EXPLORING THE OPPORTUNITIES IN THE SWEETPOTATO VALUE CHAIN IN DIVERSIFYING THE NIGERIAN ECONOMY

A thesis submitted in partial fulfilment of the requirements
for the degree of Master of AgriCommerce

at

Massey University, Palmerston North, New Zealand

ADEBOWALE ADESINA

2018

ABSTRACT

Nigeria is the second largest producer of sweetpotato in the world and the largest producer in Africa. However, the total average yields of sweetpotato in Nigeria is comparatively low (2.6 tons per hectare) when compared to the rest of Africa (9.6 tons per hectare) and the world (16 tons per hectare). Furthermore, Nigeria is not ranked among the top 150 global exporters of sweetpotato, and the unavailability of markets has been reported to as one of the primary constraints to sweetpotato production in Nigeria. The aim of this study is therefore to explore the opportunities in the sweetpotato value chain that can contribute to the development of the Nigerian economy.

A structured questionnaire survey was used to obtain information from 115 farmers who were selected through non-probability convenience sampling. The findings from the structured questionnaire were complemented by an open-ended face-to-face interview. The analysis of the findings involved descriptive and inferential statistics. With the aid of the descriptive statistics, the contributing factors to the low yield of sweetpotato were identified along with the constraints to market access and market opportunities for sweetpotato nationally and internationally. The inferential analysis using the binary logistic model was used to determine the factors that had a significant influence on the yield of sweetpotato. The constraints identified that limit the production and yield of sweetpotato farmers included: inadequate market outlets to sell increased quantity of sweetpotato; high incidence of pest and diseases; scarcity of vines for planting; lack of knowledge on pest and disease management; lack of access to financial capital to buy farm inputs and carry out necessary farm activities; early spoilage of sweetpotato roots after harvest; lack of storage facilities to increase the shelf life of harvested sweetpotato; inadequate rainfall; grazing of cattle by herdsmen on sweetpotato farms; difficulty in getting farm labourers and inadequate access to farm machinery. The empirical results of the binary logistic regression indicated that farmers age, level of formal education, gender, cultivated land area, access to extension services access to market information and membership of a farmers group all had significant positive effect on the yield of sweetpotato farmers except farmers age which had a significant negative impact on the yield of farmers. Addressing the constraint to sweetpotato production and market access had the potential to increase farmers' productivity, annual income and access to the high-value market, alleviate poverty and contribute to the economic development of Nigeria.

DEDICATION

I dedicate this thesis to God Almighty. His words and promises kept me going and sustained me throughout my study. To Him, be all the glory.

ACKNOWLEDGEMENTS

"For I know the plans I have for you, says the Lord. They are plans for good and not for evil, to give you a future and a hope. (Jeremiah 29.11 TLB)". My journey to New Zealand to study for the degree of Master of AgriCommerce would not be possible if not for God, the way maker, the promise keeper, the one who knows the end from the beginning. I give thanks to God who ordered my steps to New Zealand.

To the New Zealand Government, especially the Ministry of Foreign Affairs and Trade (MFAT), I say a big thank you for providing me with a platform by awarding me a full scholarship to study for the degree of Master of AgriCommerce. I am grateful to the fantastic team (Sylvia, Jamie, Logan and Saba) at the International Student Support Office at Massey University, Palmerston North Campus, you guys are the best. Thanks for the advice and support, it made my study less stressful.

To my supervisor, Associate Professor Nick Roskruge, thank you for your time, support, constructive criticism and the open-door policy. I appreciate your care and the hangi. You have worked hard to ensure I complete my study.

I would certainly not forget to thank a fantastic lecturer; Professor. Nicola Shadbolt, who taught me, inspired me, gave me an opportunity and listened to me. My special thanks also goes to Iona McCarthy, thank you for the immense support and your pleasant smile. Also, I am grateful to all my lecturers, the staff and management of the school of Agriculture and Environment.

My special thanks to all my colleagues in the Master of AgriCommerce programme especially Adjabui, Eunice, Farai, Khalid, Tshakazulu, Felix, Harumi, Kamara and Rithy. You have all contributed to the success of my study. Also, I am grateful to Emmanuel Donkor for his encouragement and assistance with the statistical data analysis. My special thanks to amazing friends, Fadzi and Ro-Ann, I appreciate your prayers, support and contributions towards the success of my studies

My profound gratitude to the Nigerian community at Palmerston North, especially to Prof and Dr (Mrs) Adeyinka for their immense contribution towards the success of my studies. To the African student club and all my friends at Massey University, I say a big thank you for the love and support. My immense gratitude to my parents, brother, sister and relatives. Thank you for your prayers, support and encouragement.

TABLE OF CONTENTS

ABSTRACT.....i

DEDICATION.....ii

ACKNOWLEDGEMENTS..... iii

TABLE OF CONTENTS.....iv

LIST OF FIGURES ixx

LIST OF TABLES.....x

CHAPTER 1: INTRODUCTION.....1

1.1 Background.....1

1.2 Problem Statement.....6

1.3 Research Questions.....7

1.4 Research Objective 7

1.5 Specific Research Objectives.....7

1.6 Organisation Of The Thesis.....7

CHAPTER 2: LITERATURE REVIEW.....9

2.1 Description and Definition of Key Concept 9

2.1.1 Value Chain Concept 9

2.2 Value Chain and Supply Chain.....13

2.3 Value Chain Analysis 13

2.4 Constraints of Agricultural Value Chain Participation for Smallholders in Developing Countries.....16

2.4.1 Lack of Bargaining Power 16

2.4.2 The Constraints of Production.....17

2.4.3 High Cost of Transaction 17

2.4.4 Asymmetry or Lack of Information on Market.....18

2.4.5 Lack of Social Capital.....18

2.4.6 Technological Barriers.....19

2.4.7 Regulatory Barriers 19
2.5 Value Chain Upgrading 19
2.5.1 Improving the Operational Efficiency of the Business 20
2.5.2 Upgrading the Linkages Within the Chain 21
2.5.3 Upgrading the Value Chain Governance 22
CHAPTER 3: THE SWEETPOTATO ECONOMY OF NIGERIA 24
3.1 Historical Background 24
3.2 Sweetpotato Cultivation in Nigeria 24
3.3 Sweetpotato Consumption, Utilization and Importance 28
3.4 Sweetpotato Trade in Nigeria 32
3.4.1 Prices 33
3.4.2 Marketing Systems 33
3.5 Sweetpotato Production Constrains in Nigeria 35
3.5.1 Pest and Disease Attacks 35
3.5.2 Poor Access to Extension Agents and Adoption of Improved Technologies 38
3.5.3 Fertilizer Application 39
3.5.4 Weed Control 39
3.5.5 Poor Storage Practices 40
3.5.6 Limited Access to Credit 40
CHAPTER 4: RESEARCH METHODOLOGY 42
4.1 Research Strategy 42
4.2 Sampling Procedure and Site Selection 43
4.3 Description of the Study Area 44
4.4 Design of Data Collection 46
4.4.1 Secondary Data 46
4.4.2 Primary Data 46
4.4.2.1 Questionnaires 46

4.5 Data Analysis 48
4.5.1 Binary Logistic Regression 49
4.6: Model Specification, Description of Variables, and Hypothesized Signs 52
4.6.1 Description of Independent Variables and Hypothesized Signs 52
4.6.1.1 Farmers Demographics 52
4.6.1.2 Farm and Production Characteristics 54
4.6.1.3 Marketing Features 55
4.6.1.4 Institutional Factor 55
4.7 Ethical Considerations 56
4.8 Limitation Of The Study 56
CHAPTER 5: DESCRIPTIVE STATISTICS OF THE DATA 57
5.1 Introduction 57
5.2 Farmer Demographics 57
5.2.1 Age Of Farmer 57
5.2.2 Gender 58
5.2.3 Level of Formal Education 58
5.2.4 Sweetpotato Farming Experience 59
5.2.5 Engagement in Off-Farm Employment 60
5.3 Farm and Production Characteristics 60
5.3.1 Cultivated Land Area and Land Availability 60
5.3.2: Planting and Harvesting Period 62
5.3.3 Irrigated and Rainfed Production 63
5.3.4 Variety of Sweetpotato Planted 64
5.3.5 Information Sources on Sweetpotato Varieties 65
5.3.6 Acquisition of Sweetpotato Vines Planted 66
5.3.7 Fertilizer Application 67
5.3.8 Pesticide and Herbicide Application 68

5.3.9 Fresh Root Yield 69
5.3.10 Hired Labour and Activities on Sweetpotato Farms 70
5.3.11 Constraints to the Production of Sweetpotato 71
5.4 Marketing of Sweetpotato 74
5.4.1 Marketing Channel of Sweetpotato 74
5.4.2 Farmers Mode of Communication with Buyers 75
5.4.3 Period of Payment 76
5.4.4: Prices of Sweetpotato Per Kilogram 77
5.4.5: Cost of Transporting Sweetpotato Per Kilogram 77
5.5: Institutional Factors 78
5.5.1: Access to Extension Services 78
5.5.2: Access to Credit 80
5.5.3: Access to Market Information 81
5.5.4: Membership of Farmers Group 82
5.6: Farmers Perception of Export Market 83
CHAPTER 6: DATA ANALYSIS AND DISCUSSION 86
6.1. Introduction 86
6.2. Factors Affecting the Yield of Sweetpotato Farmers 86
6.3: Discussion 87
6.3.1 Farmer Demographics 87
6.3.2. Farm and Production Characteristics 90
6.3.3. Marketing Features 91
6.3.4. Institutional Variables 91
CHAPTER 7: SUMMARY, CONCLUSION AND SUGGESTION FOR FUTURE RESEARCH 944
7.1: Summary and Conclusion 94
7.2 Suggestions for Future Research 100

REFERENCES 101
APPENDICES 120
Appendix 1: Research Questionnaire.....120
Appendix 2: Ethics Evaluation and Approval 125
Appendix 3: Information Sheet for Data Collection.....126
Appendix 4: Participant Consent Form.....128

LIST OF FIGURES

Figure 1.1: Nigeria Sweetpotato Production and Yield, 2000-2014.....2

Figure 1.2: Nigeria Sweetpotato Yield Estimates, 1990-2014 4

Figure 2.1: Actors and Activities in a Food value chain.....10

Figure 2.2: Horizontal and Vertical links in a simple value chain.....11

Figure 2.3: Basic structure of stakeholders in an agricultural value chain 12

Figure 2.4: Value Chain Analysis Framework 16

Figure 3.1: Map of Nigeria showing Agro-ecological Zones 26

Figure 3.2: Major Importers of sweetpotato in 2017 and their share in US dollars 32

Figure 3.3: Sweetpotato value chain network in Nigeria.....34

Figure 3.4: The developmental stages of the sweetpotato weevil (*Cylas puncticollis)*: (A) egg, (B) larva, (C) pupae, and (D) adult 36

Figure 3.5: Symptoms of sweetpotato weevil *(Cylas puncticollis)*: (A, B) larvae and adult damage on tubers, (C, D) larvae damage on stems, and (E, F) adult damage on leaves 37

Figure 5.1: Flow of sweetpotato from the producer to the consumer.....75

LIST OF TABLES

Table 1.1: Top 5 Producers of Sweetpotato in the World (2010-2016).....2

Table 1.2: Top 10 exporters of sweetpotato, 2012-2016 5

Table 2.1: Potential benefits of upgrading linkages for small and medium enterprises, local communities and large firms.....23

Table 4.1: Binary logistic regression variables.....53

Table 5.1. Age of farmers 57

Table 5.2: Gender of farmers.....58

Table 5.3: Educational level of farmers.....59

Table 5.4: Sweetpotato farming experience.....59

Table 5.5: Off-farm employment of farmers 60

Table 5.6: Cultivated sweetpotato land area 61

Table 5.7: Land scarcity experience 61

Table 5.8: Period of planting sweetpotato 62

Table 5.9: Period of harvesting.....63

Table 5.10: Water dependency of farmers.....63

Table 5.11: Varieties of sweetpotato planted.....65

Table 5.12: Information sources on the best variety.....65

Table 5.13: Acquisition of sweetpotato vine cuttings.....66

Table 5.14: Source of the unpurchased vines 66

Table 5.15: Source of the purchased vines 67

Table 5.16: Application of organic fertilizer 67

Table 5.17: Application of inorganic fertilizer 68

Table 5.18: Application of pesticide.....68

Table 5.19: Application of herbicide 69

Table 5.20: Yield of sweetpotato.....69

Table 5.21: Labour hire for sweetpotato farming 70
Table 5.22: Activities of hired labour for sweetpotato farming 70
Table 5.23: Constraining factors to sweetpotato production 74
Table 5.24: Marketing channel of sweetpotato 75
Table 5.25: Farmers mode of communication with buyers 76
Table 5.26: Period of payment 77
Table 5.27: Prices of sweetpotato per Kilogram (Kg) 77
Table 5.28: Cost of transporting sweetpotato per kilogram (kg) 78
Table 5.29: Access to extension services 79
Table 5.30: Access to extension services 81
Table 5.31: Access to market information 82
Table 5.32: Farmers group membership 82
Table 5.33: Farmers group area of specialization 83
Table 5.34: Advantages of selling sweetpotato to export market 84
Table 5.35: Constraints of selling sweetpotato to the export market 85
Table 5.36: Perception of government roles in facilitating sweetpotato exports 85
Table 6.1. Determinants of the yield of sweetpotato farmers 88

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

Nigeria is the most populous country in Africa and the seventh most populous nation in the world (Population Reference Bureau, 2016). With a population of about 187 million people as at 2016; by 2050 Nigeria's population is estimated to be 398 million making it the fourth most populated nation in the world after China, India and USA (Population Reference Bureau, 2016). The discovery of petroleum (crude oil) in Nigeria in the 1960s and the flourishing export of petroleum from the country to the international community has led to the country having an over-dependence on petroleum and consistent neglect of the agricultural sector which was the previous mainstay of the economy (Anyaehie & Areji, 2015). The exportation of petroleum accounts for over 90% of Nigeria's export earnings and over 80% of the federal government revenue and budget (Anyaehie & Areji, 2015).

Unfortunately, due to the fall in global oil prices, the excessive reliance of Nigeria on crude oil for its export earnings has plunged the country into an economic recession (Eneji, Dimis, & Rose, 2017). The rate of unemployment in Nigeria is rising, inflation is sky-rocketing, and the prices of crude oil are falling considerably, following the drop in prices from a peak of $US114 per barrel in July 2014 to $US33 per barrel in January 2016 (Salami, 2015). Such exogenous shocks that arise as a result of over-dependence on one product have severe consequences on the sustainable growth and development of a nation (Jooji, Okwara, & Oguchi, 2017). These consequences include hunger, lack of jobs and hyperinflation (Adebayo & Ojo, 2012), with the inflation rising from 7.2% in 2014 to 18.7% in 2017 (NBS, 2017a). Based on these harrowing economic factors, Nigeria must diversify its economy. Diversification of the Nigerian economy would undoubtedly reduce the level of poverty through employment creation (Jooji et al., 2017). The relative economic stability of a country is often connected to the extent of the diversification of its sources of income (Gelb, 2010).

Nigeria is the largest producer of sweetpotato (*Ipomoea batatas)* in Africa and second largest producer in the world with an approximated average production (2010-2014) of 3.67 million metric tonnes harvested from 1.38 million hectares of land (Figure 1.1). The top five global producers are China, Nigeria, United Republic of Tanzania, Indonesia and Uganda as shown in Table 1.1 (FAOSTAT, 2017).

