)	
		%	%	Freq	%
Sudden Changes in Produce Price	Maintaining flexibility	25	57.5	33	41
	Market through multiple channels	7.5	10	7	9

	Diversification	67.5	32.5	40	50
Sudden Changes in Consumer Demand	Maintaining flexibility	65	65	52	64
	Use of different sales point	5	30	14	18
	Diversification	30	5	14	18
Sudden Changes in Supply levels	Maintaining flexibility	65	65	52	64
	Market through multiple channels	5	30	14	18
	Diversification	30	5	25	18
Post-Harvest (rotten losses) Risk	Maintaining flexibility	7.5	32.5	16	20
	Spread purchase over season	92.5	67.5	64	80

Source; Field Survey, 2015

Finally, post-harvest related risk came fourth in terms of its importance as a risk at the processor level of the value chain. In dealing with this risk however, majority (80%) of processors preferred spreading purchase of produce (sweet potato) over the season by buying constant levels at a time which they know they can process effectively without having to store for days to face the risk of losing some proportions by the time processing of that quantity is done.

4.4 Measurement of Risk and the Extent of Predictability

Table 4.20 below presents the measurement of risk taking into consideration the meanvariance, standard deviation and the RVI which is the ultimate decision making rule. Output price risk was seen at all three levels as the risk with the least RVIs which indicates a high level of predictability since this is mainly based on the price from the previous season. The level of predictability was however seen to be high at the trader level of the value chain which is not surprising since traders are comparably abreast with price information than both farmers and processors. Variability in terms of output level was seen at the production level as risk with the highest RVI and by extension the lowest predictability level since output realized from a particular season is dependent on a combination of factors of which weather which is highly unpredictable in this part of the world is a major determinant. This coupled with the fact that Ghana's agriculture is rain fed with very little irrigation activity. With an RVI of 1.685, variation in marketing cost was seen as the risk with the least predictability partly due to various market cost incurred by traders. Related cost elements incurred by the trader such as cost of loading and offloading and cost of inputs (e.g. sacs) are highly unpredictable. Predictability of the various risks identified at the processor level was also calculated with the post-harvest (rotten losses) related risk being the least predictable. This was not surprising since processors

have to keep the produce for a considerably long period of time. As stated by Freshwater and Jette-Nantel (2008), farmers in value chains are faced with both output and price risks whilst the other actors (particularly the upper part) in the value chain are faced with mainly price related risk. This has been seen to be partly the case for the sweet potato value chain; but at the processor level, predictability was least on the post-harvest (rotten losses) related risk compared to other risks identified. The study however confirms the study by Moschini et al. (2001) who stated the possibility of adverse risk being transmitted along crop commodity value chains due to the interconnections between actors and the fact that risk is pervasive with semi-perishable and perishable commodities like.

Table 4.17 Measurement of Risk and the Extent of Predictability

Production Level Risk Measure	Mean	Variance	Std.Dev	RVI
Output Price Risk	64.713	703.44	26.523	0.407
Input Price Risk	110.129	8340.015	91.324	0.829
Output Level Risk	21.09	279.074	16.705	**0.972**
Pest and Disease Related Risk	1.1545	0.614	0.7856	0.678
Trader Level Risk Measure				
Produce Price Risk	97.0247	1353.352	36.787	0.379
Market Cost Risk	797.262	18044971	1343.492	**1.685**
Supply Level Risk	7.678	101.819	10.0905	1.314
Pest and Disease Related Risk	0.792	0.517	0.718	0.907
Final consumer demand risk	7.0616	79.443	8.913	1.262
Processor Level Risk Measure				
Produce Price Risk	82.823	1749.552	41.828	0.505
Supply Level Risk	1.504	8.943	2.991	1.988
Pest and Disease Related Risk	4.5713	639.155	25.282	**5.531**
Final consumer demand	1.1847	0.82	0.9057	0.764

Source; Field Survey, 2015

4.5 Determinants of choices of Risk Management Strategies by Sweet Potato Producers

Multinomial logit models were estimated for analysis. Possible heteroscedasticity and multicolleaniarity problems were not ruled out. The correction of heteroscedasticity was done by the use of the command robust (in Stata). The results indicated that there was no multicolleaniarity problem since the VIF computed is less than 10 for all variables (Appendix Tables 1 and 2) for the production and price models. Table 4.18 below presents the coefficients from multinomial logit regression on the existing alternative risk management strategies for production risk and their respective marginal effects. As stated, the coefficient values measure

the expected change in the logit for a unit change in the corresponding independent variable holding all other variables constant (Green, 2012). The direction of influence of the variable on the logit is also determined by the sign of the said coefficient. It follows that a negative coefficient signifies a reduction in the probability that a sweet potato producer will opt for the alternative relative to the base category and vice versa whilst the magnitude or quantum of the change is discussed in terms of the marginal effects estimated. For instance, a positive estimated coefficient indicates the likelihood of the producers expanding area cultivated or planting resistant varieties to control production (output) risk relative to the use of recommended practices increases as these explanatory variables increase and same relation for the price risk management model. The implication is that the probability of the producers to use these outcomes is greater than the probability of using recommended practices or diversification (the base category) as the risk management strategies and vice versa. Explanatory variables which do not affect producers' choice of any of the base categories (recommended practices or diversification) than the other two categories were seen not to be significantly different from zero. The explanations from the results of the MNL and their respective marginal effect are presented below.

The alternative "Following recommended practices" and "Diversification" were used as base categories (bench mark alternative) for the production (output) and price models respectively. This implies that the discussion of the results focuses on the impact of the explanatory variables on the use of any of the various categories relative to the base categories specified above.

4.5.1 Determinants of Choice of Production (Output) Risk Management Strategy

Table 4.18 presents the determinants of choice of production risk management strategy adopted to mitigate the impact of risk which adversely has an impact on the level of output. The model explained about 18.9% of the variation in risk management strategy among sweet potato producers. The results from the MNL model revealed that income obtained from sweet potato production from the previous season determined the choice of risk management strategy to adopt. However, income from sweet potato production negatively influenced the choice of output risk management tool at a 10% level of significance between making a choice of either selecting resistant variety to mitigate risk or follow recommended practices. With a negative sign of the variable, it implies that, farmers along the sweet potato value chain are less likely to select the use of resistant varieties as a way of mitigating production risk relative to following

recommended practices as prescribed for the cultivation of sweet potato. With a marginal effect of about 0.157, it can be concluded that there is a 16% increased probability of a farmer deciding to choose the use of recommended agronomic practices rather than the other risk management strategies. This confirms the findings by Goodwin (1997) who found a positive relationship between income and the use of recommended agronomic practices.

Table 4.18 Coefficients and Marginal Effects of Multinomial Logit Model for the choice of Production Risk Management Strategy

	Expansion of area			Planting Resistant. Variety			Expansion of area			Planting Resistant. Variety		
Variables	Coef	Robust std. Err.	Z	Coef	Robust std. Err.	Z	dy/dx	Robust std. Err.	Z	dy/dx	Robust std. Err.	Z
Income_Sp (GH₵)	-0.169	0.292	-0.58	-1.125*	0.519	-2.17	0.0371	0.0721	0.51	-0.157	0.0721	-2.17
FmSZ	**0.599*** **	0.209	2.86	**0.576*** **	0.221	2.61	**0.1005**	0.0406	2.47	**0.0458**	0.0264	1.74
Amount_Saved	**-0.141***	0.0761	-1.85	0.0503	0.0951	0.53	**-0.363**	0.171	-2.12	0.172	0.132	1.3
Credit	**-1.721***	0.902	-1.91	-0.541	0.959	-0.56	**-0.366**	0.174	-2.1	0.0665	0.102	0.65
FmExp	**-1.274***	0.742	-1.72	0.336	0.722	0.46	**-0.269**	0.108	-2.48	0.136	0.132	1.03
Output(previous season)	**0.283*** **	0.0807	3.51	0.129	0.0999	1.29	**0.0572**	0.0173	3.31	0.000111	0.0137	0.01
Extsn	**-1.134****	0.457	-2.48	-0.0189	0.493	-0.04	**-0.260**	0.0957	-2.72	0.0734	0.0662	1.11
Off-farm_Inc	0.478	0.966	0.49	**1.996***	1.0276	1.94	-0.043	0.199	-0.21	**0.288**	0.162	1.78
Yrs_Schooling	-0.0528	0.123	-0.43	**-0.216***	0.131	-1.65	-0.0269	0.0266	-1.01	**-0.0359**	0.0182	-1.98
MktInfo(1=access; 0=otherwise)	0.369	1.598	0.23	**-3.0591***	1.76	-1.74	-0.147	0.306	-0.48	**-0.464**	0.257	-1.8
Age	**-0.0283***	0.0165	-1.7	0.0052	0.0169	0.31	**-0.006**	0.00361	-1.92	0.00270	0.00239	1.13
Sex(1=male; 0=female)	-0.529	0.524	-1.01	-0.179	0.602	-0.3	-0.114	0.117	-0.97	0.0119	0.0801	0.15
Constant	0.92	1.881	0.49	-4.454	1.993	-2.24						

*NB: Following of recommended practices is the base outcome. dy/dx is marginal effect. N=200, LR $\chi 2$ = 69.68***, Pseudo R^2=0. 189. Log likelihood = -149.462. ***, **and * are statistical significant levels at 1%, 5% and 10%, respectively.*

Source; Field Survey, 2015

Also, there was a significant positive effect between farm size and the choice of both expansion of area cultivated and the planting of resistant varieties at a 1% significance level. This implies that sweet potato farmers are less likely to use recommended agronomic practices compared to the two risk management strategies stated above. This may be the case since farmers with access to large acreages of farm tend to plant a lot of the crop just to create room for possible or anticipated losses (Mishra et al., 2004). Amount saved from previous season's sales was also seen to negatively influence the choice of expanding area cultivated. Farmers are less likely to expand the acreage cultivated relative to following recommended agronomic practices as a risk management tool. Farmers who saved some funds from previous sales are able to have enough capital base to finance their production activities. As seen from the marginal effect for the variable estimated, there is a 36% increased likelihood of farmers following recommended agronomic practices relative to the use of the other production risk management strategy. This is in conformity with the studies done by Harris and Weiss (1984) who found that amount saved from previous year's good returns was critical in the financing of risk since risk management comes with cost. It was therefore not surprising that credit obtained for sweet potato production also affected negatively the choice of risk management strategy selected. Farmers who have other sources of funding their farm activities rather than from their own saving also have the ability to finance the use of recommended practices. There is a less likelihood of farmers who have enough credit to select planting of resistant varieties as an output risk management strategy relative to the choice of using recommended practices since it comes with additional cost. This variable was significantly different from zero at a 10% level. This was also reflective in the marginal effect generated since it was realized that there is 36.6% reduced probability of a farmer selecting the choice of planting resistant variety relative to recommended agronomic practices as a risk management strategy. Years of sweet potato farming experience was also negatively significant at a 10% level of significance for the choice of risk management strategy adopted. This follows the argument that experienced farmers may have tried a number of systems and come to a firm conclusion on the benefits derived from the system of assured output levels. Therefore an observed 30% increase in the probability of farmers adopting recommended agronomic practices as risk management strategy for dealing with production as shown in the estimates of the marginal effect. Observed output of sweet potato from the previous season was seen to positively influence the choice of risk management strategy at a 1% level of significance. Relative to the use of recommended agronomic practices, farmers are more likely to select the expansion of acreage as a risk management strategy. As

output increases, farmers are more likely to increase their acreage of cultivation in anticipation of a much higher output in the preceding season. From the marginal effect estimated, it was realized that rise in the output will lead to about 6% increased probability of a farmer choosing to expand the area of cultivation relative to the adoption of recommended agronomic practices. Access to extension contact was also negatively significant at a 5% level. Access to extension services increases farmers' access to new and recommended agronomic practices for sweet potato production which helps farmers deal with the risk of varying output levels. Ayelech (2011) noted this same relation with fruit producers when he observed a positive relationship between extension contact and new technological adoption and managerial skills. With a marginal effect estimated, it can be concluded that increased number of extension contacts will result in 26% increase in the likelihood of farmers choosing to use recommended practices as a risk management strategy relative to expansion of acreage. Age of farmers was also significantly different from zero at a 10% level and this difference was negatively correlated with the choice of risk management strategy adopted. This is not very surprising since young farmers are mostly resource constrained particularly when it comes to the ownership of land for them to rely on the expansion of area as their main risk management strategy to deal with production risk. Davis *et al*. (2008) however found that farmers who were young had high aspirations and were willing to participate actively in adopting recommended agricultural practices/techniques. However, Emah (1995) stated the contrary arguing that older farmers are less likely to adopt recommended practices since they mostly relied on the experience over the period. Years of schooling by farmers was also observed from the model to be significantly different from zero at a 10% level. Off-farm income was also seen from the model to positively influence the choice of relying on resistant sweet potato variety relative to the use of recommended agronomic practices. Farmers who have other sources of income rather than farming tend to divide their time and labour between farming and these other sources such as construction work, artisanal work, trading, formal salaried work etc. As a result of that, they are unable to keenly follow and rely on recommended agronomic practices in dealing with output risk. This however goes contrary to assertions made by Mishra and Goodwin (1997) that off-farm income increase the financial ability of the farmer and so makes him more probable to follow recommended agronomic practices since it comes with additional cost. Therefore an increase in off-farm income will lead to a 28% increased likelihood of adopting the use of resistant varieties relative to the use of recommended agronomic practices. However, it is worth noting that increase in years of schooling had a negative significant difference at a