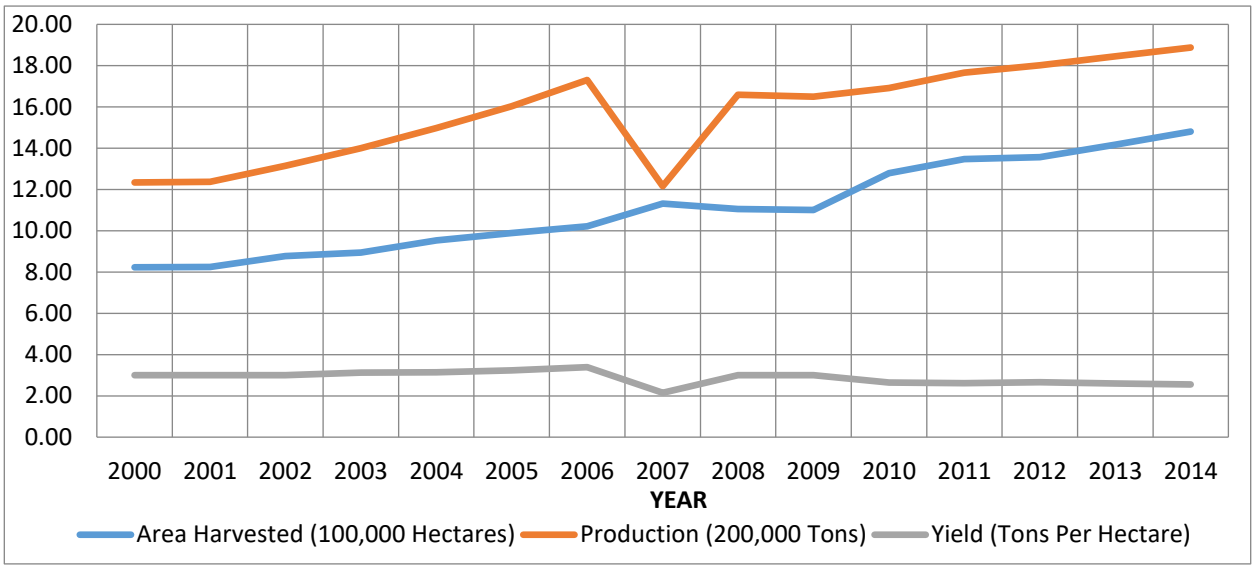


Figure 1.1: Nigeria Sweetpotato Production and Yield, 2000-2014

Source: (FAOSTAT, 2017a)

Table 1.1: Top 5 Producers of Sweetpotato in the World (2010-2016)

RANK	COUNTRIES	PRODUCTION (TONS)	WORLD SHARE (%)
	World	103,764,652	
1	China	72,036,598	69.4%
2	Nigeria	3,674,808	3.54%
3	United Republic of Tanzania	3,323,435	3.20%
4	Indonesia	2,295,454	2.21%
5	Uganda	1,919,710	1.85%

Source: (FAOSTAT, 2017)

Sweetpotato is one of the most valuable and versatile food crops in the world (Olatunde, Henshaw, Idowu, & Tomlins, 2016). It is ranked as the seventh most important staple food crop in the world, with a total production of about 104 million tonnes in 2016 (FAO, 2017; FAOSTAT, 2017). Sweetpotato has gained global prominence as a result of its short growth cycle and ability to survive in a wide range of climatic conditions and water stress soils (Sugri, Maalekuu, Gaveh, & Kusi, 2017; Zamora, de Guzman, Saguiguit, Talavera, & Gordoncillo, 2013).

Sweetpotatoes are important food crops for humans and feed crops for animals (Huang et al., 2017). The roots of sweetpotato are highly nutritious and commonly consumed, and the nutritional composition of the leaf is comparable to other green leafy vegetables (Johnson &

Pace, 2010). Ishida et al. (2000) found the leaves to contain a significant amount of protein, thus exhibiting a high amino acid score. They are the essential industrial raw material used for the manufacture of ethanol, starch, liquid glucose and flour (Huang et al., 2017; Woolfe, 1992).

Sweetpotatoes can be used as a substitute for cereals such as wheat, rice and maize for which Nigeria is a major global importer (Vaughan, Afolami, Oyekale, & Ayegbokiki, 2014; Woolfe, 1992). Nigeria was the ninth largest global importer of wheat in 2016 (ITC, 2017). The country spent approximately US$ 6.8 billion on wheat importation, US$3.16 billion on rice importation and over US$ 210 million on maize importation between 2012-2016 (ITC, 2017a).

Such immense food imports usually hurt foreign reserves and lead to budgetary depletion (Davies, 2009) as cited in (Adebayo & Ojo, 2012). Enormous imports of food commodities such as wheat, rice and maize are said to be hurting the Nigerian economy and amplifying poverty (Astou, 2015). The utilisation of sweetpotato as a substitute for cereals such as wheat, rice and maize can assist in minimising foreign exchange spending on food importation and help generate employment (Woolfe, 1992). This is particularly true for countries with a comparative advantage in producing sweetpotato (Woolfe, 1992).

Sweetpotatoes are known to be adaptable to unfavourable environmental conditions (Bergh, Orozco, Anderson, & Gugert, 2012; Woolfe, 1992). They are specifically adaptable to low or irregular rainfall, tolerate high rainfall and have a low soil nutrient requirement (Woolfe, 1992). They have the capability of producing reasonable yields in agro-ecological regions where most crops would fail (Woolfe, 1992). Sweetpotato have a short maturity period of about 3 – 6 months depending on the variety, require fewer labour inputs than crops such as wheat and can help in increasing food security in times of famine and drought, particularly for displaced persons in post-conflict areas (Bergh et al., 2012). They have a long industrial chain, high market demand and great potential for growth (Huang et al., 2017). Despite these benefits, sweetpotato has received comparatively little attention in Nigeria (Omoare, Fakoya, & Oyediran, 2015). This is possibly because of low prioritisation by the government due to insufficient information on the potential of the crop in contributing to the development of the Nigerian economy (Omoare et al., 2015).

Although, Nigeria is the second largest producer of sweetpotato in the world (FAOSTAT, 2017), the estimated total yields of sweetpotato in Nigeria are comparatively low (2.6 tons per hectare) when compared with the rest of Africa (9.6 tons per hectare), China (22 tons per hectare) and the world (16 tons per hectare) (Bassey, 2017; FAOSTAT, 2017). These figures reflect a significant yield gap. Figure 1.2 shows that there has been a notable decline over the years in the yield of sweetpotato in Nigeria. The yield of sweetpotato was 5.1 metric tons per hectare (MT/Ha) in 1990. However, it trended down to 2.5 MT/Ha in 2014.

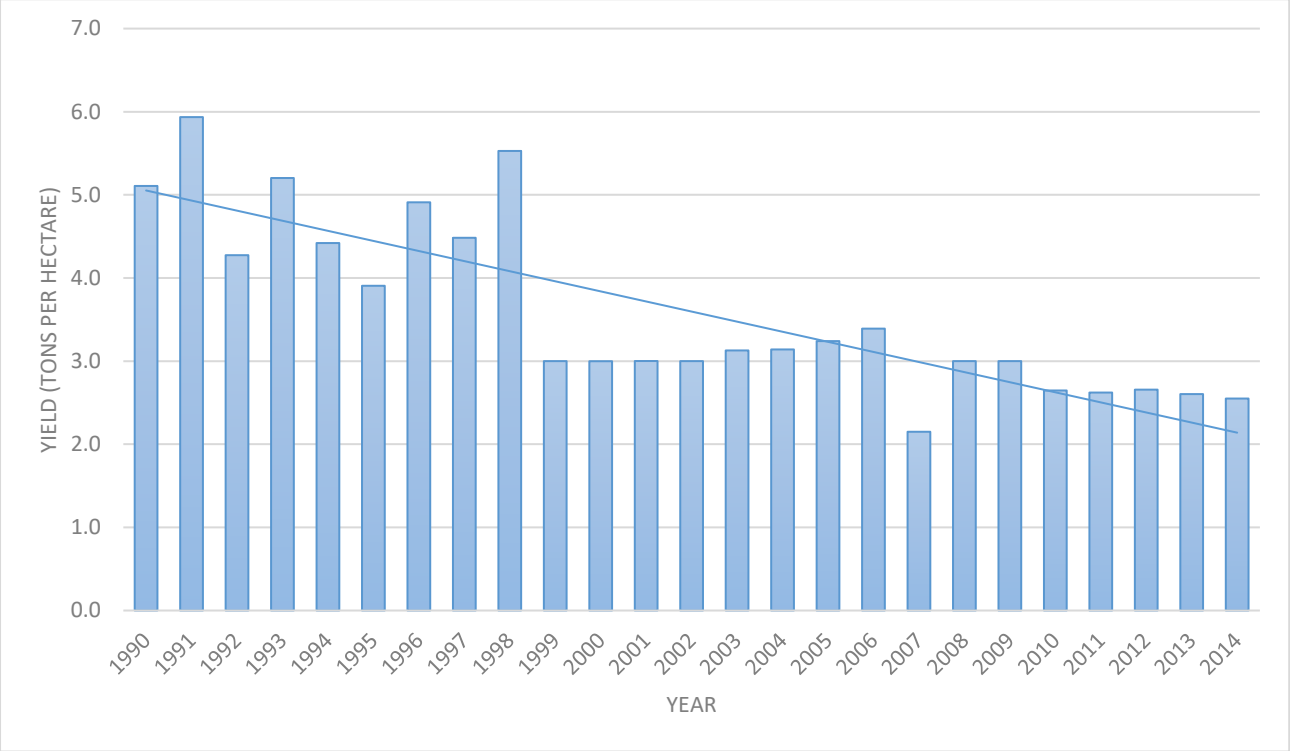


Figure 1.2: Nigeria Sweetpotato Yield Estimates, 1990-2014

Source: (FAOSTAT, 2017a)

Also, Nigeria is not ranked among the top 150 countries that exported sweetpotato between 2012 and 2016, which has a global export value of over US$1.5 billion between 2012 and 2016 (Table 1.2) (ITC, 2017b). This reflects that Nigeria's export market for sweetpotato has not been well exploited. Several researchers have cited the unavailability of markets for the sale of sweetpotato as one of the constraints to sweetpotato production in Nigeria (Fawole, 2007; Mbanaso, Agwu, Anyanwu, & Asumugha, 2012). Exports play a significant role in economic development because they can enhance domestic production and increase the supply of foreign exchange (Köksal, 2008).

Table 1.2: Top 10 exporters of sweetpotato, 2012-2016

Rank	Exporters	Exported value in 2012 US$1000	Exported value in 2013 US$1000	Exported value in 2014 US$1000	Exported value in 2015 US$1000	Exported value in 2016 US$1000	Total Exported value (2012-2016) US$1000
	World	**208,671**	**235,595**	**282,273**	**337,283**	**442,513**	**1506335**
1	United States of America	80,189	96,494	111,875	140,696	172,345	601599
2	Netherlands	14,922	20,083	35,200	37,148	50,625	157978
3	Spain	27,456	14,205	16,358	17,682	22,985	98686
4	Viet Nam	12,732	16,307	19,051	24,374	25,178	97642
5	Egypt	9,116	10,616	13,782	15,664	17,298	66476
6	China	10,561	11,924	8,466	9,281	22,809	63041
7	Indonesia	8,565	8,410	8,371	11,483	7,583	44412
8	United Kingdom	3,168	7,011	6,184	8,794	15,456	40613
9	Lao People's Democratic Republic	2,966	4,527	2,906	3,249	19,017	32665
10	Honduras	3,498	3,816	7,479	7,677	7,794	30264

Source: (ITC, 2017b)

According to the Nigerian Bureau of Statistics, over 45% of the total youth labour force, aged between 15 to 34 years are unemployed or underemployed (NBS, 2017b). The production of sweetpotato offers significant potential for creating jobs and increasing income in Nigeria (Adewumi & Adebayo, 2008).

The processing of agricultural products such as sweetpotato into different innovative products will not only promote market acceptability but will also increase the value of the product which will invariably generate more revenue and expand the horizon of human involvement (Olife, Jolaoso, & Onwualu, 2013). The activities in the sweetpotato value chain involve production, processing, utilisation and marketing and the actors include the producers/farmers, processors, marketers/exporters, researchers, government agencies and the consumers (Ugonna, Jolaoso, & Onwualu, 2013).

1.2 PROBLEM STATEMENT

The fall in the prices of crude oil in the international market from $US114 per barrel in 2014 to $US33 per barrel in 2016 made it difficult for the Nigerian Government, which is highly dependent on the exportation of petroleum, to finance the nation's budget. The overdependence of the country on the earnings from petroleum plunged the country into an economic recession resulting in the loss of jobs, high rate inflation rate and an increased rate of poverty. Hence, it is germane for the country to expand its range of economic activities and diversify its economic base.

Nigeria is a major importer of food commodities such as wheat, rice and maize. The importation of these food commodities is said to be hurting the Nigerian economy by having an adverse effect on its foreign reserves, depleting its budget and amplifying poverty. Sweetpotato has been reported to be a suitable substitute for wheat, rice and maize for countries which have a higher comparative advantage in producing the crop (Adeleke & Odedeji, 2010; Bibiana, Grace, & Julius, 2014; Trejo-González, Loyo-González, & Munguía-Mazariegos, 2014; Woolfe, 1992).

Even though Nigeria is the second largest producer of sweetpotato in the world, the current production yield per hectare is very low when compared to the rest of Africa and the world and its export market has not been well exploited (FAOSTAT, 2017; ITC, 2017b). This reflects there are potential market opportunities which could assist in creating more jobs and generating more foreign earnings. Amidst the high rate of unemployment and a dwindling economy due to low foreign revenues from petroleum exports, it is therefore essential to explore the opportunities in the sweetpotato value chain that can be utilised in diversifying its economy.

1.3 RESEARCH QUESTIONS

In view of investigating the opportunities in the sweetpotato value chain that can contribute to the diversification of the Nigeria economy, the following questions are asked.

RQ1: What are the factors that influence the yield of sweetpotato farmers in Nigeria?
RQ2: What are the opportunities in the sweetpotato value chain that can be effectively utilized in Nigeria?

1.4 RESEARCH OBJECTIVE

The overall objective of this research is to explore the opportunities in the sweetpotato value chain that can contribute to the growth of the Nigerian economy.

1.5 SPECIFIC RESEARCH OBJECTIVES

The specific objectives of this research are:

I. To determine and analyse the factors that influence the yield of sweetpotato in Nigeria.
II. To identify ways in which the yield can be increased.
III. To identify the constraints to market access
IV. To identify the market opportunities for sweetpotato nationally and internationally.

1.6 ORGANISATION OF THE THESIS

This thesis is organised into seven chapters. Chapter 1 is the introductory chapter which presents the background of the study, the research problem, the research questions, and the research objectives. Chapter 2 reviews the literature that is central to the agricultural value chain. The chapter describes the concept of value chain, the constraints of agricultural value chain participation for smallholder farmers in developing countries, and how the value chain can be upgraded to facilitate the participation of smallholder farmers. Chapter 3 reviews the literature on the sweetpotato value chain in Nigeria. The chapter gives a description of the cultivation, the consumption, utilisation, and importance of sweetpotato in Nigeria. It also describes the sweetpotato trade and marketing systems in Nigeria and presents the constraints to sweetpotato production in Nigeria. Chapter 4 presents the research methodology employed to achieve the objectives of the research. The chapter describes the research strategy, the sampling procedure, the study area, data collection methods and analysis of the primary data collected. Chapter 5 presents the descriptive statistics of the data. The chapter described the demographics of the farmers, farm and sweetpotato production characteristics, marketing

channel of sweetpotato, institutional factors that affect farmers' incomes, production and marketing of sweetpotato and farmers perceptions of the export market. In Chapter 6, the inferential statistics of the factors that influenced the yield sweetpotato are presented and described. Finally, Chapter 7 presents the main conclusions relative to the research question from the study and suggestions for future research.

CHAPTER 2: LITERATURE REVIEW

2.1 DESCRIPTION AND DEFINITION OF KEY CONCEPT

2.1.1 VALUE CHAIN CONCEPT

The concept of "value chain" was first introduced by Michael Porter (Porter, 1985) and has since been studied and described by different researchers from different perspectives (Antoniou, Levitt, & Schreihans, 2012; Kaplinsky & Morris, 2001; Kumar & Rajeev, 2016; Webber & Labaste, 2009). Porter (1985) defines value chain as the series of activities performed by an institution to design, produce, support and deliver a product to the market. Value chain encompasses the full range of activities which are required to bring a product from its conception, through the different phases of production (involving supply of input from various producer services and a combination of physical transformation) to delivery of the product to its final market or consumers locally, nationally or internationally (Kaplinsky & Morris, 2001; Kumar & Rajeev, 2016).

Value chain is a "key framework for understanding how inputs and services are brought together and then used to grow, transform, or manufacture a product; how the product then moves physically from the producer to the customer; and how value increases along the way" (Webber & Labaste, 2009, p. 1). The range of activities in a value chain must be productive (i.e. value-added) and supports the end use of the product (Sturgeon, 2001). The primary focus of the value chain is the end product and the activities required to produce it (Peppard & Rylander, 2006).

The productive activities that support the end product are typically through innovation in processes or products, as well as marketing (Webber & Labaste, 2009). The objective of innovation in the agricultural value chain is to make production and markets more efficient by improving access to information, inputs and services (Methu, Nyangaga, Waweru, & Akishule, 2013). Therefore, innovation in agricultural value chain facilitates new forms of production, technologies, labour processes, logistics and the introduction of organisational networks and relations (Trienekens, 2011). These innovations are the building blocks of competitive advantage in a value chain (Porter, 1985).

Value chain is a strategic alliance of independent organisations; it is demand driven rather than supply driven; it is responsive to the changing needs of the consumers; it offers business security with other members within the chain; it involves high level of trust between parties to

the alliance, and it requires the commitment of all parties within the chain in controlling the factors that affect product quality and consistency (Hobbs, Cooney, & Fulton, 2000).

The strategic alliance in a value chain involve several stakeholders (input suppliers, farmers, processors, exporters, policy makers and buyers) which are engaged in carrying out specific activities required to bring a product from its conception to its final use as shown in Figure 2.1 (Hawkes & Ruel, 2011; Kaplinsky & Morris, 2001). The chain is an interdependent network of actors and activities which are linked with each other (Porter, 1985). The linkage arises when the way an activity is performed affects the effectiveness of the other activities (Porter, 1985).

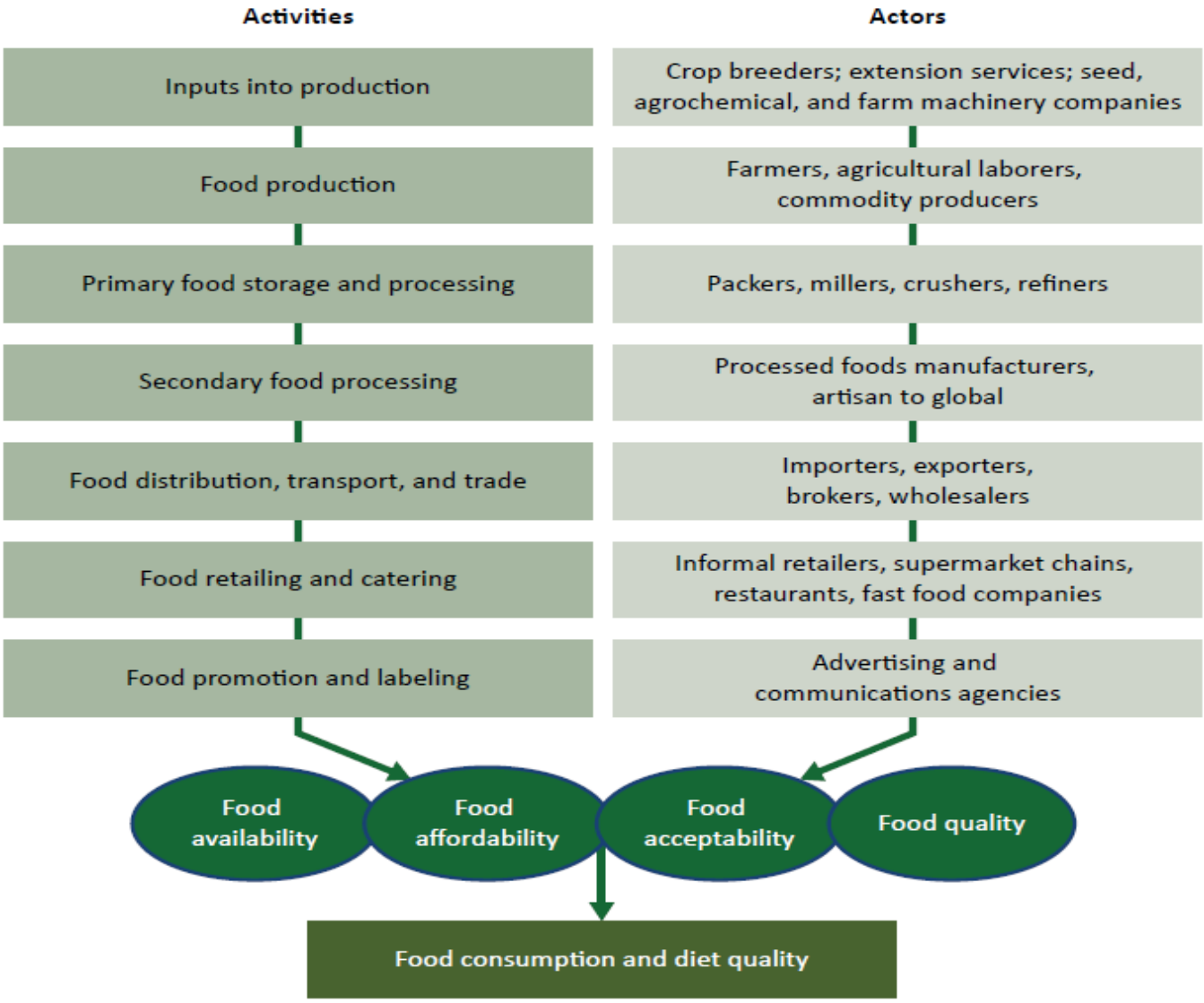


Figure 2.1: Actors and Activities in a Food value chain

Source: (Hawkes & Ruel, 2011)

The interdependent network/linkage is made up of vertically and horizontally related companies (as shown in Figure 2.2). These companies jointly work or aim at providing products or services to the market (Trienekens, 2011). Therefore, value chain does not only involve product transformation processes through value addition but also the interaction between actors both vertically and horizontally (Trienekens, 2011). The approach to value chain stimulates dialogue between stakeholders as they negotiate their common interest, which helps in identifying interventions in improving the functioning of the chain (Bolo, Lorika, & Obonyo, 2011).

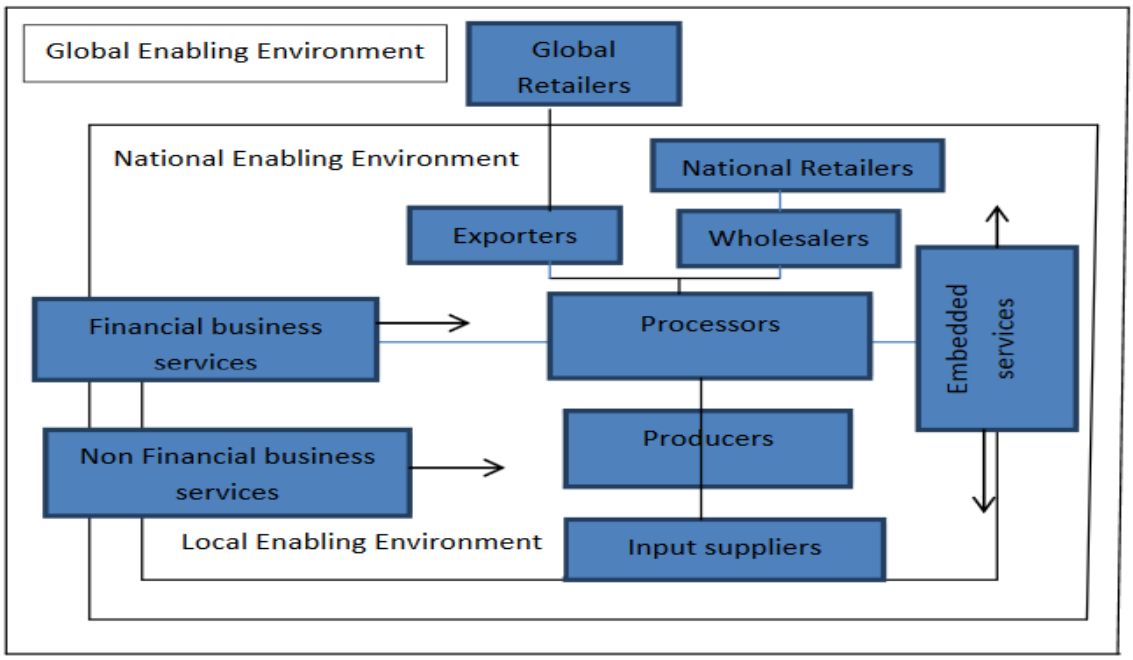


Figure 2.2: Horizontal and Vertical links in a simple value chain

Source: (Kula, Downing, & Field, 2006)

The fundamental success of a value chain is attributed to the relationship between members and the attitude of the participants (Ilyas, Banwet, & Shankar, 2007). When the relationships amongst the participants are well managed, the linkages between them can be a vital source of competitive advantage (Pathania-Jain, 2001). When managed carefully, such linkages can also be a vital source of competitive advantage (Porter, 1985). The linkages can offer enormous potential for improving farming practices, increasing income and employment (Bammann, 2007).

According to Methu et al. (2013), as shown in Figure 2.3, three important stakeholders should interact with each other to ensure the success of the value chain. These members include:

1. Value chain business actors: These are business actors in the chain who are directly related. These include providers of raw materials (input providers) who supply the producers (farmers), who then deliver their product to the processors, distributors and marketers (wholesalers, retailers, exporters) who finally sell to the final consumers.
2. Value chain supporters: These are members of the chain who may not necessarily interact with the product but provide services that add value to the product, such as; researchers, technical agencies, group associations.
3. Value chain enablers: They are authorities in the chain that are involved in the provision of enabling environment which enhance the operation for the business actors. The value chain enablers provide the following:

- Infrastructural services: Such as roads and transportation, energy supply and water supply.
- Financial services: Such as credits and risk insurance.
- Policy and regulatory framework: market and trade regulations.
- Marketing and business development services: Market intelligence, market information, technical and business training and facilitating linkages of producers and buyers.
- Production services: Genetic and production hardware from research, technological services.

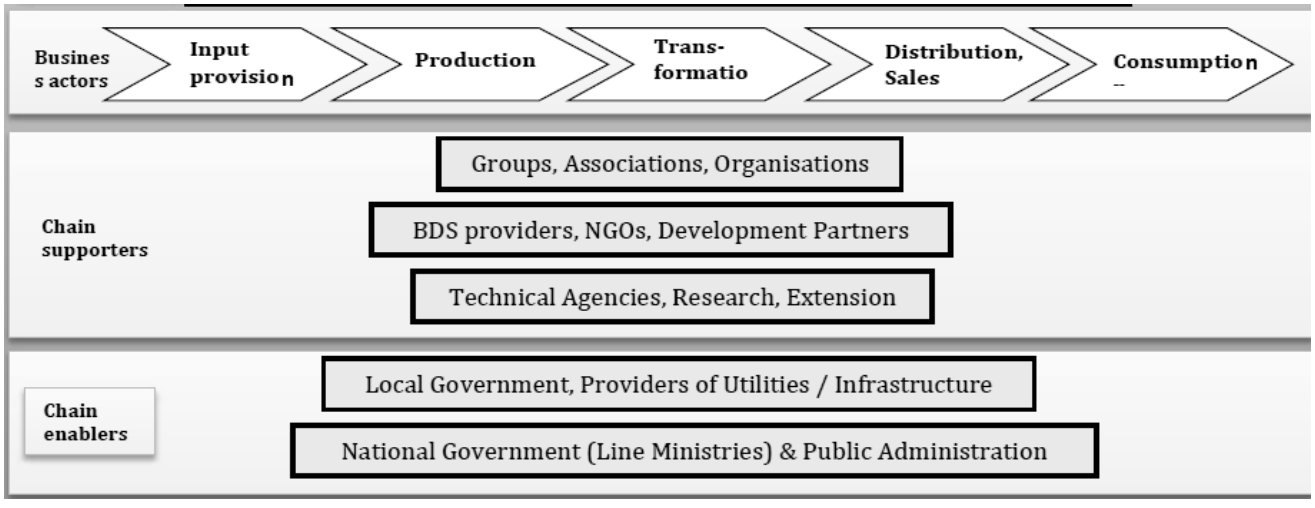


Figure 2.3: Basic structure of stakeholders in an agricultural value chain

Source: (Methu et al., 2013)

2.2 VALUE CHAIN AND SUPPLY CHAIN

A "value chain" has resemblance with "supply chain" such that either of the chains is involved with the provision of goods or services from one point to the final consumers or users (Biénabe, Rival, & Loeillet, 2017; Handfield & Nichols, 2002; Kordİtabar, 2015; Regmi & Gehlhar, 2005). As a result, there is a tendency to use value chain and supply chain interchangeably (Ilyas et al., 2007). However, there are fundamental concepts which separate value chain from supply chain and they should not be confused with each other (Ilyas et al., 2007).

Supply chains are "mechanisms for transmitting signals from consumers to food manufacturers, as well as delivering products from the farm to the consumer's table" (Regmi & Gehlhar, 2005, p. 2). It involves every logistical activity in producing and delivering a product or service, "from the supplier's supplier to the customer's customer" (Cooper, Lambert, & Pagh, 1997). The key focus of supply chain is the logistical transfer of products or services to the customer while reducing friction (delays, imbalances and blockage) and improving customer satisfaction at a lower transaction cost (Webber & Labaste, 2009).

By contrast, value chain involves the strategic alliance between different independent organisations within the same network or chain (Humphrey & Navas-Alemán, 2010). It encompasses the full range of value-added activities which are required to bring a product from its conception to delivery of the product to its final market or customer (Kaplinsky & Morris, 2001). The key focus of any value chain are linkages that generate value for the final market or customer (Webber & Labaste, 2009). The value-added activities in a value chain include; designing, producing, supporting, as well as the logistical activity of delivering a product to the market or customer (Porter, 1985). This makes supply chain a subset of value chain because value chain has a broader scope that incorporates supply chain (Ilyas et al., 2007).

2.3 VALUE CHAIN ANALYSIS

Value chain analysis facilitates the assessments of the linkages between and amongst members of the chain (Rich, Baker, Negassa, & Ross, 2009). The approach to value chain analysis is centred on analysing the structure of the chain, assessing the typologies and the locations of the chain actors, the linkages amongst them and the dynamics of exclusions and inclusions (Henriksen, Riisgaard, Ponte, Hartwich, & Kormawa, 2010). The approach analyses the factors influencing performance, regulatory and policy environment, interactions between and amongst chain actors and the level and quality of support services. The approach provides a framework to analyse the nature and factors of competitiveness in which small-scale farmers

and others actors in the chain can participate (Rich et al., 2009). It is a "potent diagnostic tool that can identify critical issues and blockages for specific target groups and provide a framework for interventions to change the circumstances of the resource-poor" (Mitchell, Coles, & Keane, 2009, p. 2).

Value chain analysis can be employed in formulating competitive strategies (Ensign, 2001). These strategies are necessary because they help business actors to exploit market opportunities through specialisation, economies of scale, competitive and comparative advantage as well as technological, institutional and organisational changes (Methu et al., 2013). It also helps the business enterprise to decide on any activity they should stop or any activity they should adopt which is a central part of the strategic plan of value chain analysis (Schmitz, 2005).