10% level. This is an indication that, with increasing years of schooling; farmers are more likely to adopt the use of recommended agronomic practices compared to the reliance of planting of resistant varieties. The model further indicates that with increase years of formal education by farmers, there a 3% likely increase in the choice of recommended agronomic practices as risk management strategy. This is because education enhances the acquisition of information and the adjustment abilities of farmers thereby improving the quality of decision making (Fakoya et al., 2007). It was also realized from the study that access to market information negatively influenced the choice of resistant varieties relative to that of following recommended agronomic practices. With a marginal effect of 46%, it means that an increase in market information access will lead to a 46% increase in the probability of a farmer deciding to choose the use of recommended agronomic practices relative to planting resistant varieties. This is because farmers with access to market information are able to easily predict the quantities of output to get from the said acreage he is cultivated since these recommended practices are mostly tried and tested through field trial and demonstration field.

4.5.2 Determinants of Choice of Price Risk Management Strategy

After the determinants of the choice of production risk management strategy adopted by farmers, a MNL model was run once again to identify the determinants of price risk management strategies adopted by farmers along the sweet potato value chain. Table 4.19 below presents the model estimates for the coefficients and marginal effects for the model with crop diversification as the base category. Average output from the previous season's production significantly affected the choice of price risk management strategy adopted.

Output from the previous season's production was positively correlated to the choice of selecting marketing through multiple channels whilst a negative sign was recorded for the choice to expand production at a 5% and 10% level of significance respectively. This implies that with increasing output, from previous seasons; farmers are more likely to sell their produce through multiple channels relative to the use of diversification as a price risk management strategy whilst they would be more likely to adopt diversify their crop enterprise relative to expanding their production in other to harvest more produce just to create some room from unanticipated price variation in the coming season, all other things being equal. This therefore implies that with an increase in the average output from previous season, there will be about 4% increase likelihood of farmers selecting to market through multiple channels, whilst

increase output will result in 40% reduction in the probability of farmers choosing to expand production as a price risk management strategy relative to diversification.

Also, farm size had a significant positive influence on the decision of farmers to expand their production at a 5% level. Farmers are therefore more likely to expand production relative to the use of crop diversification as a price risk management tool. Farmers who have the luxury of expanding production through increase in acreages are less likely to avert price risk with the use of diversification (Mishra et al., 2004; White and Irwin, 1972).

Access to extension services was also seen to negatively influence the choice of risk management strategy for both the use of multiple channels and expansion of production at a 10% and 5% level of significance respectively. This is an indication that farmers who have access to extension services are less likely to select either the use of multiple channels or expansion of production relative to the use diversification to avert price risk. Since extension increases the knowledge of farmers on good agricultural practices on diverse crops and their likely market related advantages, farmers who have such access are more likely to diversify their enterprise (Ayelech, 2011). This is therefore not surprising as seen from the marginal effects that increase in extension contacts to farmers will lead to a 7% and 10% reduction in the probability of the choice of multiple channels and expansion of production respectively relative to the use of diversification.

Table 4.19 Coefficients and marginal effects of Multinomial Logit Model for the choice of Price Risk Management Strategy

	Market Through Multiple Channels			Expand Production			Market Through Multiple Channels			Expand Production		
Variables	Coef	Robust std. Err.	Z	Coef	Robust std. Err.	Z	dy/dx	Robust std. Err.	Z	dy/dx	Robust std. Err.	Z
Credit	0.167	0.627	0.27	-1.673	1.785	-0.94	0.0350	0.125	0.28	-0.888	1.210	-0.73
Ave_Output	**0.159****	0.0709	2.26	**-0.517***	0.275	-1.88	**0.0316**	0.0132	2.39	**-0.403**	0.443	-0.91
HHsz	-0.0446	0.0852	-0.52	0.104	0.159	0.65	-0.00875	0.0162	-0.54	0.000838	0.00145	0.58
FmSZ	-0.492	0.431	-1.14	**1.781****	0.764	2.33	-0.0976	0.0796	-1.23	**0.0138**	0.0158	0.88
BuyerType	-0.678	0.624	-1.09	0.718	1.503	0.48	-0.133	0.122	-1.09	0.00629	0.0115	0.55
Extsn_Contact	**-0.381***	0.212	-1.8	**-1.518****	0.755	-2.01	**-0.0702**	0.0404	-1.73	**-0.103**	0.113	-0.91
Point_Sale	-0.452	0.742	-0.61	-2.574	1.674	-1.54	-0.0782	0.151	-0.52	-0.0384	0.0463	-0.83
FmExp	**-0.0696***	0.0406	-1.72	**-0.188***	0.0898	-2.09	**-0.0129**	0.00767	-1.69	**-0.123**	0.155	-0.79
Amount_saved (GH¢)	-0.117	0.144	-0.81	***0.576**	0.328	1.76	-0.236	0.271	-0.87	**0.0439**	0.0501	0.88
MktInfo_dummy	-0.727	0.878	-0.8	-0.754	1.599	-0.4	-0.153	0.2004	-0.7	-0.0045	0.0169	-0.27
Constant	2.331	1.858	1.25	4.428	3.298	1.34						

*NB: Crop diversification is the base outcome. dy/dx is marginal effect. N=200, LR $\chi 2 = 44.98$***, Pseudo R^2=0. 271. Log likelihood = -60.5083 ***, **and * are statistically significant at 1%, 5% and 10%, respectively.* Source; Field Survey, 2015

Farm experience or years of farming by farmers negatively affect the choice of multiple channel and expansion of production at a 10% level of significance. Farmers are therefore less likely to select the use of multiple channels or expansion of production relative to the use of crop diversification. Highly experienced farmers are more likely to know the trend of sweet potato prices making them more predictive of prices year- after- year and so make provision for the cultivation of other crops they anticipate will have a high and relatively stable price.

This is also in conformity with studies of Ayelech (2011) who found that farmers with longer of farming are anticipated to be more skillful and knowledgeable in the crop enterprise in terms of production and marketing of their produce. It was also realized that, as the years of farming of sweet potato increase, it will lead to 1% and 12% reduction in the choice of either selling through multiple channels or expansion of production respectively relative to the use of diversification as a price risk management strategy.

Finally, amount saved from previous year's profit was also seen to positively influence the choice of expansion of production at a 10% level of significance relative to the use of crop diversification as a price risk management strategy for sweet potato farmers. This is as a result of the fact that, expansion of production comes with additional cost in terms of input (fertilizer, herbicides and pesticides) acquisition which comes with additional and assured output levels in other to be able to produce more to offset the unexpected price change of the produce. This concurs with the assertion made by Harris and Weiss (1984) that farmers finance their risk with the proceeds from previous year's sales. It can therefore be concluded that as amount saved from previous year's profit increases, it will result in a 4% increase in the likelihood of farmers choosing expansion of production as a risk management strategy. The MNL price risk management strategy model explained 27.1% of the variation in the choice of risk management strategy adopted among sweet potato farmers.

4.6 Sweet Potato Value Chain Constraints

The value chains of perishable and semi-perishable commodities like vegetables including sweet potato are reported to be constrained by large post-harvest losses and inefficient value chain management among others (Kumar et al., 2011). These constraints are not just at a particular level but along the entire chain. The study therefore sought to independently identify the various constraints faced by actors along the sweet potato value chain.

4.6.1 Constraints Faced by Sweet Potato Producers

Producers in the value chain are the primary actors in the value chain who basically produce sweet potato and subsequently deliver mainly through sales to the other actors in the value chain. Table 4.21 presents constraints as faced at the production level. Producers identified and agreed to a number of constraints presented to them after they were asked to rank the constraints based on a five point likert scale *(*1=strongly Agree and 5=Strongly Disagree*)*. Generally, high cost of chemical inputs, poor road network, high cost of labour, limited access to credit facilities and high labour requirement for the cultivation of the crop were identified as the five most critical constraints that hinder the effective production of sweet potato. Farmers were however indifferent about their access to land and chemical inputs, unavailability of quality planting material and inadequate storage facilities. Although, there was a weak agreement among the various constraints identified with a Kendall's W value of
0.107, this level of agreement was significant at the 1% level. With a Chronbach's alpha of 0.677, the constraints can be said to be measuring the same construct to about 67.7% in terms of internal consistency. Critical marketing constraints identified by farmers were low commodity price, poor road network and long market distance. However, farmers from the Fantekwa and West Mamprusi districts disagreed entirely that there was low demand for the produce. The relative high demand may be as a result of the low price offered by traders for the produce coupled with the poor/inadequate nature of storage facilities which usually leave farmers with very little options for storage produce for good prices. There was nevertheless little agreement among the marketing constraints of farmers with a Kendall's W value of
0.279 which was significant at a 1% level.

Table 4.20 Critical Constraints of Sweet Potato Producers

Production Constraints*	Fanteakwa (N=100)	West Mamprusi (N=100)	Pooled(N=200)
High cost of chemical inputs	1.61	1.66	**1.64**
Poor road network	1.06	2.35	**1.71**
High cost of labour	1.59	1.89	**1.74**
Limited access to credit facilities	1.29	2.21	**1.75**
High labour requirement	1.78	1.98	**1.88**
High interest rate on credit	1.51	2.27	1.89
High incidence of pest and diseases	2.3	1.59	1.95
Erratic rainfall pattern	2.65	1.63	2.14

Poor/declining soil fertility	2.32	2.14	2.23
High cost of planting material	2.36	2.12	2.24
High weeds infestation	1.99	2.53	2.26
High level of losses	2.71	2.15	2.43
Limited access to extension services	1.71	3.2	2.46
Inadequate storage facilities	2.55	2.5	2.53
Unavailability of quality planting material	2.92	2.62	2.77
Limited access to chemical inputs	2.5	3.03	2.77
Limited access to land	2.64	3.6	3.12
Kendall's W=0.107; Chi-square=341.171; df= 16; Sig. 0.000; Chronbach's alpha = 0.677			
Marketing Constraints*	Fanteakwa (N=100)	West Mamprusi (N=100)	Pooled (N=200)
Low commodity price	1.3	1.84	**1.57**
Poor road network	1.1	2.21	**1.66**
Long market distance	1.67	2.42	**2.045**
Inadequate storage facility	2.26	2.31	2.29
High transport cost	2.53	2.1	2.32
Poor linkage with value chain actors	2.66	2.28	2.47
Inadequate market information	2.04	3.12	2.58
High market toll	3.31	2.93	3.12
Low commodity demand	3.63	3.74	3.69
Kendall's W=0.279; Chi-square=446.473; df=8; Sig. 0.000; Chronbach's alpha = 0.484			

** **Ranking scale: 1=Strongly Agree; 2=Agree; 3=Neutral; 4=Disagree; 5=Strongly Disagree.***

Source; Field Survey, 2015

4.6.2 Constraints Faced by Sweet Potato Traders

Table 4.22 presents the major constraints encountered by traders in the sweet potato value chain. From the study, it was realized that traders identified high transportation cost, inadequate storage facility, high post-harvest losses, poor road network to produce sources and limited capital as the most pressing constraints hampering effective performance of their role along the value chain. However, traders disagreed to the assertion that there was low demand for the produce. These constraints were seen to be measuring the same construct since the Chonbach's alpha value of 0.541 suggests a high level of internal consistency (54.1%). Also, the level of agreement among the constraints was seen to be a weak one since

Kendall's W was estimated at 0.171. Although the level of agreement was observed as weak, it was significant at a 1% level.

Table 4.21: Critical Constraints of Sweet Potato Traders

Constraints*	Fanteakwa (N=50)	West Mamprusi (N=50)	Pooled (N=100)
High transport cost	1.62	1.64	**1.63**
Inadequate storage facility	2.32	1.8	**2.06**
High post-harvest losses	2.52	1.76	**2.14**
Poor road network to produce source	1.94	2.38	**2.16**
Limited working capital	2.02	2.38	**2.20**
Inadequate market information	2.66	1.78	2.22
Long market distances	2.36	2.14	2.25
High market toll/tax	2.42	2.24	2.33
Poor linkage with value chain actors	2.74	1.92	2.33
Low demand for commodity	3.72	4.18	3.95
Kendall's W=0.171 ;Chi-square=154.13; df=8, Sig. 0.000; Chonbach's alpha = 0.541			

* ***Ranking scale: 1=Strongly Agree; 2=Agree; 3=Neutral; 4=Disagree; 5=Strongly Disagree.***

Source; Field Survey, 2015

4.6.3 Constraints Faced by Sweet Potato Processors

Table 4.23 presents the constraints identified by processors along the sweet potato value chain. From the study, limited working capital for business, limited access to credit, high perishability of raw materials, poor storage facilities of products, high processing cost and limited knowledge on products were identified as the most critical constraints facing processors along the sweet potato value chain. However, processors were unanimous in terms of disagreeing with the fact that there was low demand for the products and indifferent in terms of the high nature of market/processing toll or tax they pay to local assemblies. There was a 0.324 level of agreement among processors in their ranking of the constraints as seen from the Kendall's W test which was significant at 1% level. The test of reliability and internal consistency conducted revealed that the constraints were internally consistent with a Chronbach's alpha value of 0.569.

Table 4.22: Critical Constraints of Sweet Potato Processors

Constraints*	Fanteakwa (N=40)	West Mamprusi (N=40)	Pooled (N=80)
Limited working capital for business	1.625	1.10	**1.36**
Limited access to credit	1.875	1.20	**1.54**
High perishability of raw material	1.975	1.425	**1.70**
Poor storage facilities of products	2.2	1.625	**1.91**
High processing cost	2.8	1.20	**2.00**
Poor road network to produce source	2.875	2.025	2.45

High transport cost	2.875	2.10	2.49
Low product price	2.2	2.95	2.58
Inadequate storage facility	3.1	2.825	2.96
High market toll/tax	2.8	3.40	3.10
Low demand for processed product	3.75	3.45	3.60
Kendall's W=0.324 ;Chi-square=284.759 ; df=11; Sig. 0.000; Chronbach's alpha = 0.569			

* ***Ranking scale: 1=Strongly Agree; 2=Agree; 3=Neutral; 4=Disagree; 5=Strongly Disagree.***

Source; Field Survey, 2015

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. Summary and Conclusions

This study analyzed the various risks and constraints along the sweet potato value chain in Ghana using the Fanteakwa and West Mamprusi districts as case study.

Descriptive statistics were employed to summarize the demographic and socio-economic characteristics of actors along the chain and a value chain map was employed to depict the relationships among these actors in the sweet potato value chain. The various risks faced by value chain actors and the respective risk management strategies used in the mitigation of the impact were also examined. The MNL model was employed to determine the critical factors that can be used to predict the choice of risk management strategies by farmers in the sweet potato value chain.

The study revealed that, whereas there was male dominance at the production stage, there was a female dominance at the processing and marketing stages of the sweet potato value chain. Actors along the sweet potato value chain were in the economically active age bracket of between 30 and 50years. With regards to the level of education, chain actors had generally attained basic level or had never been to school.

Majority (54%) of producers in the sweet potato value chain operated on their own lands and recorded an average of output of 25 bags (2725kg) on an average farm size of 2 acres. Value chain actors were found to have limited access to credit. Majority of chain actors (>85%) financed their activities with their own funds. However, less than 30% of actors in the chain were members of producer or trader or processor associations.

The sweet potato value chain map revealed that the main value chain actors are input suppliers, sweet potato producers, collectors/assembers, wholesalers, retailers, processors and consumers. The main supporters of the sweet potato value chain in the study area are MoFA, research institutions, informal credit suppliers and banks (mainly rural banks).

Sweet potato produced was seen to pass through several intermediaries (*i.e.* collectors, wholesalers, processors and retailers) with little value addition in the form of cleaning, packaging, storage and transportation before reaching the end-users. The intermediate buyers

obtain their sweet potato from farmers at lower prices (GH₵80.00 per 109kg) and they sell to consumers at a higher price (GH₵97.00 per 109kg) justifying their cost of adding value to the produce. The main point of value addition is at the processor level as actual transformation of the produce into sliced and fried form. The absence of contract production, functional farmer co-operatives and group marketing in the value chain has made the chain buyer-driven since traders virtually dictate the price of sweet potato even though there is semblance of negotiation with producers. The highly perishable nature of sweet potato further weakens the position of producers during negotiations since delay in sales could lead to high levels of post-harvest losses. Governance in the sweet potato value chain was found to be weak since all the actors transacted business based on spot market arrangement with uneven access to market information which leads to mistrust among trading partners.

From the study, the most important risks identified at the producer level were variability in output price, input price, output level and incidence of pests and diseases. The risk identified with the lowest predictability at the production level was variability in sweet potato output level with an RVI of 0.972. Farmers used adherence to recommended agronomic practices, expansion of area under cultivation or planting of resistant varieties to deal with production risks. On the other hand, output price risk was dealt with by adopting either crop diversification, marketing of produce through different channels or expansion of area under cultivation.

Farm size cultivated, income from sweet potato, amount saved from previous season, use of credit, sweet potato farming experience, output from previous season, access to extension, age, education and off-farm income of producers significantly influence their choice of production risk management strategy. Also, with regards to price risk management strategy, access to extension services, farm size cultivated, years of sweet potato farming experience, output from previous season and amount saved were factors that significantly influenced producers' choice of particular price risk management strategies.

From the study, the crucial risks faced by traders were found to be variability in produce price, market cost, high level of post-harvest losses and inconsistency in produce supply. Among these, the risk with the least predictability was found to be marketing cost with an RVI of 1.685. The main risk management strategies employed by traders to deal with these risks are purchase

of produce based on realistic sales forecast, marketing through different channels and produce diversification.

Variability in produce price, inconsistency in produce supply, post-harvest losses and changes in final consumer demand were the main risks identified at the processor level and the one with the least predictability was post-harvest losses (RVI. 5.531). The main risk management strategies used by processors in dealing with these risks were making purchases based on sales forecast, marketing through different channels and diversification. To deal specifically with post-harvest losses (losses of the tubers after purchase), majority (80%) of processors buy in smaller quantities. This increases transaction cost associated with such multiple purchases and transportation to the processing center.

Constraints identified to be most crucial to the production of sweet potato were high cost of chemical inputs, poor road network to farms, high cost of labour, limited access to credit facilities and high labour requirement. The three (3) most important marketing constraints faced by producers were also identified as; low commodity (sweet potato) price, poor road network to market centers and long distance to markets which translates to high transportation cost.

Also, high transport cost, inadequate storage facilities, high post-harvest losses, poor road network to producing centers and limited capital for sweet potato trading were identified to be the most crucial constraints facing traders in the value chain. Processors were faced mainly with the constraints of limited working capital, limited access to credit, high level of losses, poor storability of products, and high processing cost.

5.2 Recommendations

The following recommendations have been made for policy formulation based on the findings from the study:

I. Actors along the sweet potato value chain should be encouraged to form associations where they are non-existent and strengthen existing ones to give producers in the chain some market power and improve credit access. This will consequently improve the level of coordination along the chain and subsequently reduce risk.

II. Production and marketing contract is one of the most effective ways of reducing the impact of risk along the chain. Efforts should be made to sensitize actors on the importance of contracts so as to encourage them to enter into contractual arrangement to help improve both coordination and minimize risk exposure.

III. Access to extension services was seen as a significant variable in the adoption of recommended practices and crop diversification as production and price risk management strategies. Access to extension services should be improved to help assist farmers in managerial trainings on how to deal effectively with risks at their level.

IV. Improved access to credit at reduced costs (interest) and other financial aid both from governmental and non-governmental agencies should be provided to strengthen the activities of actors along the value chain since limited capital and limited access to credit were common constraints faced by almost all actors.

V. Producers along the sweet potato value chain should be sensitized and encouraged to inculcate the habit of saving some proportion of the profit from particularly good seasons to reduce their level of exposure to risks.

VI. Poor storability and inadequate storage systems were seen to be critical constraints at the upstream of the sweet potato value chain. Research efforts should be geared towards improving the shelf life of the crop through improved storage techniques and development of shelf- stable products from the fresh produce.

VII. It is quite clear that risk along the sweet potato value chain is inimical to the effective functioning of the sweet potato value chain. However, how these risks exactly affect productivity along the chain is yet to be investigated. Further studies should be tailored towards the impact of value chain risks on actor productivity.

REFERENCES

AAFC (Agriculture and Agri-Food Canada), (2004). Value-added agriculture in Canada. Report of the standing senate committee on agriculture and forestry 2004, Agriculture and Agri-Food, Canada.

Abbot, J. and P. Makeham, (1981). Agricultural economics and marketing in the tropics. Wing Tai Cheung Printing Co. Ltd, Rome. 58pp.

Abraham, T. W. (2013). Value chain analysis of vegetables; the case of Habro and Kombolcha Woreda in Oromia region, Ethiopia.

Acharya, S. S. and N.L. Agrawal, (2001). Agricultural Marketing in India, Oxford & IBH

Ahland, R.A. and Y Arshad, (2012). Understanding Components of IT Risks and Enterprise Risk Management.

Aho, N. and D. Kossou, (1997). Précis d"agriculturetropicale. Base etéléments d"application, les éditions du flamboyant, Cotonou. 464p.

Ali J. and Kapoor S. (2008). Farmers' perception on risks in fruits and vegetables production: an empirical study of Uttar Pradesh. *Agricultural Economic Research; 21: 317-332.*

Alimi T., Ayanwale, A.B. (2005). Rrisk and risk management strategies in onion production in Kebbi State of Nigeria. *Journal of Social Science. 10 (1)*

Anandajayasekeram, P. and B. Gebremedhin, (2009). Integrating innovation systems perspective and value chain analysis in agricultural research for development: implications and challenges. Improving Productivity and Market Success (IPMS) of Ethiopian farmers project working paper 16. ILRI (International Livestock Research Institute), Nairobi, Kenya.

Anderson, P., R. P. Lorch (1999).The Role of Agriculture in Poverty Reduction. *Journal of Agriculture and Development.*Vol**6** N°2.

Antle, John J., (1985). Costly Employment Contract Renegotiation and the Labour Mobility of Young Men. *''The American Economic Review''Vol. 75(5)*

Apgar, D. (2007). Risk Intelligence. Harvard Business School Press, 29 (10): 21

Astewel Takele (2010). Analysis of rice profitability and marketing chain: The case of Fogera Woreda, South Gondar Zone, Amhara National Regional State, Ethiopia. M.Sc thesis presented to School of Graduate Studies, Haramaya University. 76p (unpublished).

Ayelech Tadesse (2011). Market chain analysis of fruits for Gomma woreda, Jimma zone, Oromia National Regional State. M.Sc thesis presented to School of Graduate Studies, Haramaya University.p110.

Babaleye, T. (2005), "Can Cassava Solve Africa's Food Crisis?" African Business, 314: 24-25.

Backman, T. and R. Davidson, (1962). Marketing principle. The Ronal Presses Co., New York. pp. 3-24.

Baltenweck I., L. Njoroge, R. Patil, M. Ibrahim and E. Kariuki (2006). Smallholder dairy farmer access to alternative milk market channels in Gujarat. Contributed paper IAAE Conference, Brisbane, Australia.

Bammann, H. (2007). Participatory value chain analysis for improved farmer incomes, employment opportunities and food security. *Pacific Economic Bulletin*, 22, (3):125.

Banque, M. (1997). Status report of poverty in sub- Saharan Africa: incidence and characteristics of poverty.