The analysis provides understanding required for designing and implementing suitable development programs and policies that will improve production fragmentation and enhance market participation (Rich et al., 2009). Understanding how producers are linked to final markets may stimulate their ability to benefit from participating in global markets (Kaplinsky & Morris, 2001). It will also inform local producers to consider the differences between global buyers and the precise need of a particular buyer who supplies the export market (Schmitz, 2005).

The approach of value chain analysis is useful for poor producers who are trying to enter into the export market in a manner that will provide sustainable income growth (Kaplinsky & Morris, 2001). It can be used in several developmental interventions as an important entry point for engaging small-scale farmers, individually or collectively, in high-value export markets (Rich, Ross, Baker, & Negassa, 2011). The United Nations Industrial Development Organization (UNIDO), an agency responsible for promoting industrial development for poverty reduction, admitted that support to value chain development could help drive job creation, poverty alleviation, sustainable development, increased export competitiveness and economic diversification (Humphrey & Navas-Alemán, 2010).

In conducting a value chain analysis, the first step is for the analyst to break down the key activities of the business institution according to the activities required in the chain framework. The next step is to determine the potential for increasing efficiency by adding value along the chain. Finally, it is important for the analyst to spotlight the activities that would facilitate the business enterprise to attain competitive advantage (Mmasa & Msuya, 2012). Porter (1985) also argued that competitive advantage could not be understood by looking at a firm as a whole

because, it emanates from the many activities a firm performs in designing, producing, marketing, distributing and supporting its product. In order to understand the structure and functioning of a value chain, it has to be broken into its constituent parts

The approach of Kaplinsky and Morris (2001) for conducting a value chain analysis has four main steps. The first step involves mapping out the business actors involved in the production, marketing, distribution and sales of a specific product. This describes the actors, flow of goods, profits and cost structures, employment characteristics, destination and quantity of domestic and foreign sales (Kaplinsky & Morris, 2001).

The second step focuses on the governance of the chain. The analysis of value chain governance is important because it illuminates the vision of policymakers, to see how local enterprise fits into the global economy (Schmitz, 2005). This further allows for policies aimed at enhancing efficiency, correcting distortion in distribution, improving market access and increasing value added (Rich et al., 2009).

The third step assesses the opportunities for upgrading within the chain. Upgrading involves targeting an improved regulatory and business environment (Henriksen et al., 2010), innovative capacity and profitability of actors (Rich et al., 2009).

The last step involves identifying how benefits are distributed along the chain. That is, who benefitted from participating in the chain and who could benefit from institutional alignment and increased support (Kaplinsky & Morris, 2001). Identifying how benefits are distributed along the chain can facilitate individual producers and countries to increase their portion of the gains (Kaplinsky & Morris, 2001).

Trienekens (2011) proposed a framework for a value chain analysis (shown in Figure 2.4). The framework comprises three main components; describing the value chain constraints, identifying the opportunities to improve the value chain and then describing the options for upgrading the value chain.

Figure 2.4: Value Chain Analysis Framework

SOURCE: (Trienekens, 2011)

2.4 CONSTRAINTS OF AGRICULTURAL VALUE CHAIN PARTICIPATION FOR SMALLHOLDERS IN DEVELOPING COUNTRIES

Several researchers have identified constraints to agricultural value chains in developing countries (Humphrey & Navas-Alemán, 2010; Maître d'Hôtel, Lemeilleur, & Biénabe, 2011; Trienekens, 2011; Webber & Labaste, 2009). These constraints include; limited production and productivity risk (Maître d'Hôtel et al., 2011), limited access to market (Henriksen et al., 2010), lack of market information (Humphrey & Navas-Alemán, 2010), poor physical infrastructure (Kaplinsky & Morris, 2001), lack of social capital (Maître d'Hôtel et al., 2011), lack of innovation and knowledge (Webber & Labaste, 2009), inadequate access to credits and equipment (CFS, 2015), high production and marketing risk (Maître d'Hôtel et al., 2011), weak bargaining power (Ouma & Jagwe, 2010) and low level of trust (Van der Heijden, 2010).

2.4.1 LACK OF BARGAINING POWER

Bargaining power is the relative ability of various actors in the value chain to obtain favourable terms from their business transaction (Maître d'Hôtel et al., 2011). The access of smallholders to a limited number of stable markets to sell their products may limit their ability to obtain

favourable terms for their transaction (M4P, 2008). Biénabe, Coronel, Le Coq, and Liagre (2004) argued that the bargaining power of smallholders is weak because of inadequate access to market information and limited access to credit which prevents them from selling their produce at the most profitable period. Also, because smallholders individually produce small quantities, it can make them vulnerable to abuse by buyers (Van der Heijden, 2010). Their products are mostly under-valued, and they receive a comparatively smaller share added value created in the value chain because of their lack of bargaining power (Bijman, Ton, & Meijerink, 2007).

2.4.2 THE CONSTRAINTS OF PRODUCTION

In order to produce a product for the market, production factors, such as land, labour and capital assets are required (Biénabe et al., 2004). One of the characteristics of smallholder farmers is a low capability in the production factors, which often affect the way they benefit from the opportunities in agricultural markets (Biénabe et al., 2004). As a result of their low capability in production factors, they produce low quantities of products that are often of poor quality which are neglected or undervalued by the output market (DAFF, 2012). The increasing concern about food safety and an increase in the demand for high-quality food make it difficult for smallholders to participate in the high-value market because they are unable to meet the quality standards (Baloyi, 2010).

Also, farmers are highly susceptible to production risk as a result of their low resource capacity (Maître d'Hôtel et al., 2011). Production risk are related to climate variability and extreme weather conditions, such as drought and excessive rainfall (Haile, 2005). Smallholders are unable to avert these risks which affect their productivity potential, due to their low capacity in production factor (Maître d'Hôtel et al., 2011).

2.4.3 HIGH COST OF TRANSACTION

Transaction cost is the cost incurred while carrying out any exchange, that is, the array of costs associated with buying, selling and the transfer of goods and services (Jaffee & Morton, 1995). Smallholders are faced with transaction costs which include; transfer costs, market and information costs, bargaining costs, monitoring costs and the costs associated with contract enforcement (Kherallah & Kirsten, 2002). These costs tend to be very high for farmers who live in rural areas with poor infrastructure for transportation and communication (Maître

d'Hôtel et al., 2011). Also, smallholders who live in areas with undeveloped markets coupled with the absence of market support institutions tend to face high transaction costs (Bijman et al., 2007). These high transaction costs make it difficult for smallholders to participate and compete in the lucrative market because of their low social capital (Baloyi, 2010). However, farmers and traders with high social capital are in a better position to participate in capital-intensive marketing activities such as long-distance transport and wholesaling (Kherallah & Kirsten, 2002).

2.4.4 ASYMMETRY OR LACK OF INFORMATION ON MARKET

Market information has been identified as a significant hindrance to market access (Biénabe et al., 2004; IFAD, 2003; Kherallah & Kirsten, 2002). This occurs because smallholders do not have the understanding of how a market operates and do not know where demand is located (IFAD, 2003). Also, if they do not have information on what influences the prices of different quantities and qualities of goods, they will not be able to determine the best marketing channel and will be prone to unfair treatment by buyers (IFAD, 2003).

Furthermore, lack of information will prevent farmers from putting into use new technologies and inventions that could increase their productivity, efficiency and competitive advantage (Ruben et al., 2006) as cited in (Van der Heijden, 2010). Farmers and traders are often disadvantaged due to lack of information about quality, packaging and certification requirements that are unique to different markets (Bijman et al., 2007). The lack of information prevents the business actors in the agricultural value chain from deriving the best benefits from their product (Baloyi, 2010).

2.4.5 LACK OF SOCIAL CAPITAL

Social capital refers to institutions, social networks, mutual trust and correspondence that inspires social relationships which then makes resources available to individuals because they have a place within the social structures (Biénabe et al., 2004). Social capital can facilitate cooperation within a society which will eventually impact the economic performance of the society (Putnam, Leonardi, & Nanetti, 1994). It can also result in more favourable trade terms, a reduction in transaction cost, and a broad range of choices for coping with risk through social associations and networks (Brown & Ashman, 1996).

However, developing countries are often characterised by poor social network, associations, institutions and low level of trust between buyers and producers (Marconatto, Barin-Cruz, &

Pedrozo, 2016; Van der Heijden, 2010). These create constraints from enjoying the benefit of social capital which has the potential of facilitating productivity, the flow of information, market access and reducing transaction cost (Brown & Ashman, 1996; Marconatto et al., 2016).

2.4.6 TECHNOLOGICAL BARRIERS

Technological innovations have been a major contributor to the progress of agribusinesses over recent years and will continue influencing the smooth running of the agribusiness value chain (Baloyi, 2010). Technology can facilitate rapid dissemination of information; it can aid production efficiency, it can facilitate compliance needs, it can connect buyers with sellers via e-commerce and help reduce transaction cost (Baloyi, 2010). However, the majority of smallholders in developing countries lack access to the necessary technology that could facilitate their trade due to poor technological skills, financial constraints, and poor support services (DAFF, 2012). The technological barriers faced by smallholders in developing countries has a negative impact on their production efficiency and their ability to access markets locally, nationally and internationally (Baloyi, 2010).

2.4.7 REGULATORY BARRIERS

Regulatory arrangements such as government legislation and policies that are meant to support markets are either absent, weak or fail to achieve the tasks expected from them (Trienekens, 2011). Some smallholders' who have the potential to export their product are constrained with government legislation and policies which set trade barriers, by imposing unfavourable taxes and disregarding infrastructural investments that would be beneficial to the value chain (Trienekens, 2011).

2.5 VALUE CHAIN UPGRADING

Value chain upgrading can be defined as "increasing the competitiveness of the value chain by moving it in a new direction, toward a new market, market segment, or customer; toward increased efficiency within the value chain; or toward adding operations within the value chain" (Webber & Labaste, 2009, p. 69). McDermott (2007, p. 104) defines upgrading as "a shift from lower to higher value economic activities by using local innovative capacities to make continuous improvements in processes, products, and functions". It involves improvement in products, processes, functions and access to new markets and also investments in people, their know-how and creating a favourable environment to work (Fromm, 2007). Upgrading is what happens to a particular actor within the chain that improves the performance

of the actor which consequently increases the benefit and reduces the exposure to the risk of that actor (Riisgaard et al., 2010). It addresses the innovative capabilities of actors, their horizontal and vertical relationships and market linkages that will improve their competitiveness (Fromm, 2007).

Value chain upgrading options have been proposed by several researchers from different perspectives (Kaplinsky, 2000; McDermott, 2007; Riisgaard et al., 2010; Trienekens, 2011). Kaplinsky (2000) provides four ways whereby economic actors can upgrade, these include; increasing business operational efficiency such that they are much better than those of rivals, improving old products or introducing new products, improving inter-firm linkages and changing the various activities conducted within the business or transferring the activities to different links in the chain.

Riisgaard et al. (2010) identified three upgrading options; improvement in the process, product or volume within a link in the value chain, change and/or addition of activities across several links within the value chain, and improvement of the value chain coordination or linkages.

Trienekens (2011) categorised upgrading options into three groups; Improving value-added productions, upgrading value-chain network structure and upgrading the form of governance within the chain.

Based upon the value chain upgrading options proposed by Kaplinsky (2000), Riisgaard et al. (2010) and Trienekens (2011) and the relevance of this topic, value chain upgrading options were grouped into three categories; Improving the efficiency of the business, upgrading the linkages within the chain, and upgrading the value chain governance.

2.5.1 IMPROVING THE OPERATIONAL EFFICIENCY OF THE BUSINESS

The operational efficiency of any business focuses on enhancing the cycle of production (Kaplinsky & Morris, 2001). Improving the cycle of production can take various forms: upgrading the processes, upgrading the products, and upgrading the functions (Kaplinsky & Morris, 2001; Riisgaard et al., 2010).

- **Upgrading the processes:** This implies increasing the efficiency of internal processes (Kaplinsky & Morris, 2001). This ensures inputs are transformed into outputs more efficiently, by restructuring the system of production or introducing better technology (Humphrey & Schmitz, 2000). An example of this can incorporate improving agricultural practice to enhance yields which can consequently result in increased sales

(Mitchell et al., 2009). Agricultural yields can be increased by improved planting materials, planting techniques and investment in infrastructure such as irrigation (Mitchell et al., 2009). For example, farmers can grow more by applying fertiliser or switching varieties; they may reduce pest infestation and save costs through integrated pest management instead of spraying with chemicals (Faida, 2006).

- **Upgrading the products:** This involves an improvement in the quality of the product which may be stimulated by the requirements of end markets (USAID, 2017). The requirement of the end market can occur as a result of changes in customer preferences or desire for high quality and higher value-added (USAID, 2017). If a farmer can produce higher quality, the end result may be measured in terms of increased unit values which consequently increase the profit of the farmer (Hawkes & Ruel, 2011). Farmers can improve their product to meet the requirements of the end market in several ways. For instance, they may plant a new variety that has more desirable attributes; alternatively, they may stop the use of agrochemicals and apply for certification to have access to a desired market (Faida, 2006).
- **Upgrading the functions:** This implies changing the mix of activities performed by actors in the value chain either by increasing (upgrading) or decreasing (downgrading) the number of activities performed by firms or individuals in the chain (Mitchell et al., 2009). For example, producers can increase their activities by performing downstream activities such as grading, packaging, transporting or advertising their product (Riisgaard et al., 2010). Also, producers can decrease their activities by moving from production and processing to focus only on production because of the low profitability of processing (Riisgaard et al., 2010).

2.5.2 UPGRADING THE LINKAGES WITHIN THE CHAIN

Upgrading the linkages within the chain involves improving the horizontal as well as the vertical relationships between, and amongst, the stakeholders in the value chain (Trienekens, 2011). Upgrading the linkages focuses on ensuring the right product gains access to the most appropriate market that will be most beneficial for the key stakeholders (Riisgaard et al., 2010). The potential benefits of upgrading linkages for the small and medium enterprise, local communities and large firms are shown in Table 2.1

- **Upgrading the Horizontal Linkages:** This is the process of improving the relationship between actors in the same node (intra-nodal) in order to achieve some form of common or collective structure (Mitchell et al., 2009). The collective structure can have various

forms, such as producer or marketing cooperatives, groups or associations (Trienekens, 2011). The collective structure describes the agreement among marketers or producers to cooperate over joint purchasing of production inputs, certification, marketing, and crop insurance (Riisgaard et al., 2010). This form of upgrading helps to strengthen bargaining power, reduce transaction costs and achieve economies of scale (Mitchell et al., 2009). However, the success of the collective structure or horizontal coordination strategies is largely dependent on the entry rules to join the association and the quality of management of the association or cooperative (Mitchell et al., 2009).

- **Upgrading the Vertical Linkages:** This represents a move away from one-off spot market-type transactions towards longer-term inter-nodal interactions (Mitchell et al., 2009). Upgrading the vertical linkages can take the shape of contract farming whereby an exporter can contact sweetpotato out-grower farmers, or a situation whereby a producer group will have a contract agreement with retailers or wholesalers (Mitchell et al., 2009; Riisgaard et al., 2010). This form of upgrading involves "interlocking contracts" (a situation whereby sales contracts are embedded with services from buyers, such as credits, fertiliser, extensions etc.) and "learning from buyers" (meeting market requirements) (Riisgaard et al., 2010). Upgrading vertical linkages can result in greater assurance about market access and future revenue flows (Mitchell et al., 2009). It can also result in access to price premiums, reduced price risks, decreased marketing costs, improved access to market information, finance and inputs (Riisgaard et al., 2010). However, this form of upgrading requires developing trust relations between buyers and sellers to avoid breaching contractual obligations (Mitchell et al., 2009).