Baquet, A., R. Hambleton, and D. Jose. (1997). Introduction to risk management. 20p. Risk Management Agency, USDA, Washington, D.C., USA.

Bauer, L., and D. Bushe, (2003). Designing risk management strategies, managing the modern farm business, Third Edition University of Albert.

Berga, S.L., Guzick, D.S. and Winters, S.J. (1993). Increased luteinizing hormone and alphasubmit secretion in women with hyperandrogenic anovulation. J. Clin. Endocrinol. Metab.,77, 895-901.

Bezabah Emana, (2008). Value chain analysis of horticultural crops in Kombolcha districts of eastern Oromia Region, Ethiopia. A study conducted for Action Aid Ethiopia, Addis Ababa.

Bezabah, E. and M. Nugussie (2011). Potato value chain analysis and development in Ethiopia. International Potatoes Center Annual Report 2000 with funding from USAID.

Binswanger, H.E (1980), "Attitudes toward risk: Experimental measurement in rural India", *American Journal of Agricultural Economics 62:395407.*

Binswanger, H.P. (1981), "Attitudes toward risk: Theoretical implications of an experiment in rural India", Economic Journal 91:867-890.

Bongiwe, G. and B. Masuku, (2012). Factors affecting the choice of marketing channel by vegetable

Bowler, I., G. Clark, A. Crockett., B. Ilbery, and A. Shaw, (1996). "The Development of Alternative Farm Enterprises: A Study of Family Labor Farms in Northern Pennines of England."*Journal of Rural Studies"* 12 (3):285-295.

Bröring, S. (2010). Developing Innovation Strategies in Times of Market Convergence. *International Journal of Technology Management, Special Issue on Technology Convergence 49 (1): 272-294.*

Bryceson, K and Kandampully, J. (2004). The balancing act: "E" issues in the Australian agri-industry sector. Proceedings of the McMaster World Congress on the Management of Electronic Business, 14–16 Jan 2004, Hamilton, Ontario.

Burt, R. S. (1997). The Contingent Value of Social Capital, *Administrative Science Quarterly,* 42:339 – 365.

Cameron, C. and K. Trivedi, (2009). Microeconometrics using stata. A stata press publications, StataCorps LP, Collage Stations, Texas.

CIAT (Centro International de Agricultureal Tropical), 2004. Increasing the competitiveness of market chains of smallholder's producers. Manual, 3: Territorial Approach to Rural Agro Enterprise Development Project.

Classification of Instructional Programs (CIP), (2000).*Effect of Women Farmers Adoption of Orange Fleshed Sweet Potatoes*: Stories From Fields: International Potatoes Center Annual Report 2000.

Coleman J.S. (1990). Foundations of Social Theory, Cambridge, MA: Harvard University Press. Delhi Tata McGraw – Hill. Delhi: Academic Foundation; Pp 22.

Damianos, D., and D. Skuras, (1996). "Farm Business and the Development of Alternative Farm Enterprises: An Empirical Analysis in Greece." *Journal of Rural Studies" 12(3):273-283.*

Deloach, J.W. (2000), Enterprise-wide Risk Management. Strategies for Linking Risk and Opportunities, Financial Times/Prentice-Hall, London.

Demographic Trends, Vol. 1 UNFPA funded Project (GHA/01/P07). Undertaken by Ghana Statistical Service.

Dercon S. (2002). Income risk; coping strategies and safety nets. The World Bank Research

Dey, Jennie. (1981). "Gambian Women: Unequal Partners in Rice Development Projects." *Journal of Development Studies 17(3) : 109-22.*

Dunne, A. (2001). Supply chain management: fad, panacea or opportunity? Occasional paper Vol 8(2) 1–40. School of Natural and Rural Systems Management, University of Queensland, Gatton, Queensland, Australia. Economics and Management Embeddedness. *Administrative Science Quarterly* 42: pp35-67. Empirical study of Uttar Pradesh. Agricultural Economic Research.

Emah, G. N. (1995): Participation of Small-Scale Farmers in Agricultural Development in Rivers State of Nigeria. Unpublished Ph.D. Dissertation. Department of Agricultural Extension. University of Nsukka. 136pp.

European Commission DGAGRI (2009) – *Historical Price Volatility*. Available at: http://ec. europa.eu/agriculture/analysis/tradepol/commodityprices/volatility_en.pdf

Evans, P. and T. Wurster, (2000). *Blown to bits: How the new economies of information transform strategy*. Harvard Business School Press, Cambridge, Massachusetts, USA.

Ewell, P. T. (2002). Sweet potato production in Sub-Saharan Africa: Patterns and key issues. Nairobi, Kenya: CIP.

Fakoya, O., M. Agbonlahor and A. Dipeolu, (2007). Attitude of women farmers towards sustainable land management practices in South-Western Nigeria. *World Journal of Agricultural Sciences*, 3(4): 536-542.farmers in Swaziland. Canadian Center of Science and Education. Sustainable Agriculture Research; 2, (1);123.

Fitter, R. and R. Kaplinsky, 2001. Who gains from product rents as the coffee market becomes more differentiated? A value chain analysis. IDS Bulletin Paper.University of Sussex, Institute of Development Studies, Sussex.

Food and Agricultural Organization (FAO), (2001), Handbook for Defining and Setting up a Food Security Information and Early Warning System (FSIEWS), Rome, Italy, pp.128

Food and Agricultural Organization (FAO), (2002). *FAO Statistics*.Food and Agriculture Organization, Rome, Italy [http:www.apps.fao.org].

Food and Agricultural Organization (FAO), (2006). Food Security and Agricultural Development in Sub-Saharan Africa: Building a Case for more Public Support, Rome.

Foster A and M. Rosenzweig. (1995). Learning by Doing and Learning from Others: Human Capital and Technical Change in Agriculture. *The Journal of Political Economy. Volume 103 (6); 1176-1209.*

Freshwater, D. and S. Jette-Nantel, (2008). ''Agricultural risk management through household portfolio choice''. Paper in the 2008 NAREA. Agricultural Policy Workshop, June 2008.

Gangwar, L.S. and S. Singh, (1999).Marketing of Nagpur mandarins – A case study of Nagpur district of Maharashtra. *Journal of Agricultural Marketing, 41(4): 18-20*.

Gangwar, L.S., and D.B. Singh, (2007). Estimation of Post-harvest Losses in Punjab. *Agricultural Economics Research Review Vol. 20, pp 315-331*

Gao, X. M. and Spreen, T. (1992): A micro-econometric analysis of the US meat demand, *Canadian Journal of Agricultural Economics*, Vol. 42, No. 3: 397- 409.

Gasson, R. (1988). "Farm Diversification and Rural Development." *Journal of. Agricultural Economics.* 39(2):175-182.

Gereffi G., Humphrey J, and Strurgen T (2005). The governance of global value chains. *Review of International Political Economy. Vol. 12 (1) pp. 78-104*

Ghana Statistical Service (2008). Ghana Living Standards Survey Round 5 (GLSS5); GSS, Accra, Ghana.

Ghana Statistical Service (2013). Statistics for Development and Progress. Provisional Gross Domestic Product; GSS, Accra, Ghana. *www.statsghana.gov.gh.*

Gibbon, P. and S. Ponte, (2005). Trading down Africa value chains and the global economy. DIIS, Copenhagen.

Glauber, J.W. (2004). Crop insurance reconsidered. *American journal of agricultural economics.Vol.86 pp1179-1195.*

Goksel A. and O. Altug (2007). Determinants of Total Factor Productivity with CobbDouglas Production function in Agriculture. *Journal of Applied Sciences 7 (4).pp. 449-502*

Goodwin, B. K., and T. C. Schroeder. (1994). "Human capital, producer education programs, and the adoption of forward pricing methods." *American Journal of Agricultural Economics Vol.* 76, 936_947.

Gray, C.F., E.W. Larson, (2008). Project Management: The Managerial Process (3rd ed) New

Gujarati, D. (2003). Basic Econometrics. 4th edition. Tata McGraw-Hill Publishing Company Limited, New Delhi, India. 614p.

Gulati, R. (1998). Alliances and Networks, *Strategic Management Journal* 19: 293-317

Haggblade, S. and Theriault V. (2012): Improving the Inclusiveness of Agricultural Value Chains in West Africa: The Role of Market Segmentation and Emerging SubChannels (http://www.aec.msu.edu/fs2/IFAD-WA/index.htm).

Harris, M. and Y. Weiss, (1984).Job matching with (nite horizon and risk aversion. *Journal of Political Economy 92, 758–779.*

Heitzmann, K., R.S. Canagarajah, and P.B. Siegel, (2002). "Guidelines for Assessing Risk and Vulnerability," SP Discussion Paper 0218. *Social Protection Unit, Human Development Network, the World Bank, Washington, D.C.*

Hillocks, R. (2002). Cassava in Africa. In: Hillocks, R. J., Thresh, J. M. and Bellotti, A. C.(eds), Cassava: Biology, Production and Utilization. CABI, Wallingford, pp. 41-54.

Hobbs, J., A. Cooney and M. Fulton, (2000). Value market chains in the agrifood sector: What are they? How do they work? Are they for me? Department of Agricultural Economics, University of Saskatchewan,Canada.

Howell J.B. and Hazzard R.V. (2012). *Risk management and crop insurance for New England vegetable grower*. Meister Publishing Company, Willoughby; Pp 81-104.

Huang, J., J. Jiang, J. Wang and L. Hou, (2014). Crop Diversification in Coping with Extreme Weather Events in China.

Humphrey, J. (2003). Opportunities for SMEs in developing countries to upgrade in a global economy. ILO SEED Working Paper No. 43, Geneva.

Humphrey, J. and H. Schmitz, (2002). How does insertion in global value chains affect upgrading in industrial clusters? Institute of Development Studies, Brighton.

Humphrey, J. and O. Memedovic, (2006). Global value chains in the agri-food Sector UNIDO Working Paper, Brighton.

Ilbery, B. (1991) "Farm Diversification as an Adjustment Strategy to the Urban Fringe of the West Midlands." *Journal. Rural Studies.*7(3):207-218.

International Labour Organisation (2000). Employment and social protection in the informal sector. First Item on the Agenda, Committee on Employment and Social Policy, 277th Session, GB.277/ESP/1/1.

Islam, M., H. Miah, and M. Haque, (2001). Marketing system of marine fish in Bangladish. *Bangladish Journal of Agricultural Economics.* 24(2): 127-142.

Jordaan H and B Grové, (2007). Factors Affecting Maize Producers Adoption of Forward Pricing in Price Risk Management: The Case of Vaalharts. *Agrekon journal, Vol 46.*

Kaplinsky, R. and M. Morris , (2001). A handbook of value chain analysis. Working paper prepared for the IDRC, Institute for Development Studies, Brighton, UK.

Kaplinsky, R. and M. Morris, (2000). A handbook for value chain research, IDRC. Ottawa, Canada.

Kasina, M. & Nderitu, J. H. (n.d.) Policy Implementation and its Economic Impact on Potato Marketing Value Chain in Kenya. Kenya Agricultural Research Institute – NARL.1198–1205.

Kay, R.D. (1986) Farm Management, Planning, Control and Implementation, 2nd edition:

KIT, Faida Mali and IIRR, (2006). Chain empowerment: Supporting African farmers to develop market. Royal Tropical Institute, Amsterdam; Faida Market Link, Arusha; and International Institute of Rural Reconstruction, Nairobi.

Knight, Frank (1921). *Risk, Uncertainty and Profit.* Houghton Mifflin, Boston.

Kohls, R., and N. Uhl, (1985). Marketing of agricultural products. 5th Edition. McMillian Publishing Company, NewYork, USA.

Kohls, R.L. and J.N. Uhl, (2002). Marketing of Agricultural Products, Prentice Hall of India Private Limited, New Delhi.

Kotler, P. and G. Armstrong, (2003). Principle of marketing, 10th Edition. Hall of India Pvt. Ltd. New Delhi. pp 5-12.

Kramer, R. A., and R. D. Pope, (1981). "Participation in Farm Commodity Programs: A Stochastic Dominance Analysis." *American Journal of Agric. Economics* 66 (1):119128.

Kuyrah J.N., Obare G, Herrero M. and Waishaka M. (2006). Agricultural Income Risk and Rural Poverty Dynamics Strategies of Smallholder Producers in Kenya, Contributed Paper presented at the International Association of Agricultural Economics Conference; Gold Coast, Australia, August;pp12–16.

Lundy, M., C. Felipe and R. Best, (2002). Value adding, agro enterprise and poverty reduction: a territorial approach for rural business development and rural agro enterprise development project, Colombia

Lynch, R. (2003). Corporate Strategy, 3rd Edition, Prentice Hall Financial Times.

Maddala, G.S. (2001). *Introduction to Econometrics.* Third Edition, John Will.

Mamo, G. and D. Abebaw, (2012). Patterns and determinants of livestock farmers' choice of marketing channels: micro-level evidence. Ethiopian Economics Association, Addis Ababa, Ethiopia. Pp.55.

Markowitz, H. (1952), "Portfolio selection", *Journal of Finance 7:77-91. McGraw – Hill Inc. New York: pp 383.*

Martin, G. O. Boualay and B. Julio (2007). North Houaphanh bamboo value chain analysis.

Netherland.

Mathia, G. A. (1976). Empirical measures of risk for selected field and horticultural crops. *Southern Journal of Agricultural Economics, paper series 4943: pp. 115-122.*

Matthews, A. (2010) – *Perspectives on Addressing Market Instability and Income Risk for Farmers*. Paper presented at Joint AES / SFER Conference on 'The Common Agricultural Policy Post 2013'. Available at: http://www.aes.ac.uk/_ pdfs/_confere nces/2 01_paper.pdf

McFadden, D., 1978. Quantal choice analysis: a survey. *Annals of Economic and Social Measurement*, 5(1976):*363-390.*

McGranaham, G. (1999). Environmental Change and Human Health in Countries of Africa, the Caribbean and the Pacific, Stockholm Environment Institute, Stockholm, pp. 214

McNally, S. (2001) "Farm Diversification in England and Wales—What Can We Learn from Farm Business Survey?"*Journal of Rural Studies, 17 (2).pp. 247-257.*

Mendoza, G. (1995). A Premier on Marketing Channel and Margins. Lyme Rimer Publishers Inc., USA.

Mikhayloa, L.I. (2005). Risk Management in International Agricultural Markets. IAMO – Forum, Agricultural and Food Markets in Central and Eastern Europe, Seminar paper 16 – 18 June, Halle (Saalie).

Ministry of Food and Agriculture (MoFA) (2010). Agriculture in Ghana: Facts and Figures. Statistics, Research and Information Directorate (SRID),

Mishra, A. K., and B. K. Goodwin (1997). Farm Income Variability and the Supply of Off-Farm Labour. *American Journal Agric. Economics.79 (3):880-887.*

Mishra, A. K., H. S. El-Osta, and C. L. Sandretto (2004). Factors affecting farm enterprise diversification.

Mmasa, J.J. and E.E. Msuya (2012). Mapping of the sweet potato value chain linkages between actors, processes and activities in the value chain: A case of '*Michembe and Matobolwa'* products. *Journal of Sustainable Agriculture Research 1(1): 130-146.*

Montgomery, C. A. (1994). "Corporate Diversification." *Journal of Economic Perspectives* 8:163S178.

Moschini, G. and D.A. Hennessy (2001). Uncertainty, risk aversion, and risk management for agricultural producers, Chapter 2.

MSPA (Mauritius Sugar Producers' Association), (2010). Value-added products of sugarcane. http://www.mspa.mu/index.php?rubrique=15.

Muhammed, U. (2011). Market chain analysis of teff and wheat production in halaba special woreda, southern Ethiopia. M.Sc thesis submitted to the School of Graduate Studies, Haramaya University. 104p.

Mulcahy, R. (2003). Risk Management, Tricks of Trade for Project Managers, RMC Publications, Inc.USA:

Musser, W. N., and G. Stamoulis (1981). Evaluating the Food and Agricultural Act of 1977 with Firm Quadratic Programming." *American Journal of Agric. Economics* 63(3):447-456.

Ndugbu, M.O. (2003). *Foundation of Project and Investment Analysis,* Barloz Publishers limited, Owerri.

Nelson, R. R., and E. S. Phelps (1966) 'Investment in humans, technological diffusion, and economic growth.' *American Economic Review* 56(1/2), 69–75

Njavro M. (2009). Risk Management in Agribusiness. Paper presented at Zagreb School Observer; Pp 141-166.

of Pennsylvania. http://www.bcg.com/publications/files/BCGSupplyChainReport.

Orodho, A. B., Alela, B. O., & J. W. Wanambacha (1995).*Use of sweet potato (Ipomoea batatas L.) vines as starter feed and partial milk replacer for calves*.KARIKakamega, Kenya.

Oscar I. Ayuya, Job K. Lagat and John M. Mironga (2011). Factors Influencing Potential Acceptance and Adoption of Clean Development Mechanism Projects: Case of Carbon Trade Tree Project among Small Scale Farmers in Njoro District of Kenya. *Research Journal of Environmental and Earth Sciences 3(3): 275-285*

Pires, G. D. & Aisbett, J. (2001).A dual Marketing and Informational Perspective to ECommerce Adoption.*The Newcastle University Research Publications.*Production and Utilization.CABI Publishing.

Ponte, S., (2002). The late revolution? Regulation, markets and consumption in the global coffee chain. *World Development*, 30 (7): 1099-1122.

Pope, R. D. Prescott R. (1980). Diversification in relation to farm size and other socioeconomic characteristics. *American Journal of Agricultural Economics*, **62**, 554- 559.

Porter, M.E. (1985). *Competitive Advantage: Creating and Sustaining Superior Performance* (New York: The Free Press) Publishing Company, New Delhi.

Rahko, J. (2012). Potato value chain in Tanzania. A thesis presented to the Graduate School at the University of Helsinki (Unpublished).

Ramaswami, B., S. Ravi and S.D. Chopra, (2004). State of Indian farmer risk management

Ramiro, I. (2009). Agricultural Insurance, *Primer series on insurance issues*, pp.2-3

Raynor, M. E. (2007). The Strategy Paradox: Why Committing to Success Leads to Failure *[and What to do About it]*. Currency Double day Publishing.

Rees, M., (2009). What is The Impact of Livelihood Strategies on Farmers' Climate Risk Perceptions in the Bolivian Highlands?: A Thesis Presented to the Faculty of the Graduate School at the University of Missouri-Columbia.

Richard, B. (2010). Risk Management and Finance along the Cassava Value Chain in Guyana. Inter-American Institute for Cooperation on Agricultural; AAACP Paper Series-No. 13.

Robison, L. J., and P. J. Barry (1987). The Competitive Firm's Response to Risk. New York: Macmillan Publishing Company.

Royal Society (1992). Analysis, Perception and Management, The Royal Society, London.

Sarah A. Drollete (2009). Managing Production Risk in Agriculture. AG/ECON/2009-03RM. http://www.extension.usu.edu/agribusiness/htm/.

Scarborough, V. and J. Kydd, (1992). Economic analysis of agricultural markets. A manual of marketing series 5, Chatham, UK: Natural Resource Institute: 172p.

Schmitz, H., 2005. Value chain analysis for policy makers and practitioners. International Labour Office and Rockefeller Foundation, Geneva, Switzerland.

Schultz, T. W., 1964. Transforming Traditional Agriculture, New Haven, CT: Yale University Press.

Shephard, G.S. (1965). Farm Products –An Economic Analysis, Iowa State University Press, U.S.A.

Shucksmith, M., Smith,R., (1991). Farm household strategies in pluriactivity in upland Scotland. *Journal of Agricultural Economics,* 42 (3), pp. 340-353.

Siegel, P.B. (2005) "Looking at Rural Risk Management Using an Asset-Based Approach." Background paper prepared for the report: *Managing Agricultural Production Risk: Innovations in Developing Countries*. Commodity Risk Management Group, Agricultural and Rural Development Department. Report No. 32727. The World Bank, Washington, D.C.

Smith, M. (2004). Born-again crops give hope to Zimbabwean farmers [http://www. Zimbabwean +farmers:+Ian+Robertson+and...-a0126583061] site visited on 24/ 12/201.

Steven, J., P. Siegel and C. Andrews, (2008). Rapid Agricultural Supply Chain Risk Assessment. Agricultural and Rural Development Department, World Bank. Conceptual Framework and Guidelines for Application.

Swiss Reinsurance (Swiss Re.). (2007). Insurance in emerging markets: sound development; Greenfield for agricultural insurance. Swiss Reinsurance Company Limited, Zurich.

Thiele G., Lynam J., Lemaga B. and Low J. (2009). Challenge theme paper 4: sweetpotato value chains. International Potato Centre (CIP): Lima, Peru.

Tobin, J. (1958), "Liquidity preference as behavior towards risk", *Review of Economic Studies*, Vol (25):65-86.

Tshiunza, M., J. Lemchi, A.Tenkouano, (2001). Determinants of market production of cooking banana in Nigeria. *African Crop Science Journal,* 9 (3): 537-547.

UNIDO (United Nations Industrial Development Organization), (2009). Agro-value chain analysis and development: a staff working paper, Vienna.

USAID (United States Agency for International Development), 2011. Value chain analysis of off-season vegetables sub-sector in Nepal. Nepal Economic Agriculture, and Trade Activity. USAID general development office. Kathmandu, Nepal.

Uzzi, B. (1997). Social Structure and Competition in Interfirm Networks: the Paradox of Embeddedness. *Journal of Administrative Science*, Vol. (42), pp.35-67.

Vanany, I., S. Zailani and N. Pujawan, (2009) Supply chain risk management: literature review and future research. International *Journal of Information System and Supply Chain Management,* 2(1):16–33.

Wharton School (2006) "Creating the Optimal Supply Chain: Special Report" University

Williamson, O. (1979). Transaction-cost economics: The governance of contractual relations. *Journal of Law and Economics*, Vol (22): 233-261.

Williamson, O. (1985). *The Economic institutions of capitalism: Firms, Markets, Relational Contracting.* The Free Press, New York.

Williamson, O. (2002). *The theory of the firm as governance structure: From choice to contract.* Brookfield, VT. Edward Elgar.

Zsidisin, G.A. and R. Ritchie, (2008). Supply Chain Risk: A Handbook of Assessment, Management, and Performance. New York: Springer International.

APPENDICES

APPENDIX A

Table 1. The Result of Multicollinearity Test for Production Risk Model

Variable	1-R_2	1/1-R^2
Income	1.0418	0.959
FmSZ	1.251	0.799
Amount_Saved	1.0432	0.959
Credit	0.915	1.093
FmExp	1.0896	0.918
Output(previous season)	0.981	1.0194
Extsn	1.876	0.533
Off_Farm_Inc	1.0096	0.990
Yrs_Schooling	0.538	1.858
MktInfo	0.849	1.177
Age	0.985	1.0152
Sex	1.109	0.9015
Mean VIF	**1.057**	

Source: Field Survey, 2015.

Table 2. The Result of Multicollinearity Test for Price Risk Model

Variable	1-R^2	1/1-R^2
Credit_dummy	1.0063	0.994
Ave_output	0.8788	1.137
HHsz	0.996	1.004
FmSZ	1.251	0.799

BuyerType_dummy	1.0437	0.958
Extsn_Contact	1.235	0.809
Point_Sale	1.044	0.959
FmExp	1.057	0.946
Amount_saved	1.306	0.766
MktInfo	0.995	1.005
Mean VIF	**1.081**	

Source: Field Survey, 2015

APPENDIX B. Producer Questionnaire

1.0 General Information/Household Characteristics

1.1 Name of enumerator ……..

1.2 Date of interview ……

1.3 Time interview started …… Time interview ended ……..

1.4 Region 1. Eastern [ ] 2. Northern [ ]

1.5 District 1. Fanteakwa [ ] 2.West Mamprusi [ ]

1.6 Name of Community ……

1.7 Name of respondent ……. Telephone No……..

1.8 Sex of respondent 1. Male [ ] 2. Female [ ]

1.9 Actual age of respondent (years) …….....

1.10 Level of formal education 1. None [ ] 2. Basic [ ] 3. Secondary [ ] 4. Tertiary [ ]

1.11 Actual number of years of schooling (formal education) ……

1.12 Main occupation 1. Farming [ ] 2. Artisan/vocational work [ ] 3. Salaried work [ ] 4. Trading [ ] 5. Others [ ] specify…….