2.5.3 UPGRADING THE VALUE CHAIN GOVERNANCE

Governance is the *"authority and power relationships that determine how financial, material and human resources are allocated and flow within a chain"* (Gereffi, 1994, p. 97). The value chain governance determines, coordinates and controls the activities of other actors/ stakeholders involved in the value chain (Frederick & Gereffi, 2009). Upgrading the value chain governance involves establishing parameters that exert control on the product, process and logistics qualification of the chain, encompassing bundles of activities, roles and actors (Kaplinsky & Morris, 2001). The control exerted from an upgraded governance sets standards, monitors adherence to the standards, assists the concerned parties in meeting the standards and imposes sanctions when the set standards are violated (Kaplinsky & Morris, 2001). This control

often leads to innovation and enables producers and traders to improve their performance and achieve competitive advantage (Frederick & Gereffi, 2009).

Table 2.1: Potential benefits of upgrading linkages for small and medium enterprises, local communities and large firms

Small and medium enterprises (SMEs)	Local communities	Large Firms
Increase in employment and income generation	Stimulation of economic activity and improved local economic development	Reduction of foreign exchange needs through import substitution
Access to new domestic and foreign markets	Access to more reliable and affordable products and services	Improved productivity
More diversified customers and market structure	Increased participation of businesses in community development	Reduced procurement, production and distribution costs
Sharing of risk through joint operations and funding	Increased local purchasing power	Compliance with government local content requirements
Facilitation of access to finance	Increased employment	Improved integration in new foreign markets
Acceleration of access to market information, knowledge transfer and improved technology	Development of local business service providers catering to SMEs and large firms	Enhanced reputation and local license to operate
More stable relationships with producer or buyer organisations	Long-term increase in local competitiveness	Increased opportunities for corporate responsibility combined with profitability
Enhanced skills, capacity and standards	Balance of payment benefits when products are exported and/or substituted for imports	Increased ability to reach consumers at the base of the economic pyramid
Opportunities to innovate and increase competitiveness		Increase in flexibility in making design and production changes due to the proximity of local suppliers
The attraction of foreign investments in cluster effects		Proactively deal with downsizing

Source: Adapted from (Humphrey & Navas-Alemán, 2010)

CHAPTER 3: THE SWEETPOTATO ECONOMY OF NIGERIA

3.1 HISTORICAL BACKGROUND

Sweetpotato (*Ipomoea batatas* L, Family Convolvulaceae) is an important staple root crop in numerous parts of the world and grown in more than 100 countries (Anyaegbunam & Nto, 2011). It is a high yielding, versatile, drought-resistant crop having a maturity period of up to five months and adapting well to a wide range of ecological conditions (Laurie & Van Heerden, 2012). Cultivated mostly in developing countries, sweetpotato is ranked seventh, among total world food crop production behind wheat, rice, potato, maize, cassava and barley and fifth most valuable crop after rice, wheat, maize and potatoes (FAO, 2017; Mbanaso et al., 2012; Woolfe, 1992). Considered to be among the oldest crops in the wet tropics and among the early staple crops, sweetpotato together with other root crops (cassava, yams and aroids) is considered the second most relevant set of staple food crops in Sub-Saharan Africa behind cereal crops (Lebot, 2009). Often considered as the most misunderstood root crop, sweetpotato is usually confused with yam (*Dioscorea* spp) (Woolfe, 1992). Despite the controversies surrounding its origin, Portuguese explorers are reported to have brought sweetpotato to Africa in the early 16th century ((Allemann, Laurie, Thiart, Vorster, & Bornman, 2004; Lebot, 2009; Woolfe, 1992). From Africa, it was taken by Spanish explorers to other parts of the world in the late 16th century in the form of storage roots (Lebot, 2009). Following the failure of the crop to yield in Europe due to low temperatures, it was brought back and cultivated in the warm coastal areas of the continent where it spread rapidly (Lebot, 2009).

Sweetpotato was introduced into Nigeria in the 16th century by Portuguese explorers (Mbanaso et al., 2012). As of 1971, the riverine states and middle belt region of Nigeria were the areas under sweetpotato cultivation (Tewe, Ojeniyi, & Abu, 2003). As a result of how long the crop has been in Nigeria, sweetpotato has become indigenized in the country, and the production, marketing and utilisation of crop have expanded to the semi-arid, humid and sub-humid regions of the country (Schippers, 2002). The national production figures show that the cultivation and production of sweetpotato have been increasing in the country (Tewe et al., 2003).

3.2 SWEETPOTATO CULTIVATION IN NIGERIA

Nigeria is the world's second highest producer of sweetpotato's behind China, and the highest producer in Africa followed by Uganda and Tanzania (FAOSTAT, 2017). Other notable producers include Indonesia, India, the Philippines, Vietnam, the United States, the Republic

of Korea and Japan (FAOSTAT, 2017). Nigeria produced about 0.3 million metric tons (MT) of sweetpotato in 1994 which increased to approximately 3.9 million MT in 2016 (FAOSTAT, 2017). This shows that the production of sweetpotato in Nigeria has increased significantly by more than 1300 percent over twenty-two years. Despite this increase in production, sweetpotato is still considered a minor crop within Nigeria (Omoare et al., 2015).

Various researchers have cited reasons for the rapid growth in sweetpotato production and acceptance in recent decades (Bergh et al., 2012; Crissman et al., 2007; Goldman, 1996). According to Goldman (1996), cropping challenges such as diseases threatening the production of other major crops like cassava, groundnuts, cocoyam, bananas and plantains over the past 50 years, have made Nigerian smallholders diversify production to include sweetpotatoes. Other explanations for the crop's rapid expansion include the failure of other crop, as a result of climate change, which has caused farmers to switch to sweetpotato production (Crissman et al., 2007). Cassava and sweetpotato are often grown on the same farm or same region, and farmers frequently turn to sweetpotato when cassava fails due to pest and disease attacks (Crissman et al., 2007). Moreover, a decline in government support for maize production has caused farmers to seek other low-cost alternatives. Lastly, the impact of HIV/AIDS and large migration of rural males to urban areas reduced family labour options for agricultural production; remaining family members chose to plant crops such as sweetpotato that required less labour, cost and risk (Crissman et al., 2007).

Grown in all regions of the country and diverse agro-ecological zones (from arid to semi-arid and rainforest zones) (see Figure 3.1), sweetpotato is considered a very important cash crop in certain parts of Nigeria and is grown in most areas as a secondary crop (Fawole, 2007). Most sweetpotatoes are produced in the northern part of Nigeria signalling a shift in the concentration of production from the sub-humid regions of Plateau, Kwara, Benue and Niger states to semi-arid agro-ecological zones, where Kano, Bauchi and Kaduna states are leading producers (Fawole, 2007). There are at least 12 varieties of sweetpotato spread across various agro-ecological zones of Nigeria (NRCRI, 2010). Common varieties include NARSP/05/022 (orange flesh), K134, SPK004, CIP 440141, NARSP/05/007C, CIP440037, NASPOT2, 1900411, TIS87/0087, NASPOT4 and CIP440293 (orange skin and flesh) (Egbe, Afuape, & Idoko, 2012).

Sweetpotato production is influenced by rainfall. For optimal production and best yield, sweetpotato requires a rainfall range of between 750 to 1,000 millimetres of annual precipitation, with at least 500 mm falling during the growth season (Tewe et al., 2003). However, sweetpotatoes do not grow well in water-logged soil because it can result in tuber rots and reduced storage roots (Rufai & Omonona, 2012). Rainfed sweetpotato crops can be cultivated twice in a year (April to August and August to December) (Ehisianya, Lale, Umeozor, Amadi, & Zakka, 2011). In most regions, planting takes place from February through July when rainfall is more substantial, however, planting along rivers in the central part of the country or swampy areas in the north can extend the planting season from September to December (Tewe et al., 2003).

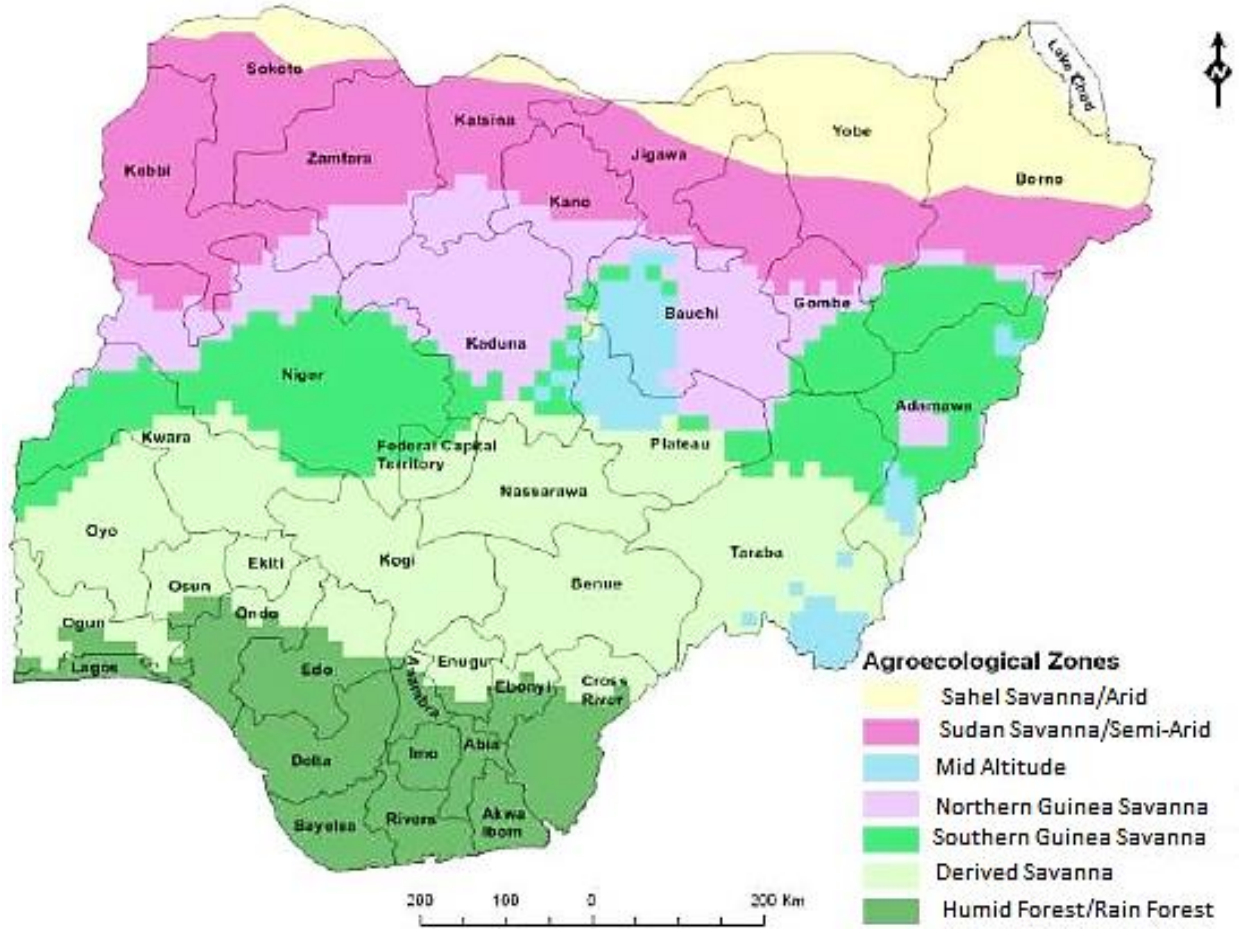


Figure 3.1: Map of Nigeria showing Agro-ecological Zones

Source: (IITA, 2011)

Most farmers grow sweetpotatoes on plots of land less than one hectare in size and are often intercropped as the secondary or minor crop (Eneji, Agboola, & Ubi, 1997). In the south and central parts of Nigeria, sweetpotatoes are intercropped with other root and tuber crops (yams, cassava, cocoyams), and in the north, they are intercropped with cereals such as maize and

millet (Eneji et al., 1997). Sweetpotatoes provide soil cover and leave a vegetative residue that can be incorporated into the soil after harvest, which also contributes to the primary crop's production (Eneji et al., 1997). The sweetpotato production cycle in Nigeria suggested by Tewe et al. (2003) involves the following major activities - land clearing, packing and burning, tilling/ ploughing and mounding or ridging, sorting the planting materials, planting, first weeding, application of fertiliser, second weeding and harvesting.

Planting begins at the onset of the rainy season and continues until two months before rains stop (Akoroda, 2009). Sweetpotatoes may be planted on mounds, ridges, beds, or on flat ground. However, they perform best on mounds and poorest on flat ground (Ehisianya et al., 2011). Sweetpotatoes confront weed problems during the first two months of growth, after this period, intense vine growth causes rapid and effective coverage of the ground, smothering the weeds present (Iyagba, 2010). Most small-scale farmers do not make an effort to weed their sweetpotato plots at all, due to this recognised pattern (Iyagba, 2010). However, at least one weeding is recommended three weeks after planting (Tewe et al., 2003).

Harvesting occurs 3-6 months after planting, depending on the sweetpotato variety (Bergh et al., 2012). Harvesting involves the cutting of shoots, carefully digging out tubers out of the soil while avoiding bruises, using a metal rod with flattened ends, fork, shovel, hoes or long wooden sticks (Tewe et al., 2003). Harvest time is flexible and often staggered, however, harvesting at the earliest maturation period is recommended to avoid attacks from weevils (*Cylas* Spp) as moisture in the soil decreases (Tewe et al., 2003). In times of adverse conditions, only mature tubers are harvested for consumption or market sale while small tubers are left for continued growth (Tewe et al., 2003). In order to obtain tubers with the right dryness composition farmers must know when to harvest and variability by cultivar (Tewe et al., 2003).

The commercial cultivation of sweetpotato is mostly concentrated in the same semi-arid zone (see Figure 3.1) where year-round cultivation is made possible by irrigation. Farmers grow high dry matter and less sweet varieties that are in high demand in major urban markets (SSP-WA, 2012). According to Akoroda (2009), sweetpotatoes are flexible in mixed cropping systems, adaptable to marginal environments and have a short maturation period (3-6 months depending on the variety), which allows for two or more crop cycles in a year. Sweetpotatoes generally have lower soil fertility and rainfall requirement than other root and tuber crops like yams (Babatunde, Dantata, & Olawuyi, 2012).

China, the largest producer of sweetpotato in the world, contributes more than 65 percent of the world's supply (FAOSTAT, 2017). It also has one of the world's highest average farm yields estimate of about 22 tons per hectare (Bassey, 2017). In Africa, average yields are as low as 9.6 tons per hectare, with Nigeria having a much lower average yield of about 2.6 tons per hectare (FAOSTAT, 2017). This indicates considerable potential for increased production of sweetpotato in Nigeria.

Sweetpotato production in Nigeria continues to show a significant decline in yield and stagnant productivity. According to FAOSTAT (2017), while the area of sweetpotatoes harvested increased by more than 5,500% from 28,000 hectares in 1990 to 1,546,562 hectares in 2016, yields have shown a notable decline over that same period. The yield for sweetpotatoes was down from 5.1 tons per hectare in 1990 to 2.5 tons per hectare in 2016 (FAOSTAT, 2017). Sweetpotato yields were as high as 12.4 tons per hectare in the 1960s (FAOSTAT, 2017). The negative correlation between area harvested and yield is common to sweetpotato data in Sub-Saharan Africa and not just Nigeria (Walker, Thiele, Suárez, & Crissmann, 2011). Yields are generally low in many developing countries, but there is a clear potential for increasing yields, for example, by introducing improved varieties and more efficient farming practices (Akoroda, 2009).

3.3 SWEETPOTATO CONSUMPTION, UTILIZATION AND IMPORTANCE

The consumption of sweetpotato in Nigeria has increased significantly since 1990. Consumption grew from 143,000 MT in 1990 to 2,746,000 MT in 2010 (FAO, 2012) as cited in (Bergh et al., 2012). However, for a country with a population of about 180 million, a per capita annual consumption of about 15 kilograms (Kg) is considered very low when compared with other African countries such as Uganda, Burundi and Rwanda, whose per capita annual consumption can be around 100Kg (CIP, 2006; FAOSTAT, 2017; NBS, 2017a).

Sweetpotato are used more frequently for human consumption than animal feed and various industrial uses (Laurie, Van den Berg, Magoro, & Kgonyane, 2004). They can be prepared in many different ways for human consumption, but the most common is that the fresh root is peeled, boiled, roasted, or fried into chips (fries) (Mukhopadhyay, Chattopadhyay, Chakraborty, & Bhattacharya, 2011). The roots can be cooked along with cowpea, lima beans, sesame, millet and/or other root and tuber crops to make a traditional porridge (Tewe et al., 2003). Sweetpotato dough is incorporated with other root and tuber crops to create two staple

dishes in Nigeria: *amala,* a thick porridge that is often served with soup; and *fufu* a stiff, gelatinous dough prepared by pounding pieces of boiled tuber in a mortar (Tewe et al., 2003). In addition, the leaves of sweetpotato can be boiled and incorporated into soups, and stews or stir-fried with shrimps (Tewe et al., 2003).

In the northern and central regions of Nigeria, peeled and sun-dried sweetpotato can be milled into flour which is often used as a sweetener for local dishes or to make a fermented drink called *kunu* (Amienyo & Ataga, 2007). Sweetpotatoes are already a staple crop in northern Nigeria, where most of the crop is produced (Amienyo & Ataga, 2007). However, the high level of sweetness remains a major barrier to sweetpotato uptake in the south, where most of the country's population is concentrated (Afuape, 2011). This uptake barrier is as a result of a myth that sweetpotato causes diabetes due to its high level of sweetness (Umoh & Njoku, 2013). However, research has confirmed that sweetpotato does not cause diabetes and is often included in the meal plan for people with diabetes because it releases glucose slowly into the bloodstream which helps to control blood sugar (glucose) level (Umoh & Njoku, 2013). However, the National Root Crops Research Institute (NRCRI) is developing non-sweet, high dry matter, easy to pound sweetpotato varieties that would appeal to the large segment of the Nigerian population (Afuape, 2011).

Sweetpotatoes also have several additional agricultural and industrial uses. The roots, leaves and vines are used to feed rabbits, goats and sheep (Tewe et al., 2003). Some studies have found that when animals are fed with high protein sweetpotato vines, they produce a lesser amount of methane gas than animals given other types of feed (CIP, 2017; Tavva & Nedunchezhiyan, 2012). This suggests that the utilisation of sweetpotato vines as an animal feed can help in reducing global methane emissions which is harmful to the environment (Tavva & Nedunchezhiyan, 2012). Some varieties were introduced in Nigeria specifically for livestock feed due to their high foliage yield and include; Wagaboligbe, TIS 8164, and Tanzania (Ikwelle, Ezulike, & Eke-Okoro, 2001). Other varieties with bland taste have also been introduced to benefit consumers averse to the usual sweet taste of sweetpotato (Njoku, Nwauzor, Okorocha, Afuape, & Korieocha, 2006). These varieties include; Naspot 2, TIS 87/0087, 440163, 440216, and Tanzania (Njoku et al., 2006). Varieties such as Centennial, 199004.2, 440216, 440163, 440031, and Tanzania have a desirable frying quality because of its low oil absorption capacity which are demanded for preparation of snacks (Njoku et al., 2006).

China, the world's leading producer of sweetpotato also makes use of sweetpotato for the production of starch and as a raw material for biofuel production (Woolfe, 1992). Also, in South America, the plant sap (juice) of red sweetpotato plays a vital role in the production of fabric dyes (Liu, 2011). Another non-nutritive benefit of sweetpotato is its use as an ornament, due to its attractive foliage (Anon, 2011).

With regard to processing, sweetpotato can be processed into fufu flour (fermented), unfermented sweetpotato flour for use in confectioneries, toasted sweetpotato, sweetpotato starch, in addition to its use as livestock feed (Ezeano, 2010; Ojeniyi & Tewe, 2001). According to the International Potato Center (CIP), sweetpotatoes are also processed industrially into fried snacks like sweetpotato fries (chips), candy, starch, noodles, and flour. There is a high demand in urban areas for fried sweetpotato crisps (CIP, 2017). Sweetpotatoes can also be exploited for the production of biofuel and ethanol (Akoroda, Edebiri, Egeonu, Bello, & Yahaya, 2007). Sweetpotatoes can be processed to yield about 137 litres of ethanol per MT of sweetpotato tubers (Akoroda, 2009).

Sweetpotatoes play an important role in cultural traditions in Kwara state, a state in the north central region of Nigeria, where the harvest season is usually celebrated with festivals and cultural dances (Agbo & Ene, 1994). Sweetpotatoes also have some traditional medicinal purposes; sweetpotato leaves are boiled in water to make a tea to cure problems ranging from mouth and throat tumours to asthma and diarrhoea (Adewumi & Adebayo, 2008; Ezeano, 2010).

The sweetpotato storage root provides a balanced diet on its own. It can provide almost all the nutrients needed by the human body on a daily basis (Allemann et al., 2004). Woolfe (1992) reported that it contained significant amounts of carbohydrates by weight as compared to other starchy crops such as rice, maize and sorghum porridge, although the protein content is slightly lower than in potatoes and other grain crops. It contains almost all the macro and micronutrients, substantial quantities of vitamin C, moderate amounts of vitamin B complex (Vitamin B1, B2, B5 and B6) and folic acid, as well as adequate amounts of vitamin E (Allemann et al., 2004).

Orange-fleshed sweetpotato has been reported by several authors to contain high amounts of vitamin A and is currently being promoted by the Food and Agriculture Organization (FAO) and other in-country programs as a supplementary food to combat vitamin deficiencies in

children (Amagloh et al., 2011; Ebregt, Struik, Odongo, & Abidin, 2007; Kulembeka et al., 2004). Research done by Khachatryan et al. (2003) indicated that the leaves were an excellent source of lutein. Lutein is responsible for central vision in the human eye and helps keep eyes safe from oxidative stress and high-energy photons of blue light (Khachatryan et al., 2003). Sweetpotato is also popular in low-fat diets and is recommended as a low glutamate index (GI) food (Podsędek, 2007).

Sweetpotato is considered an excellent food security crop since it often survives where other crops (e.g. maize) fail due to his high tolerance to drought and post-flood recovery (Low et al., 2007). It contributes to food security by improving rural livelihoods, especially those involved in small-scale agriculture (Yngve, Margetts, Hughes, & Tseng, 2009). Sweetpotato has also often been a lifesaver: According to Lebot (2009), it saved the Japanese nation when typhoons destroyed all their rice fields just before the First World War. Also, during the early 1960s, China was attacked by famine and sweetpotato saved millions of their population from starvation (Ebregt et al., 2007). This is evidence that sweetpotato is indeed a food security crop as referred to by many (Amagloh et al., 2011).

Low et al. (2007) reported that studies conducted in sub-Saharan Africa demonstrated that consumption of boiled orange-fleshed sweetpotato improved vitamin A status of children. A separate study by Amagloh et al. (2011) confirmed that orange-fleshed sweetpotato was high in vitamin A and could be used as a complementary food in infant feeding. To improve the consumption of this vitamin A rich type of sweetpotato, Laurie, Van Jaarsveld, Faber, Philpott, and Labuschagne (2012) further prepared different food types (chips, doughnuts, juice and a green leafy dish from the leaves) from orange-fleshed sweetpotato to determine consumer acceptability. They reported that 92% of the consumers liked the colour of the products while 88% indicated that they would buy such products or prepare them at home (Laurie et al., 2012).

The potential exists to diversify sweetpotato use further. Afuape (2011) cites sweetpotato breeding efforts to create varieties that are easier to turn into flour and using orange-fleshed sweetpotatoes to make juice (Afuape, 2011). Adeleke and Odedeji (2010) showed that blending sweetpotato flour with up to 20% wheat flour produced samples that can be used to make baked goods with improved functional properties, including reduced baking time and prolonged shelf life (Adeleke & Odedeji, 2010). Ukpabi, Ekeledo, and Ezigbo (2012) explored the potential to use orange-fleshed sweetpotato roots in the production of beta-carotene rich chips that Nigerian

consumers would appreciate. These chips could potentially serve as a mechanism for addressing vitamin A deficiencies in endemic communities.

3.4 SWEETPOTATO TRADE IN NIGERIA

The unavailability of market has been reported by several researchers as one of the major constraints to sweetpotato production in Nigeria (Fawole, 2007; Mbanaso et al., 2012). According to the International Trade Centre (ITC), Nigeria is not ranked amongst the top 100 sweetpotato exporters in the world making the overall export value of sweetpotatoes in Nigeria insignificant (ITC, 2017b). Although Nigeria is the second largest producer of sweetpotato in the world, it only exports a very limited quantity FAOSTAT (2017). This trend reflects Nigeria's overall agricultural export market, which has not been fully utilized since the country's discovery of oil.

There is a recognised long-standing sweetpotato trade relationship between Nigeria and neighbouring northern countries like Niger and Chad, with Nigeria as the supplier and Chad and Niger as buyers (Akoroda et al., 2007). The ITC also reports export quantities and values of sweetpotatoes and importing countries. Niger and South Africa were major Nigerian sweetpotato importers in 2011 (ITC, 2017b). Other reported importing countries since 2001 include Canada, France, Germany, Italy, Japan, the Netherlands, Singapore, Thailand, the United Kingdom, and the United States (ITC, 2017b).

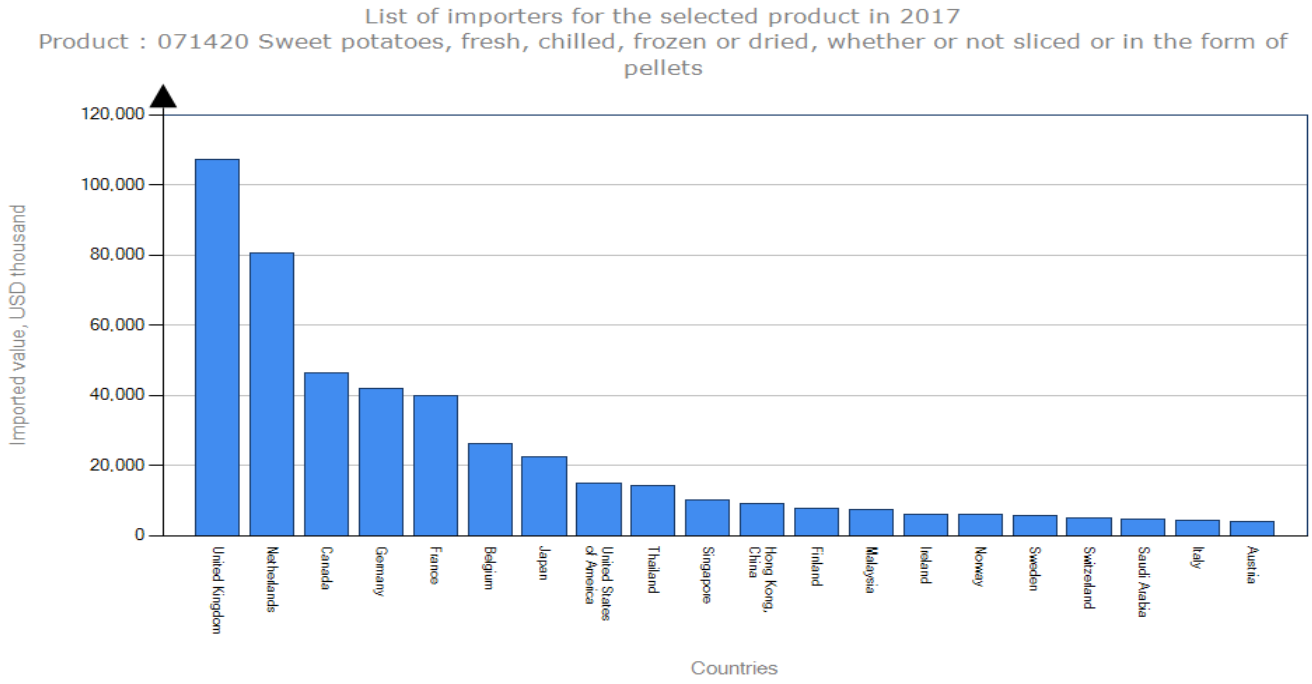


Figure 3.2: Major Importers of sweetpotato in 2017 and their share in US dollars

Source: (ITC, 2017b)

Figure 3.2 shows the list of major importers of sweetpotatoes in 2017, and the value of sweetpotato imports in US dollars to each country; all are a potential market destination that can be explored for the export of sweetpotato from Nigeria.

3.4.1 PRICES

The prices of agricultural produce rise and fall depending on the time of the year in Nigeria. In the last decade, there has been a reported increase in the prices of sweetpotato per kilogram (kg) (NBS, 2018). A Sweetpotato Support Platform for West Africa (SSP-WA) study in 2012 stated that market prices of sweetpotatoes ranged from ₦16.8 to ₦20.13[1] per kg bag (SSP-WA, 2012). Market prices in 2017 ranged from ₦45.5 to ₦46.03 per kg bag (CBN, 2018). The National Bureau of Statistics reported a price range of ₦77.78 to ₦276.46 per kg bag in April 2018 (NBS, 2018). Sweetpotato prices also fluctuate over the course of the year (CBN, 2018; NBS, 2018). At the peak of harvest between July and January, prices are lower (NBS, 2018). Between February and June, when sweetpotatoes are scarce, market prices are much higher (NBS, 2018). Monthly prices also vary from one state of the country to another (NBS, 2018)). According to NBS (2018), exactly one kilogram of sweetpotato was sold for ₦77.78 at Bauchi state while the same quantity was sold for ₦276.46 in Bayelsa state. Sweetpotato prices increased overall in 2018, with those in the very southern part of the country priced the highest (NBS, 2018).

Orange-fleshed sweetpotatoes, which have been marketed in Nigeria for their nutritional value, sell at higher prices than white-fleshed varieties (Chima, Umoh, Njoku, & Mbanasor, 2012). Comparing the national market prices of different staple crops in Nigeria, sweetpotatoes were priced lower that yam, maize, cassava tubers, millet but higher than sorghum (CBN, 2018). Similarly, according to NBS (2018), sweetpotatoes were priced lower than all staple crops surveyed which included yam, Irish potatoes, maize, rice and beans.

3.4.2 MARKETING SYSTEMS

Nigeria's sweetpotato value chain involves many participants. Anyaegbunam and Nto (2011) identified a complex marketing structure made up participants comprising of producers, farm-gate middlemen, rural and urban wholesalers, rural and urban retailers and rural and urban consumers. Producers are mostly farmers who produce sweetpotatoes and farm gate

[1] ₦ = Nigerian Naira (1 United States (US) Dollar = approximately ₦360 on 07/05/2018) retrieved online from https://www.fx-exchange.com/usd/ngn-exchange-rates-history.html

middlemen (also known as transporters or rural assemblers) serve as the link between rural producers and urban markets.