1.13 Secondary occupation 1. Farming [ ] 2. Artisan/vocational work [ ] 3. Salaried work [ ] 4. Trading [ ] 5. Others [ ] specify…….

1.14 Religion 1. Christianity [ ] 2. Islam [ ] 3. Traditionalist [ ] 4. Atheist [ ]

1.15 Ethnic affiliation 1. Akan [ ] 2. Ga [ ] 3. Ewe [ ] 4. Northerner [ ] 5. Krobo [ ] 6. Others [ ] specific ……

1.16 Marital Status 1. Single [ ] 2. Married [ ] 3. Separated/Divorced [ ] 4. Widowed [ ]

1.17 Household size ……. Household members above 15 years ……

1.18 Average distance from home to: a. Sweet potato farm ……Km b. Market ……Km

1.19 How many years have you been farming? ……

1.20 How many years have you been involved in sweet potato cultivation? ……

2. Production Information

2.1 Main land tenure arrangement for sweet potato production: 1.Own land [ ] 2. Family land [ ] 3. Share cropping [ ] 4. Renting [ ] 5. Others [ ] Specify ……..

2.2 Total land available to household for agriculture (acre)? ……..

2.3 Did any member of the household cultivate sweet potato during the past one year? 1. Yes [ ] 2.No [ ]

2.4 What was the size of your sweet potato farm during the last season? ……acres

2.5 Main planting method used? 1.Level ground [ ] 2. Mounds [ ] 3. Ridges [ ] 4. Other [ ] specify……..

2.6 Main source of planting materials (**tick all that apply**)? 1. Own farm [ ] 2.Friends/Fellow farmers [ ] 3.MoFA [ ] 5. Others [ ] Specify …….

2.7 What is the main objective for cultivating sweet potato?

1. Only for household food [ ] 2. Mainly for food, sell surplus [ ] 3. Equally for food and sale [ ]

4. Mainly for sale [ ] 5. Others [ ] Specify ……

2.8 What is your observed trend of sweet potato production in the past 3 years?

1. Increasing [ ] 2. The Same [ ] 3. Declining [ ] 4. Fluctuating [ ]

2.9 Please give a reason for the observed trend over the said period

……

2.10 What is your predicted trend for sweet potato production for the next 3 years?

1. Increase [ ] 2. The Same [ ] 3. Decrease [ ] 4. Fluctuating [ ]

2.11 Please give a reason for the predicted trend for the next 3 years

……

2.12 What is the main source of capital for sweet potato production? 1. Own funds [ ] 2. Friends/relatives [ ] 3. Financial institutions [ ] 4. Middlemen/Traders [ ] 5. Money lenders [ ] 6. Others [ ] specify: ……

2.13 If borrowed funds are used, please indicate the main source? 1. Friends/relatives [ ] 2. Financial institutions [ ] 3. Middlemen/Traders [ ] 4. Moneylenders [ ] 5. Others: …….

2.14 On the average how many times do you harvest in a typical season? ……

2.15 What is the main tool used in harvesting sweet potato? 1. Cutlass [ ] 2. Hoe [ ] 3. Mattock [ ] 4. Hand [ ] 5. Other [ ] specify……..

2.16 Please, provide the following information on sweet potato production for the past three seasons

Year	Main Variety Cultivated*(see code sheet)	Do you plant multiple varieties;1=Yes; 2=No	Minor Varieties*	Farm size in acres	Actual Output at harvest(120kg)	Quantity of harvest sold (120kg)	Quantity of harvest lost(120kg)
2014							
2013							
2012							

***1. Yellow flesh 2. Purple/Mauve flesh 3. White flesh 4. Red flesh 5.Santom Keni 6. Agric.Variety 7. Orange flesh 8.Other specify…….**

2.17a Do you have access to extension services? 1. Yes [ ] 2. No [ ]

2.17b If yes, what is the average number of visits in the past one year? ……

2.18a Do you have an account with a bank or financial institution? 1. Yes [ ] 2. No [ ]

2.18b Number of years of owning an account…….

2.18c How much were you able to save during the last cropping season? GH¢ ……

2.19a Have you received credit for your sweet production for the past three years? 1. Yes [ ] 2. No [ ]

2.19b If yes, how much did you receive? GH¢…….. Interest rate …….

2.20a Are you a member of a farmer based organization? 1. Yes [ ] 2. No [ ]

2.20b If yes, for how many years have you been a member of this farmer based organization?
…….

2.21 Do you keep written records on your farm activities? 1. Yes [ ] 2. No [ ]

2.22 If No, please indicate the main reason. 1. It is too cumbersome [ ] 2. I can't write [ ] 3. Just don't see its importance [ ] 4. Do know how to keep records [ ] 5. Others [ ] specify
……

2.23a Have you experienced diseases on your sweet potato farm the past 3 seasons? 1. Yes [ ] 2. No [ ]

2.23b If yes, which disease(s) **(tick all that apply)**? 1. Root rot/decay [ ] 2. Leaf blight [ ] 3. Both [ ] 4. Other [ ] specify: ……..

2.23c Were you able to treat the disease(s)? 1. Yes [ ] 2. No [ ]

2.23d Mode of treatment: 1. Spraying with agrochemicals [ ] 2. Uprooting and throwing away infected plant [ ] 3. Burying of infected plant [ ] 4. Others [ ] specify:
……..…...

2.24a Is your sweet potato farm affected by any pests? 1. Yes [ ] 2. No [ ]

2.24b If yes, which pests **(tick all that apply)**? 1. Rodents [ ] 2. Birds [ ] 3. Both [ ] 4. Others [ ] specify: …

2.24c Did you control the pests? 1. Yes [ ] 2. No [ ]

2.24d Mode of treatment: 1. Spraying with agrochemicals [ ] 2. Physical control [ ] 3. Others [ ] specify: ……

2.25 Agro-Input Information

Type of AgroInput	**Main agroinput used***	**Amount Spent on agro-input** 2014	2013	2012	**Source of agroinput** ***	**Main Location ******	**Training on Input Usage 1=Yes; 2=No**	**Service Providers ********
Herbicides								
Pesticides								
Fertilizer								

*****1=NPK; 2=Sulphate of ammonia; 3=Muriate of Potash; 4=Urea; 5=TSP; 6=SSP 7=Gramozone; 8=Actara; 9=Condem

******1=Wholesaler; 2=Retailer; 3. MoFA/Government 4. NGOs 5=Others

Specify……

*** 1= Within Community; 2=Nearest town; 3=District capital; 4=Outside district; 5=Other

Specify……

**** 1=MoFA; 2=NGOs; 3=Input dealers; 4=Other Specify……

2.26a Level of input use and Cost structure for sweet potato production last season (per acre)

Activity	Performed by *	Quantity per acre	Unit of measure **	No. of days	Unit Price (GH¢)	Total Cost (GH¢)
Land clearing/Ploughing (labour)						
Mounding or ridging(labour)						
Planting materials						
Carting of planting materials(labour)						
Planting(labour)						
1st Weeding(manual)						
2nd Weeding(manual)						
Herbicides/Weedicides						
Herbicide application(labour)						
Fertilizer						
Fertilizer application(labour)						
Harvesting(labour)						
Gathering of produce/heaping						

*1=Adult male in HH; 2=Adult female in HH; 3=both 1 and 2; 4=Children; 5=Hired labour; **1=Mandays; 2=Kilograms; 3=Liters

2.26b Fixed Cost Information for the Last Cropping Season

Fixed Input	Number Used	Unit Cost(GH¢)	Economic Life(months)
Hoes			
Cutlasses			
Baskets			
Sacks			
Mattock/Axe			
Land rent			

Knapsack Sprayer			
Other 1……..			
Other 2 …….			

2.27 Do you add any value to your sweet potato before sale? 1. Yes [ ] 2. No [ ]

2.28a If yes to question 2.11, please indicate the type of value added to your sweet potato and its associated cost

Activity	**Activity Performed 1=Yes; 2=No**	**Labour per 105kg (mandays)**	**Unit Cost GH¢**
Cleaning	[ ]		
Bulking	[ ]		
Storage	[ ]		
Grading/Sorting	[ ]		
Packaging	[ ]		
Other 1……	[ ]		
Other 2……	[ ]		

2.8b. If you do some grading and sorting, on what basis is it done? 1. Size [ ] 2.Colour [ ] 3. Varietal [ ] 4. Others specify …….

2.33 What are the major production constraints you face in your sweet potato operation?

Production Constraints	**Rank(1=strongly agree; 2=agree; 3=neutral; 4=disagree; 5=strongly disagree)**
Limited access to land	
Poor/declining soil fertility	
Unavailability of quality planting materials	
High cost of planting materials	
High incidence of diseases and pest attack	
Erratic rainfall pattern	
Unavailability/Inadequate storage facilities	
High level of losses	
Limited access to extension services	
Limited access to credit facilities	
High interest rate on credit	
High weeds infestation/incidence	
High labour for farm activities	
High cost of labour	
Limited access to chemical inputs	
High cost of chemical inputs	
Poor road network	
Other 1……..	
Other 2……..	
Other 3……..	

3.0 Sweet Potato Marketing Information

3.1 What is you mode marketing of your sweet potato? 1. Regular trade/ Spot trade [ ] 2. Contractual agreement/arrangement [ ] 3. Others [ ] specify……

3.2 Who is your target market for your sweet potato? 1. Collectors [ ] 2. Wholesalers [ ] 3. Retailers [ ] 4. Processors [ ] 5. Consumers [ ] 6. Others [ ] specify ……

3.3a Are you usually aware of the sweet potato information before sale? 1. Yes [ ] 2. No [ ]

3.3b If Yes, how do you get your market information? 1. Radio [ ] 2. Friends/fellow traders [ ] 3. Telephone calls [ ] 4. MoFA [ ] 5. Others [ ] specify …….

3.3c What type of information do you get? 1. Price information [ ] 2. Market place information [ ] 3. Buyers' information [ ] 4. Other [ ] (specify) ……

3.3d At what time interval do you get the information? 1. Daily [ ] 2. Weekly [ ] 3. Bi-weekly 4. Monthly [ ] 5. Other [ ] (specify) ……..

3.4 Please provide the following marketing information for Sweet potato for the past 3 years

Year	Main Point of Sale *	Quantity sold(105kg)			Farm gate Price (GH¢)			Price in main market(GH¢)		
		small	medium	large	small	medium	large	small	medium	large
2014										
2013										
2012										

*1=Farm gate; 2=Main district market; 3=other market in the district; 4=Market outside the district; 5=Processing Company; 6=Others
(specify…….)

3.4a If main point of sale is a market, what is the mode of transportation mostly used? 1. Trek by foot [ ] 2. Use of own vehicle [ ] 3. Public transport system [ ] 4. Other [ ] specify …….

3.4b If mode of transport is own vehicle, please indicate which vehicle. 1. Bicycle [ ] 2. Motor bike [ ] 3. Tricycle [ ] 4. Lorry [ ] 5. Other [ ] specify……..

3.5 Please provide the following marketing cost specific to your sweet potato output for the past 3 years

Cost Item	**2014**	**2013**	**2012**
Transportation			
Loading			
Offloading			
Storage			
Market toll/tax			
Other 1……			
Other 2……			

NB; Total cost on output in GH¢

3.8 What are the major constraints you face in terms of marketing your sweet potato harvested

Marketing Constraints	**Rank(1=strongly agree; 2=agree; 3=neutral; 4=disagree; 5=strongly disagree)**
Low commodity price	
Inadequate storage facilities	
Low demand for commodity	

High market toll/tax	
Poor road network	
High transportation cost	
Poor linkage with Value chain actors	
Inadequate market information	
Long market distances	

4.0 Risk Information

4.1 Please indicate the main risks of your operations in the past three (3) production seasons

Production Level Risk	**Rank ((**1=strongly agree; 2=agree; 3=Neutral; 4=disagree; 5=strongly disagree**))**	**Risk Management Tool Adopted ***
Sudden changes in output price	[ ]	
Sudden changes in input price	[ ]	
Prolonged decline in output prices	[ ]	
Sudden increase in wage rate	[ ]	
Changes in the operation of input provider	[ ]	
Changes in output level	[ ]	
Pest and disease related risk	[ ]	
Transport failure	[ ]	
Fluctuations in transport cost	[ ]	
Changes in the demand of traders	[ ]	
Unexpected fire outbreak	[ ]	
Unreliable profit levels	[ ]	
Other1 ……..	[ ]	
Other 2 …….	[ ]	
Other 3 …….	[ ]	

*1=Follow recommended practices; 2=Diversification; 3=Expand production; 4=Plant resistant varieties; 5=Joining of cooperative society; 6= Contract farming; 7= Marketing through multiple channels; 8= Other (specify……)

4.2 Please indicate among the risk management strategies the main tool used to deal with production risk at the production level? 1. Follow recommended practices [ ] 2=Expand production [ ] 3=Plant resistant varieties [ ]

4.2 Please indicate among the risk management strategies the main tool used to deal with price risk at the production level? 1. Diversification [ ] 2. Marketing through multiple channels [ ] 3. Expansion of production [ ]

5.0 Household Income Information

5.1 Indicate sources of income and their proportions to the total household income during 2013 cropping.

Income source	**Amount (GH¢)**	**Proportion to HH income (%)**
Sales from sweet potato		
Sales from other crops		
Sales from cash crops		

Sales from farm animals		
Salaries/pensions		
Remittances		
Casual labour (farmhand)		
Trading		
Other non-farm sources		

APPENDIX C: TRADER QEUSTIONNAIRE

1. **General Information/Household Characteristics**

1.1 Name of interview ……..

1.2 Date of interview ……

1.3 Time interview started …… Time interview ended ……..

1.4 Community/market ……. District ……. Region……

1.5 3.1 Name/location of business/market…….