The sweetpotato marketing system functions through many middlemen working in both rural and urban markets Anyaegbunam and Nto (2011). Figure 3.3 shows the various alternate paths from the producer to the final consumer for sweetpotato (fresh produce)

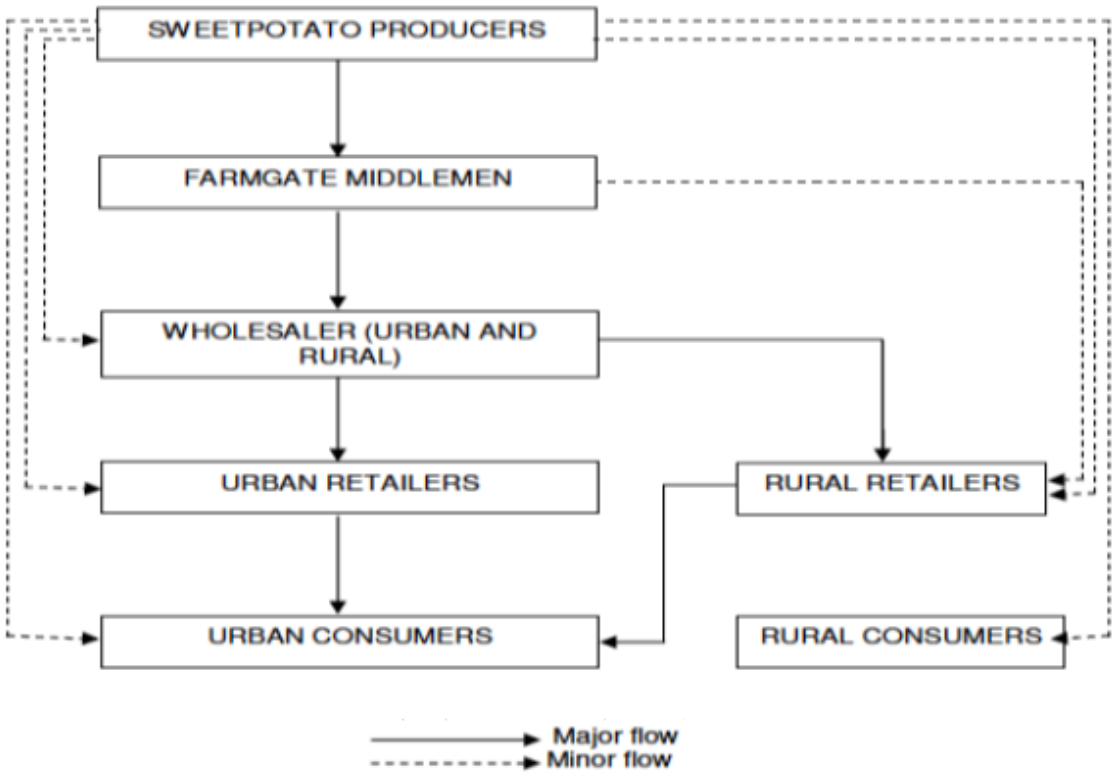


Figure 3.3: Sweetpotato value chain network in Nigeria

Source: (Anyaegbunam & Nto, 2011)

Anyaegbunam and Nto (2011) distinguish between single and multi-stage channels and major and minor flows in the Nigeria sweetpotato value chain. A single channel consists of sweetpotatoes that flow directly from the farmer to the consumer, without any intermediaries. Multi-stage channel marketing systems include middlemen or intermediaries. Major links include rural assemblers, transporters, urban and rural wholesalers, and then the retailers (Anyaegbunam & Nto, 2011). All of these intermediaries can be bypassed if the farmer chooses to sell directly to a wholesaler or retailer (minor flow). One implication of a multi-stage channel

system is that as the sweetpotatoes pass through more intermediaries, marketing costs tend to increase and the consumers often assume these costs (Anyaegbunam & Nto, 2011).

In West Africa, sweetpotatoes are usually sold wholesale in rural markets in baskets or sacs that weigh between 20 and 70 kg (Akoroda, 2009). Urban traders sometimes contract local farmers to produce tubers (Akoroda, 2009). Traders buy the sweetpotatoes in bulk and transport them in vehicles weighing less than 10 MT to urban markets. In Osun state in southwestern Nigeria, sweetpotatoes are usually transported in trucks, trailers, or pick-up vans and marketed as fresh produce (Akoroda, 2009)

The Sweetpotato Support Platform for West Africa (SSP-WA) conducted a preliminary sweetpotato value chain study in Nigeria and identified the strengths, weaknesses, and constraints of key players, such as NGOs, schools, rural and urban vendors, bakeries and chain restaurants, that are engaging in new sweetpotato processed products including: sweetpotato crisps, fries (chips), glucose syrup, puree, sweetener, and flour (SSP-WA, 2012). According to the same study, fried sweetpotato snacks are in high demand by women and school children. Urban residents like sweetpotatoes because they are filling, relatively cheaper than yam and potato fries (chips) (SSP-WA, 2012). There is growing interest in serving sweetpotato products in fast food restaurants (SSP-WA, 2012)..

3.5 SWEETPOTATO PRODUCTION CONSTRAINS IN NIGERIA

Farmers of sweetpotato in Nigeria face several constraints that affect their production. In a study conducted by Fawole (2007), sweetpotato farmers' perceived constraints to production included high incidences of pests and diseases, limited access to credit, high labour costs, limited access to improved technologies and inadequate government aid. Earlier study by Agbo and Ene (1994) identified other constraints which include the need to sustain sweetpotato vines through the dry season since they serve as planting materials in the next crop cycle, and consumption preferences of other crops over sweetpotatoes (cassava, yams, plantain, cowpeas and rice in the south and cassava, yam, millet sorghum, cowpeas and rice in the north).

3.5.1 PEST AND DISEASE ATTACKS

Fawole (2007) highlighted that 60% of sweetpotato farmers cited the high incidence of pests and diseases as a major production constraint. Pests and diseases attack the vines, leaves, and tubers after harvest, while being transported to the market, and within the market stores before sales. The most commonly cited pest and disease constraints to the production and storage are

weevils (*Cylas punctcollis and Cylas brunneus*) and virus complex respectively (Akoroda, 2009). Akoroda (2009) described how weevils threaten sweetpotato production systems The author stated that weevils attack tubers planted in shallow soil or fully matured tubers protruding from the soil. Adult weevils lay their eggs on stems and tubers, and the eggs develop into adult weevils within 25 days. Hatched larvae dig into tubers, pupate on stems, and are transferred to the shoots. Once they become established in a crop, they are difficult to control (Akoroda, 2009). Figure 3.4 shows the development stages of sweetpotato weevil (*Cylas puncticollis*) and Figure 3.5 shows the effect of *Cylas punctcollis* on the sweetpotato tubers, stem and leaves. Land clearing or rotating sweetpotato with another crop after each planting season helps break weevil incidence cycles. Also, the right scheduling of harvest dates helps reduce the damage of weevil even if eggs have already been laid on the tubers (Akoroda, 2009).

Figure 3.4: The developmental stages of the sweetpotato weevil (*Cylas puncticollis)*: (A) egg, (B) larva, (C) pupae, and (D) adult

Source: (CIP, 2017b)

Sweetpotato weevils are most harmful during significant dry periods, causing losses in the range of 60% to almost 100% during periods of severe drought (Loebenstein & Thottappilly, 2009). Weevils are expected to become an even more severe problem as climate change is anticipated to prolong the dry season (Loebenstein & Thottappilly, 2009). Weevil-resistant varieties have been developed by CIP in Uganda and Kenya but have not been introduced to Nigeria (Loebenstein & Thottappilly, 2009). Sweetpotato vines easily carry the weevil from one field to another, and it is therefore recommended that vines are treated with insecticides before being planted in areas where significant weevil damage is likely (Ehisianya et al., 2011).

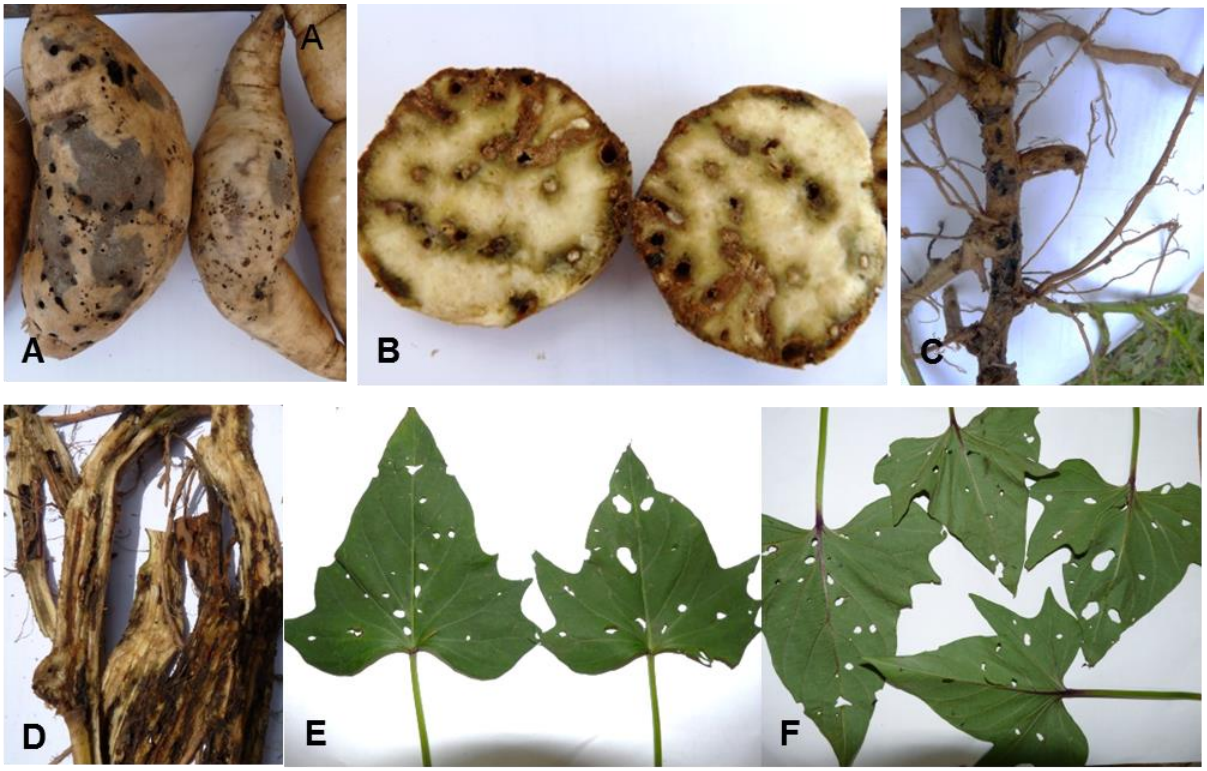


Figure 3.5: Symptoms of sweetpotato weevil *(Cylas puncticollis)*: (A, B) larvae and adult damage on tubers, (C, D) larvae damage on stems, and (E, F) adult damage on leaves

Source: (CIP, 2017b)

Sweetpotato virus complex poses another significant challenge for farmers (Akoroda, 2009). The Sweetpotato Virus Disease Complex (SVDC) comprises of four viruses (vein-clearing, feathery mottle, mottle and mosaic) that distort tubers and inhibit yields, especially when sweetpotato vines are repeatedly re-planted from the same infected source (Akoroda, 2009). Other prominent pests include root-knot nematodes (*Meloidogyne incognita*), which are responsible for sweetpotato production losses of 20%-30% (Tewe et al., 2003). Fawole and Claudius-Cole (2000) found several types of nematodes such as root-knot nematodes (*Meloidogyne incognita*), brown ring nematode *(Ditylenchus destructor),* dry rot nematode *(Scutellonema brady*sand) and lesion nematodes (*Pratylenchus* spp.) on sweetpotato tubers in mixed cropping systems in Nigeria with cassava and or maize. Nematodes damage tuber quality and quantity, which in turn affects tuber prices (Fawole & Claudius-Cole, 2000). However, nematodes have not severely constrained the production of sweetpotato in southwestern Nigeria (Akoroda, 2009).

3.5.2 POOR ACCESS TO EXTENSION AGENTS AND ADOPTION OF IMPROVED TECHNOLOGIES

Sweetpotato farmers in Nigeria currently use using a mix of traditional and improved technologies. Fawole (2007) found that 63.3% of sweetpotato farmers used improved varieties, while 36.7% cultivated local varieties. Access to these technologies most often comes in the form of extension agents. Ekwe and Onunka (2006) surveyed 150 sweetpotato farmers in Abia State to evaluate their adoption of improved technologies jointly developed by International Institute of Tropical Agriculture (IITA) and the National Root Crops Research Institute (NRCRI) that were first introduced to farmers in the state over ten years ago. The study found that only 47% of respondents were aware of improved, available varieties and technologies. Of those who were aware, there was a medium-level uptake of improved technologies and medium-level uptake of related component technologies such as better knowledge about the importance and efficient practice of timing of planting, fertiliser application, improved varieties, intercropping systems, and harvesting technique. There was a low uptake of improved planting space and planting pattern techniques

Ezeano (2010) revealed more promising results regarding modern technology use in sweetpotato production. Results from the study involving 144 farming households in southeastern Nigeria indicated that several improved technologies had been adequately communicated through extension agents and translated into practice in the area. Mbanaso et al. (2012) also examined the extent of adoption of modern or improved sweetpotato production technologies in southeastern Nigeria and found that 79.63% of the sweetpotato farmers were aware of the technologies the interviewers asked about (ranging from land preparation methods like ridging and mounding to timely harvesting), while 20.37% were not. The majority of the farmers had adopted all the improved sweetpotato production practices except plant spacing.

Sweetpotato farmers in the same study also identified major constraints to modern or improved sweetpotato production technology adoption to include difficulty in incorporating sweetpotato production technology into their current production system, unavailability of sweetpotato vines/planting materials, low consumer preferences for sweetpotato products, lack of market for sweetpotato products, unavailability of inorganic fertilizer, high cost of available sweetpotato vines and scarcity of land (Mbanaso et al., 2012). Since most rural farmers were unwilling to adopt any innovation that was too complex, Mbanaso et al. (2012) recommended

that extension services in the area should focus on simple, clear ways of explaining the advantages of adopting innovations.

3.5.3 FERTILIZER APPLICATION

Studies show that fertiliser and manure application can be advantageous to productivity (Agbede & Adekiya, 2011). It can significantly improve sweetpotato yield by up to 116.7% when compared to manual clearing alone and conventional tillage alone (Agbede & Adekiya, 2011). Agbede (2010) conducted field experiments over two cropping seasons to evaluate the effect of tillage method and fertiliser type on soil property and sweetpotato yield. The study concluded that conventional tillage in combination with NPK (Nitrogen Phosphorus Potassium) fertiliser and poultry manure (high in Nitrogen) gave the highest tuber yield of sweetpotatoes and improved the soil's physical and nutritive quality. Asawalam and Unwudike (2011) evaluated the use of cow dung and fertiliser to improve sweetpotato yields. The results from their experiment showed that some combination of both inputs is recommended for sweetpotato production in the two analysed locations in south-eastern Nigeria. Nitrogen application suppressed weed growth by faster sweetpotato plant establishment and also increased beta-carotene content for selected varieties (Ukom, Ojimelukwe, & Okpara, 2009). Despite the reported importance of fertiliser application, Adewumi and Adebayo (2008) found that 88.16% of sweetpotato producing households did not use fertiliser in production, and when they did use it, the fertiliser was applied incorrectly or insufficient quantities were used.

3.5.4 WEED CONTROL

Most smallholders in Nigeria do not bother to weed their sweetpotato plots (Iyagba, 2010). Weeds cause sweetpotatoes to compete for nutrients, reducing the soil's fertility and overall crop yield, and ultimately impairing quality of the roots and reducing market price for the crop (Korieocha, Ogbonna, Korieocha, & Nwokocha, 2011). Weeding, if it practised at all, is typically done manually by hoe (Iyagba, 2010).

Effective weed control in sweetpotato production in south-eastern Nigeria could be achieved through the application of atrazine/metolachlor at a rate of 1.5 kg -per Ha (Korieocha et al., 2011). According to Korieocha et al. (2011), this method is recommended over other weed control treatments experimented within the study because it produced the highest total yield. Nitrogen application has also been found to reduce weed growth 12 weeks after planting (Okpara, Okon, & Ekeleme, 2009). Ezeano (2010) found that 26.4% of sweetpotato farmers used herbicides for weed control, but the study did not explain why only a minority of farmers

used herbicides. However, in several studies conducted across various agro-ecological zones in the country, Nigerian smallholders identified the cost, scarcity, and difficulty in correctly applying the product as constraints to herbicide adoption (Imoloame, 2013; Iyagba, 2010; Kolo, 2004).