1.6 Name of respondent …… Telephone No……..

1.7 Type of trader. 1. Retailer [ ] 2. Wholeseler [ ] 4. Collecters [ ] 5. Others [ ]

1.8 Sex of respondent 1. Male [ ] 2. Female [ ]

1.9 Actual age of respondent (years) …….....

1.10 Educational level 1. None [ ] 2. Basic [ ] 3. Secondary [ ] 4. Tertiary [ ]

1.11 Actual number of years of schooling (formal education) ……

1.12 Religion 1. Christianity 2. Islam [ ] 3. Traditionalist [ ] 4. Atheist [ ]

1.13 Ethnic affiliation 1. Akan [ ] 2. Ga [ ] 3. Ewe [ ] 4. Northerner [ ] 5. Krobo [ ]

1.14 Marital Status 1. Single [ ] 2. Married [ ] 3. Separated/Divorced [ ] 4. Widowed [ ]

1.15 Household size ……. Household members above 15 years ……

1.16 Average distance from supply market to destination market 1: ……..Km

1.17 Total annual income for 2014 GH¢ ……

1.18 How many years have you been trading in root and tuber crops? ……..

1.19 How many years have you been involved in sweet potato marketing? ……

2.0 Please indicate the major produce that you trade in and the respective proportions to you total trading business

Major produce traded	Rank these crops in order of importance (1=most important; 5=least important)	Volumes handled per week
a. Sweet potato	[ ]	
b. Cocoyam	[ ]	
c. Yam	[ ]	
d. Other 1…….	[ ]	
e. Other 2……	[ ]	
f. Other 3…….	[ ]	

2.3 Total number of employees

Total …….. Family……Hired…….

Description	Number of Males	Number of Females	Total
Family Members			
Non-Family Members			
Total			

3.0 Sweet Potato Marketing Information

3.1a What is the main point of sale of your sweet potato? 1=Main district market [ ]; 2= market in the district [ ]; 3=Market outside the district [ ]; 4=Processing Company [ ]; 5=Others [ ] specify……

3.2a Distance from market to the main source……..km

3.2b If in a market, describe the type of market in which you are selling. 1. Open market with shed/roofing [ ] 2.Open market without shed/roofing [ ] 3. Open space (Not in a market) [ ] 4. Other [ ] specify……

3.3 If you trade in a market, please give a rough estimation of the number of traders in this market selling sweet potato? …….

3.4 Who are the main target consumer group for your sweet potato product? 1. Low income earners [ ] 2. Middle income earners [ ] 3. High income earners [ ] 4. Every income level [3.5 What is the target age group for your sweet potato product? 1. <30 [ ] 3. 31-50 [ ] 4. > 50 [ ]6. No particular age group [ ]

3.6a What is the mode of transportation mostly used to convey your sweet potato to the point of sale? 1. Trek by foot [ ] 2. Use of own vehicle [ ] 3. Public transport system [ ] 4. Other [ ] specify ……

3.6b If mode of transport is own vehicle, please indicate which vehicle. 1. Bicycle [ ] 2. Motor bike [ ] 3. Tricycle [ ] 4. Lorry [ ] 5. Other [ ] specify……..

3.7 How many times in a month do you buy sweet potato for sale? ……..

3.8 What sweet potato tuber size is most purchased for sale? 1. Small [ ] 2. Medium [ ] 3. Large [ ]

3.9 **Sweet potato Purchase Volumes, Prices, Transportation and related cost for the last month**

Frequency	Quantity Purchased (105kg)(check weight)	Unit Cost (GH¢/105kg)	Average Distance covered (Km)	Total T&T Cost (GH¢)	Loading & Offloading	Market Toll (Total quantity purchased)
1st trip						
2nd trip						
3rd trip						
4th trip						
5th trip						
Total						

3.10 Do you have storage facilities/structures at the market to keep unsold produce? 1. Yes [ ] 2. No [ ]

3.11 If yes, do you pay for using the facility? 1. Yes [ ] 2.No [ ]; If Yes, how much GH¢ …….. Per unit

3.12 If No to 2.8, where is unsold produce stored?

……

3.13 What is the minimum capital requirement for starting your business? GH¢

……

3.14 Basic material/resources needed to trade in sweet potato?

……

3.15a Returns and loss estimation from Sweet potato for the last month

Frequency	**Quantity of Produce Sold (120kg)**	**Selling Price Per Unit (GH¢)**	**Quantity of Produce lost (120kg)**	**Estimated value of Produce lost (GH¢)**
1st Sale				
2nd Sale				
3rd Sale				
4th Sale				
5th Sale				
Total				

3.15b Fixed Cost Information for the Last Financial Year

Fixed Item	Number Used	Unit Cost (GH¢)	Economic Life(months)
Sacks			
Baskets/Pans			
Table			
Chairs			
Rent of market space			
Shed for selling			
Employee salary			
Other 1……..			
Other 2……..			

Other 3……..			

4.0 Transaction Related Information

4.1 What mode is used for marketing your sweet potato? 1. Spot trade [ ] 2. Contractual agreement/arrangement [ ] 3. Others [ ] specify……

4.2 Who are your target customers for your sweet potato? 1. Fellow trader [ ] 2. Processors [ ] 3. Consumers [ ] 4. Others [ ] specify ……

4.3a Are you always aware of the sweet potato price in other markets? 1. Yes [ ] 2. No [ ]

4.3b If Yes, how do you get your price information? 1. Radio [ ] 2. Friends/fellow traders [ ] 3. Telephone calls [ ] 4. MoFA [ ] 5. Others [ ] specify …….

4.4a Are there any entry barriers (restrictions) to new entrants (traders)? 1. Yes [ ] 2. No [ ]

4.4b If Yes, Explain

……

4.5 How much do new entrants normally pay before they are allowed to trade in this market? GH¢ ……..

4.6a Do you have a market queen in your market? 1. Yes [ ] 2. No [ ]

4.6b If yes, do you make any payments/contributions to the market queen? 1. Yes [ ] 2. No [ ]

4.6c If yes, what is the value of the total contributions you give to the market queen per month? GH¢……

4.7 Which variety do you normally sell?

1. Red fleshed [ ] 2. Purple/Mauve fleshed [ ] 3. White fleshed [ ] 4. Santom Keni [ ] 5. Agic. Variety [ ] 6. Yellow fleshed [ ] 7. Other [ ] specify…….

4.8 Do customers normally differentiate among the various varieties of sweet potato?1. Yes [ ] 2. No [ ]

4.9 Which sweet potato variety do consumers normally demand?

1. Red fleshed [ ] 2. Purple/Mauve fleshed [ ] 3. White fleshed [ ] 4. Santom Keni [ ] 5. Agic. Variety [ ] 6. Yellow fleshed [ ] 7. Other [ ] specify…….

4.10 What characteristics /features/qualities do consumers look out for when purchasing the sweet potato for household consumption? 1. Taste [ ] 2. Colour [ ] 3. Availability [ ] 4. Shelf life [ ] 5. Low price [ ] 6. Type of variety [ ] 6. Others [ ] specify …….

4.11a What is your observed trend of sweet potato marketing in the past 3 years?

1. Increasing [ ] 2. The Same [ ] 3. Declining [ ]

4.11b Please give a reason for the observed trend over the said period

……
……
……

4.12a What is your predicted trend for sweet potato marketing for the next 3 years?

1. Increase [ ] 2. The Same [ ] 3. Decrease [ ]

4.12b Please give a reason for the predicted trend for the next 3 years

……
……
……

4.13 How/ Who determines the price of sweet potato traded? 1. Trader determine price 2. Market queen determines price [ ] 3. Parties negotiate and come to consensus [ ] 4. Based on prevailing market price [ ] 5.
Producers determine the price [ ] 6. Others [ ] Specify……..

4.14 Do you add any value to your sweet potato before sale? 1. Yes [ ] 2. No [ ]

4.15 **If yes to question 4.14, please indicate the cost of adding value to the produce**

Activity	**Activity Performed 1=Yes; 2=No**	**Labour per 105kg (mandays)**	**Unit Cost GH¢**
Cleaning	[ ]		
Bulking	[ ]		
Storage	[ ]		
Grading/Sorting	[ ]		
Packaging	[ ]		
Transportation	[ ]		
Other 1……	[ ]		
Other 2……	[ ]		
Other 3……	[ ]		

5.0 Other Information

5.1 Main source of capital for sweet potato trading activities? 1. Own equity [ ] 2. Bank [ ]3. Credit union [ ] 4. Susu scheme [ ] 5. Friend and Relatives [ ] 6. Other [ ] specify ……

5.2a Where do you normally save your income from sweet potato trading? 1. No savings [ ] 2. At home [ ] 3. Bank [ ] 4. Credit union [ ] 5. Susu scheme [ ] 6. Others [ ] specify ……..

5.2b How much were you able to save on the average last financial year? GH¢ ……

5.3a Did you receive credit for your sweet potato business over the last 3 years? 1. Yes [ ] 2. No [ ]

5.3b If yes, how much did you receive? GH¢ …….

5.4 Do you belong to any trader association? 1. Yes [ ] 2. No [ ]

5.5a Do you keep` records on your farm activities? 1. Yes [ ] 2. No [ ]

5.5b If No, please indicate the main reason. 1. It is too cumbersome [ ] 2. I can't write [ ] 3. Just don't see its importance [ ] 4. Do know how to keep records [ ] 5. Others [ ] specify

……

5.6 What are the major constraints you face in marketing or trading your sweet potato?

Marketing Constraints	**Rank(1=strongly agree; 2=agree; 3=neutral; 4=disagree; 5=strongly disagree)**
Low commodity price	
Inadequate storage facilities	
Low demand for commodity	
High market toll/tax	
Poor road network	
High transportation cost	
Poor linkage with Value chain actors	
Inadequate market information	
Long market distances	
High post- harvest losses	
Other 1…….	
Other 2…….....	

6.0 Risk Information

6.1 Please indicate whether you have faced the following market risk for the past three (3) financial years

Market Level Risk	Rank (1=strongly agree; 2=agree; 3=Neutral; 4=disagree; 5=strongly disagree)	Risk Management Tool Adopted **
Sudden changes in produce prices	**[ ]**	
Sudden changes in marketing cost	**[ ]**	
Prolonged decline in commodity purchase prices	**[ ]**	
Changes in the operations of domestic output markets	**[ ]**	
Storage and pest related risk (Post harvest)	**[ ]**	
Transport failure	**[ ]**	
Sudden changes in wage rate	**[ ]**	
Sudden changes in the transportation cost	**[ ]**	
Changes in final consumer demand	**[ ]**	
Unreliable profit levels	**[ ]**	
Other 1……	**[ ]**	
Other 2……	**[ ]**	
Other 3……	**[ ]**	

****1=Develop a market plan; 2=Join a market co-operative; 3=Market through multiple channels; 4=Enter into sales/price contracts with producer; 5=Spread sales over the season; 6=Diversification; 7= Other (specify……)

4.4 In your opinion, which single management strategy do you employ to harness your price risk? 1. Develop a market plan [ ] 2. Marketing through multiple channels [ ] 3. Diversification [ ]

APPENDIX D: PROCESSOR QUESTIONNAIRE

2. **General Information/Household Characteristics**

1.1 Name of interview ……..

1.2 Date of interview ……

1.3 Time interview started …… Time interview ended ……..

1.4 Community ……. District ……. Region…….

1.5 Name of respondent ……. Telephone No……..

1.6 What do you process sweet potato into? 1. Boiled [ ] 2. Fried [ ] 3. Roasted [ ]

4. Sweet potato flour [ ] 5. Other [ ] specify product …….

1.7 Sex of respondent 1. Male [ ] 2. Female [ ]

1.8 Actual age of respondent (years) …….....

1.9 Educational level 1. None [ ] 2. Basic [ ] 3. Secondary [ ] 4. Tertiary [ ]

1.10 Actual number of years of schooling (formal education) ……

1.11 Religion 1. Christianity 2. Islam [ ] 3. Traditionalist [ ] 4. Atheist [ ]

1.12 Ethnic affiliation 1. Akan [ ] 2. Ga [ ] 3. Ewe [ ] 4. Northerner [ ] 5. Krobo [ ]

1.13 Marital Status 1. Single [ ] 2. Married [ ] 3. Separated/Divorced [ ] 4. Widowed [ ]

1.14 Household size ……. Household members above 15 years ……

1.15 Average distance from supply market to destination point: ……..Km

1.16 Total annual income GH¢ ……

1.17 How many years have you been involved in sweet potato marketing? ……

1.8 Please indicate if you process any of these root and tuber crops apart from sweet potato

Major produce processed	**Tick those that apply**	**Proportion(%) to total produce that apply**
g. Cocoyam	[ ]	
h. Yam	[ ]	
i. Plantain	[ ]	
j. Cereals	[ ]	
k. Other 1…….	[ ]	
l. Other 2…….	[ ]	

1.9a If process any of these, do you process these produce above concurrently (all together at the same time)? 1. Yes [ ] 2. No [ ]

1.9b If yes, main reason? 1. Income security [ ] 2.Available demand [ ] 3.High product prices [ ] 4. Profit [ ]

5. No particular reason [ ] 5. Others [ ] specify …….

1.10 Please indicate the number of employees for your operations in the specification below

Description	Number of Males	Number of Females	Total
Family Members			
Non-Family Members			
Total			

1.11a Do you engage family labour for assistance **(without a salary)**? 1. Not really [ ] 2. Sometimes [ ] 3. Mostly [ ] 4. All the time [ ]

1.11b How many times per typical week is such assistance obtained? ……..

2. Sweet Potato Processing Information

2.1 Name/location of processing site

……..

2.2 Describe the place of operation in which you process your sweet potato. 1. Near/within a marketplace [ ] 2. Residential area [ ] 3. Lorry station [ ] 4. Hawking [ ] 5. Other [ ] specify:

…….

2.3 Type of facility used for your operations? 1. Table top [ ] 2. Kiosk/wooden structure [ ] 3. Shop [ ] 4. Other [ ] specify: …….

2.4 Please give a rough estimation of the number of processors in this vicinity processing sweet potato?

……..

2.5 How many times in a year do you buy sweet potato for processing? ……..

2.6 What sweet potato tuber variety is most purchased for processing? 1. Red fleshed [ ] 2. Purple/Mauve fleshed [ ] 3. White fleshed [ ] 4. Santom Keni [ ] 5. Agic. Variety [ ] 6. Yellow fleshed [ ] 7. Other [ ] specify…….

2.7 Which sweet potato variety do consumers normally demand?

1. Red fleshed [ ] 2. Purple/Mauve fleshed [ ] 3. White fleshed [ ] 4. Santom Keni [ ] 5. Agic. Variety [ ] 6. Yellow fleshed [ ] 7. Other [ ] specify…….

2.8 What is your main point of purchase of sweet potato for processing? 1. Farm gate [ ] 2. Collectors [ ] 3. Wholesalers [ ] 4. Retailers [ ]

2.9 Sweet potato Purchases, Transportation and related cost for the last month

Frequency	Quantity Purchased (105kg)	Unit Cost (GH¢/105kg)	Total Cost (GH¢)	Average Distance covered (Km)	Total T&T Cost (GH¢)	Loading & Offloading	Market Toll (Total quantity purchased)
1st trip							
2nd trip							
3rd trip							
4th trip							
5th trip							

Total							

2.10a Do you have storage facility/structure to keep fresh produce? 1. Yes [ ] 2. No [ ]

2.10b If yes, storage method for the fresh produce? 1. Floor Open-space [ ] 2. Raised platform [ ] 3. Floorenclosed room [ ] 4. Raised platform-enclosed room 5. Other [ ] Specify ……..

2.10c Do you pay for using the facility? 1. Yes [ ] 2.No [ ]; If Yes, how much GH¢ ……Per unit OR …… Per month

2.11 If No to 2.8, where is fresh produce stored pending processing?
……

2.12 Do you store unsold processed products as well? 1. Yes [ ] 2. No [ ]

2.13 If yes, please indicate the method of storage? 1. Pan/basin/bucket [ ] 2. Polythene bags [ ] 3. Refrigeration [ ] 4. Others [ ] specify: ……

2.14 What is the minimum capital requirement for your business? GH¢ ……

2.15 Basic material/resources needed to process sweet potato for sale?
……..

2.16 Returns and loss estimation from Sweet potato for the last financial year

Frequency	**Quantity of Produce Sold (105kg)**	**Selling Price Per Unit (GH¢)**	**Total Revenue (GH¢)**	**Quantity of Produce lost (105kg)**	**Estimated value of Produce lost (GH¢)**
1st Sale					
2nd Sale					
3rd Sale					
4th Sale					
5th Sale					
Total					

2.17a How do you see the supply in sweet potato for the past 3 years? 1. Increasing [ ] 2. The same [ ] 3. Decreasing [ ]

2.17b Reason for answer in 2.19a
……

2.18a How do you see the demand in sweet potato products for the past 3 years? 1. Increasing [ ] 2. The same [ ] 3. Decreasing [ ]

2.18b Reason for answer in 2.20a
……

2.19a How do you see the demand in sweet potato products for the next 3 years? 1. Increasing [ ] 2. The same [ ] 3. Decreasing [ ].

2.19b Please give a reason for your answer:

……

……..

2.20 Fixed Cost Information for the Last Financial Year

Fixed Item	Number Used	Unit Cost (GH¢)	Economic Life(months)
Sacks			
Baskets/Pans			
Table			
Chairs			
Rent of market space			
Shed for selling			
Utensils			
Barrel			
Other 1…….			
Other 2……..			
Other 3……..			

2.21a Do you add any other value to the sweet potato? 1. Yes [ ] 2. No [ ]

2.21b If yes to question 2.11, please indicate the type of value added to your sweet potato and its associated cost

2.21c Value addition Information

Activity	**Activity Performed 1=Yes; 2=No**	**Labour per 105kg (mandays)**	**Unit Cost GH¢**
Cleaning	[ ]		
Bulking	[ ]		
Storage	[ ]		
Grading/Sorting	[ ]		
Packaging	[ ]		
Transportation	[ ]		
Other 1……	[ ]		
Other 2……	[ ]		
Other 3……	[ ]		

2.22 Please indicate how much you spend on a typical day on for processing your sweet potato

Item	**Cost in GH¢**
Cooking oil	
Water used	
Washing per 105kg	
Vegetables(pepper, tomato etc)	
Fuel (charcoal, gas, kerosene)	
Peeling per 105kg	
Other 1…….	
Other 2……..	

Other 3…….	

3.0 Transaction information

3.1 What mode is used for marketing your sweet potato? 1. Regular trade [ ] 2. Spot trade [ ] 3. Contractual agreement/arrangement [ ] 4. Others [ ] specify……

3.2a Are you always aware of the sweet potato prices in other markets? 1. Yes [ ] 2. No [ ]

3.2b If Yes, how do you get your price information? 1. Radio [ ] 2. Friends/fellow traders [ ] 3. Telephone calls [ ] 4. MoFA [ ] 5. Others [ ] specify …….

3.3 Who are the main target consumer group for your sweet potato product? 1. Low income earners [ ] 2. Middle income earners [ ] 3. High income earners [ ] 4. Others [ ] specify……..

3.4 What is the target age group for your sweet potato product? 1. < 20 [ ] 2. 21-30 [ ] 3. 31-40 [ ] 4. 41-50 [ ] 5. > 50

3.5 Which variety do you normally sell? 1. Yellow flesh [ ] 2. Purple/mauve flesh [ ] 3. White flesh [ ] 4. Agric. Variety [ ] 5. Other [ ] specify …….

3.6 Which sweet potato variety do consumers normally demand most? 1. Yellow flesh [ ] 2. Purple/mauve flesh [ ] 3. White flesh [ ] 4. Agric. Variety [ ] 5. Other [ ] specify ……

3.7 Do customers normally differentiate among the various varieties of sweet potato used for processing? 1. Yes [ ] 2. No [ ]

3.8 What characteristics /features/qualities do consumers look out for when purchasing the sweet potato for household consumption? 1. Taste [ ] 2. Colour [ ] 3. Availability [ ] 4. Shelf life [ ] 5. Low price [ ] 6. Others [ ] specify ……

3.9a Are there any entry barriers (restrictions) to new entrants (processors)? 1. Yes [ ] 2. No [ ]

3.9b If Yes, Explain ……

3.10 How much do new entrants normally pay before they are allowed to process in this vicinity? GH¢ ……

3.11a Are you a member of a processor association? 1. Yes [ ] 2. No [ ]

3.11b If yes, how meetings were you able to attend the past year? ……..

3.11c Do you make any payments/contributions as an association? 1. Yes [ ] 2. No [ ]

3.11d If yes, how much is paid annual? GH¢…….

4.0 Other Information

4.1 Main source of capital for your sweet potato processing activities? 1. Own equity [ ] 2. Bank [ ]3. Credit union [ ] 4. Susu scheme [ ] 5. Friend and Relatives [ ] 6. Other [ ] specify ……

4.2 Where do you normally save your income from sweet potato processing? 1. No savings [ ] 2. At home [ ] 3. Bank [ ] 4. Credit union [ ] 5. Susu scheme [ ] 6. Others [ ] specify ……..

4.3 How much are you able to save in a typical business month? GH¢ ……

4.4 Have you receive credit for your sweet potato business for the past 3 years? 1. Yes [ ] 2. No [ ]

4.5 If yes, how much did you receive? GH¢ …….

4.6 What are the major constraints you face in marketing or trading you sweet potato? (Rank in order of severity)

Constraints	**Rating (1=strongly agree; 2=agree; 3=neutral; 4=disagree; 5=strongly disagree)**
Limited capital	
Inadequate storage facilities	
Poor road network to produce source	
Limited access to credit	
Low demand for product	
High transportation cost	
High perishability of raw material	
Low product price	
High market toll/tax	
High processing cost	
Poor storability of products	
Limited knowledge on sweet potato products	
Other 1…….	
Other 2…….	
Other 3…….	

5.0 Risk Information

5.1 Please indicate whether you have faced the following market risk for the past three (3) financial years

Market Level Risk	Rank (1=strongly agree; 2=agree; 3=Neutral; 4=disagree; 5=strongly disagree)	Risk Management Tool Adopted **
Sudden changes in produce prices	**[ ]**	
Sudden changes in input prices	**[ ]**	
Prolonged decline in output prices	**[ ]**	
Changes in the operations of domestic output markets	**[ ]**	
Pest and disease related risk (Post harvest/storage losses)	**[ ]**	
Transport failure	**[ ]**	
Sudden changes in the transportation cost	**[ ]**	
Changes in final consumer demand	**[ ]**	
Unreliable profit levels	**[ ]**	
Other 1……	**[ ]**	
Other 2……	**[ ]**	
Other 3……	**[ ]**	

****1=Develop a market plan; 2=Join a market co-operative; 3=Market through multiple channels; 4=Enter into sales/price contracts with buyer; 5=Spread harvest and sales over the season; 6=Diversification; 7=Other (specify……)

5.2 Which single management strategy do you employ to harness your price risk? 1. Develop a market plan [ ] 2. Diversification [ ] 3. Multiple purchase point [ ]