3.5.5 POOR STORAGE PRACTICES

Sweetpotato storage is heavily constrained by the crop's short storage life and threats of sprouting, dehydration, sweetpotato weevil (beetle) attacks, and black rot damage (Akoroda, 2009; Fawole, 2007). When stored at room temperature, sweetpotatoes may lose 10-15% of their weight by two weeks after harvest (Akoroda, 2009). According to Tewe et al. (2003), fully matured sweetpotatoes generally cannot be left unharvested for extended periods of time due to weevil damage, which can result in losses of 12-90%. However, in the arid north, farmers face better storage conditions (Tewe et al., 2003). Farmers can store sweetpotatoes for two to three months in pits lined with dried grass, followed by a layer of sweetpotatoes treated with wood ash, followed by another layer of dried grass or leaves, and at least five centimetres of topsoil to protect against weevils (Amienyo & Ataga, 2007). This practice allows northern farmers to store their sweetpotatoes in order to maintain a famine reserve or to sell the sweetpotatoes later in the sale season when the crop is scarce, and the crop is priced higher. In general, in non-arid climates, traditional storage practices only allow sweetpotatoes to be stored for up to a month (Etejere & Bhat, 1986). Otherwise, the fresh tubers must be processed into dry, storable forms to be reconstituted into other food, feed, or industrial products is encouraged to diminish post-harvest tuber losses (Akoroda, 2009).

3.5.6 LIMITED ACCESS TO CREDIT

Access to credit to purchase inputs would scale up production and profitability for smallholder sweetpotato farmers (Nwaru, Okoye, & Ndukwu, 2011). This is because a farmer with access to credit may be willing to adopt riskier but potentially more profitable technologies, or to plant a more drought-prone but higher value crop (Nwaru et al., 2011).

Adewumi and Adebayo (2008) found that 84.21% of sweetpotato farmers finance the production of sweetpotato from personal savings, 7.24% from friends and family savings, 5.26% cooperative society, 3.29% cooperative/personal savings. Another study found that an average of 26.67% of female sweetpotato farmers had access to credit and 35.83% were members of cooperatives/ organisations (Nwaru et al., 2011). The same study found that 5.92% of all sweetpotato farmers were members of a cooperative and 30.26% farmer's association. Sixty-four percent did not belong to any associations or cooperatives (Nwaru et al., 2011).

However, Gbigbi (2011) observed about 63.5% of sweetpotato farmers had access to credit while 60.3% belonged to a farmer cooperative. One of the biggest advantages of belonging to a farmer cooperative or association is gaining access to credit from a more extensive resource pool, but becoming a member often requires a small contribution that some farmers are unable to afford (Gbigbi, 2011).

CHAPTER 4: RESEARCH METHODOLOGY

4.1 RESEARCH STRATEGY

The purpose of this study was to examine the opportunities in the sweetpotato value chain that could contribute to the diversification of the Nigerian economy. More specifically, this study determined and analysed the factors that influence the yield of sweetpotato in Nigeria, identified ways in which the yield can be increased, identified the constraints to market access and identified the market opportunities for sweetpotato nationally and internationally. This study employed a mixed method strategy approach, which involved the combination of both quantitative (close-ended) and qualitative (open-ended) approach in response to the research objectives (Creswell, 2014). The importance of this strategy is that by linking both approaches in tandem, the strength of the study is more significant than either the qualitative or quantitative approach (Creswell, 2014).

The quantitative approach is associated with numerical interpretations, whereby the data collected are transformed into numbers, which are tested to validate if a relationship can be discovered, in order to derive conclusions from the outcome of the results (Bryman & Bell, 2011). In contrast, the qualitative approach does not rely on statistics or numbers but emphasises the understanding, interpretation, and observation of words in natural settings (Ghauri, Gronhaug, & Kristianslund, 1995).

The quantitative approach was used as the main research strategy in this study, while the qualitative approach was integrated to support the quantitative findings. A survey was used as the main quantitative research strategy. The survey design provides a quantitative or numeric description of the trends, opinions, and attitudes of the population by studying a sample of that population (Creswell, 2014). A survey design was used because it allows the collection of a large amount of data from a sizeable population in a timely and highly economical way (Saunders, Lewis, & Thornhill, 2009). The findings from the survey were integrated with a qualitative interview approach.

The qualitative approach was used to complement the findings from the quantitative survey design, in order to collect a more detailed view from fewer participants which helped to further explain the initial quantitative survey findings. The qualitative research approach is more flexible than the quantitative approach, thus allowing researchers to adopt methods that fit into a local situation (Meinzen-Dick, DiGregorio, & McCarthy, 2004). The qualitative research method permits the researcher to build rapport with respondents, who in turn can provide the

insider's view so that the researcher can have a broader and more profound understanding of a particular situation (Meinzen-Dick et al., 2004). Qualitative research helps the researcher to understand how people construct their worlds, interpret their experiences, and the meaning they ascribe to their experiences (Merriam & Tisdell, 2015). An open-ended interview is a qualitative research approach that allows the researcher to understand the issues surrounding a particular subject from the point of view of the informant (Boeije, 2010). It enables the researcher to ask questions systematically and explore beyond the answers to their structured questions (Boeije, 2010). This study utilised an open-ended interview approach as the qualitative research strategy to complement the quantitative findings.

4.2 SAMPLING PROCEDURE AND SITE SELECTION

When the number of the potential participants is too much or when the social setting under observation is so complex that observation of all sites, activities, or events is not possible, it is essential to select a sample to collect data (Gagnon, 2010). A sample is a selection from the population, with the population referring to all cases under study (Robson, 2011). The population for this study includes sweetpotato farmers and leaders of sweetpotato farmer groups in, Kwara state, Nigeria.

Sampling procedures are categorised into two types; probability sampling and non-probability sampling (Saunders et al., 2009). A sample selected by probability sampling, such as a simple random sample, has a higher chance of being a true representative of the population because every element or person has an equal chance of being selected (Sekaran & Bougie, 2013). Whereas, a non-probability sampling, such as convenience sampling, may not be a true representative of the population because not every element or person in the target population has a chance of being selected into the sample (Hair, Money, Samouel, & Page, 2007). However, non-probability sampling such as convenience sampling is useful for exploratory research, and it is the best way of getting some basic information in a timely, efficient and cost-effective manner (Sekaran & Bougie, 2013).

In convenient sampling, samples are selected by finding conveniently or readily available respondents in the population who can provide the required information (Hair et al., 2007). The convenience sampling technique was used in this study. The primary consideration for this is due to the unavailability of the exact number of sweetpotato farmers in Nigeria. Another reason for choosing this technique is due to limitations in time and budget, the high level of insecurity

to lives and properties in some of major sweetpotato producing States in Nigeria at the time of collecting for this research and the exploratory nature of this research.

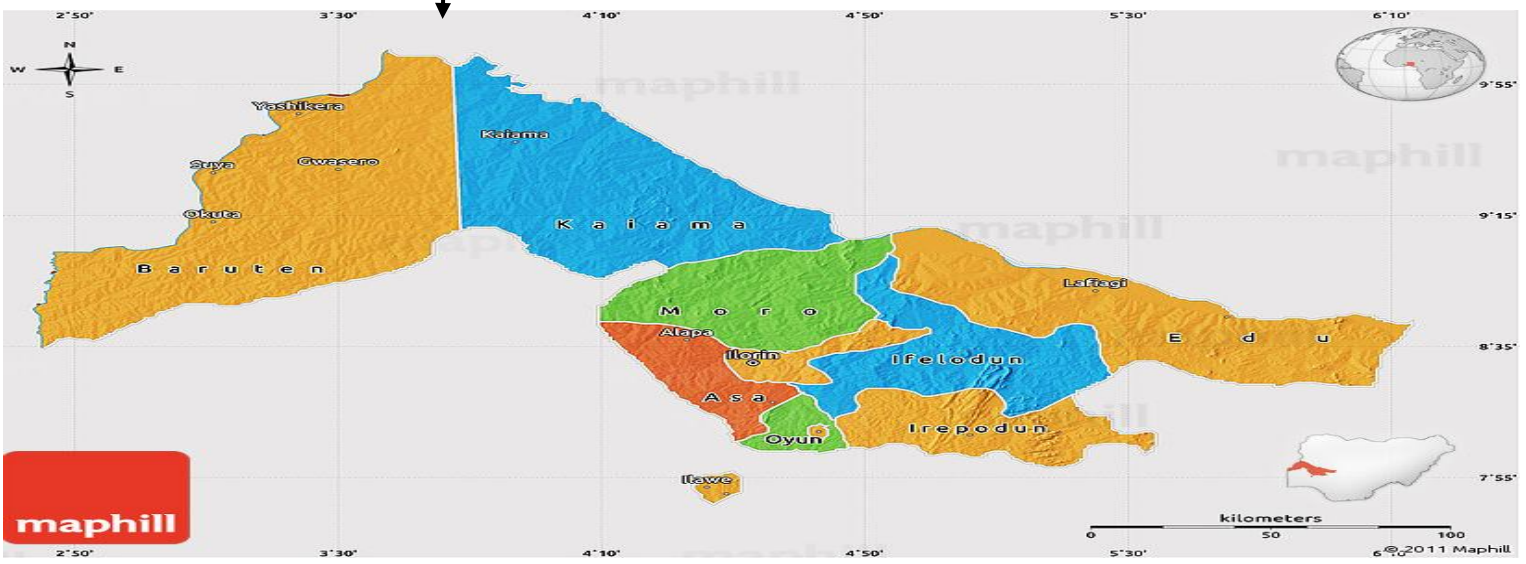
In this research, attempts were made by the researcher to obtain respondents who are justifiably representative of sweetpotato farmers in Nigeria. Firstly, the researcher sourced information about the major producing sweetpotato states in Nigeria from several works of literature. The second step was selecting one of the major sweetpotato producing states. Kwara State was selected due to its prominence in sweetpotato production in Nigeria, and the low level of insecurity to lives and properties at the time data was collected for this study. The third step was selecting local governments within Kwara State that were the highest producer of sweetpotato. This was done by informally questioning seven representatives from the Ministry of Agriculture in the state and confirming the information through literature. These activities resulted in selecting two local governments namely; Offa and Irepodun local government which were the highest producers of sweetpotato in Kwara State. A convenience sampling technique was applied within the two chosen local communities in Kwara State to obtain a total of 117 respondents who were commercial sweetpotato farmers.

4.3 DESCRIPTION OF THE STUDY AREA

This study was undertaken in Kwara State, which is in the north-central geopolitical zone of Nigeria. Nigeria is made of 36 States, which is divided into six geopolitical zones; these zones are south-west, south-south, south-east, north-central, north-west and north central (Giddens, 2006). Nigeria shares an international border with the Republic of Benin in the west, Cameroon and Chad in the east and the Niger Republic in the North (Nationsonline, 2017). Its coast in the south lies in the Gulf of Guinea on the Atlantic Ocean (See Figure 4.1). Kwara State is a major producing hub of sweetpotato in Nigeria (Babatunde, Olorunsanya, Orebiyi, & Falola, 2007; Bergh et al., 2012; Chima et al., 2012; Fawole, 2007). The State is under the moist agro-ecological zone and lies approximately between $7^0$15' and $6^0$18' North of the equator. The State is made up of sixteen local government areas and shares state boundaries with Ondo, Ekiti, Oyo, Osun, Kogi, and Niger States (Chima et al., 2012). The total population of the state was about 3.2 million in 2016, which represents about 1.8% of the total population of Nigeria (NBS, 2017a). About 88% of the State population are under 45 years (NBS, 2017a). A humid tropical climate prevails over the State, and it has two distinct seasons; the rainy and dry seasons. The rainy season lasts between April and October and the dry season between November and March (Babatunde et al., 2007). The rainfall ranges between 51mm during the driest periods to

2413mm in the wettest period. The mean annual rainfall is about 1500mm. The average minimum temperature ranges from 21^{O}C to 25^{O}C while the maximum average temperature ranges from 30^{O}C to 35^{O}C (Babatunde et al., 2007). The State is primarily agrarian with great spreads of arable land and rich fertile soils. The State has about 255,000 hectares of cropped area and about 247,000 farming families. The total land area of the State is about 352,500 km^2, which is 7.24% of the total land area of Nigeria (FAO, 1995). An estimated 75.9% of the state land is arable, 14.1% is forest, and 10% is unavailable for agricultural use (Chima et al., 2012).

Figure 4.1: Map of Nigeria showing Kwara State



Source: (Maphill, 2017; Nationsonline, 2017)

4.4 DESIGN OF DATA COLLECTION

Both secondary and primary data were collected for this research work. The secondary data collected provided an overview of the sweetpotato value chain, identified the gaps and partially addressed the research objectives. However, because the secondary data were insufficient to fully address all the research objectives, primary data were utilized to address the research objectives and fill some of the gaps identified from the secondary data.

4.4.1 SECONDARY DATA

Secondary data are data already collected for some other purposes which can provide a useful source of information from which to answer or partially answer the research question (Saunders et al., 2009). In this research, secondary data were collected from reputable journals, published articles, websites of Central Bank of Nigeria, Nigerian Bureau of Statistics, Food and Agricultural Organization of the United Nations and the database of International Trade Statistics. The data collected from these sources gave information that assisted in partially the research objectives.

4.4.2 PRIMARY DATA

Primary data are new information which are collected first-hand by the researcher on the variables of interest for the purpose of the study (Sekaran & Bougie, 2013). Primary data are collected when the available information is not sufficient to answer the research question (Robson, 2011). This study used two primary data collection method. Primary data were collected via questionnaires which were complemented by an open-ended interview from a smaller population. These methods were chosen to get a broader understanding of the situation. According to Gary (2011), including different data collection methods is often vital in understanding the reason for a particular situation.

4.4.2.1 QUESTIONNAIRES

Questionnaires are one of the most widely used quantitative data collection method within the survey strategy (Saunders et al., 2009). Survey questionnaires are generally designed to obtain large quantities of data (Hair et al., 2007). There are several methods of administering a survey questionnaire which includes; online surveys, self-completed surveys, and face to face surveys (Babbie, 2016). Face to face survey administration takes place when the researcher is present while the questionnaire is being completed (Gorard, 2003). Given the purpose of this study and the nature of the respondents, the most appropriate method that was considered for data collection was a face to face survey questionnaire administration. The approach of a face to

face questionnaire permits a broader response that includes those with low levels of literacy and visual difficulties (Gorard, 2003). A face to face survey questionnaire administration typically has a higher response and completion rate (Babbie, 2016). In the situation where a respondent misunderstands the intent of a question, it is easier to clarify matters and obtain relevant information through the administration of a face to face questionnaire (Babbie, 2016). It also allows the researcher to have a much deeper understanding of the issues surrounding the research objectives from the perspective of the respondents through observations and further investigation (Dane, 1990). For this study, a structured questionnaire was developed to obtain the appropriate information needed to achieve the research objectives. This was administered through face to face interviews. This allowed the researcher as a native speaker of the study area community language (Yoruba) to translate the questionnaire into the local language spoken by the respondents because most of the respondents could not read, write or speak the English language. Also, the researcher was able to obtain further information outside the structured questionnaire via face to face interviews.

4.4.2.1.1 QUESTIONNAIRE DEVELOPMENT

The development of a questionnaire involves four key steps which include; the construction of a draft questionnaire, pre-testing the draft questionnaire, reviewing the questionnaire and preparing a final version of the questionnaire (Babbie, 2016; Synodinos, 2003). A draft structured questionnaire was constructed from the literature on agricultural value chain, building competitiveness in agriculture for smallholder farmers, agricultural production constraints and opportunities, boosting productivity in agriculture and approaches to market access for smallholders (FARMD, 2011; Fawole, 2007; Hernández, Reardon, & Berdegué, 2007; Maspaitella, 2015; USAID, 2017; Van der Heijden, 2010; Webber & Labaste, 2009). The information contained in the draft questionnaire included variables that affect farmers' productivity and market access nationally and internationally. This information was inferred from farmer demographics, farm and production characteristics, sweetpotato marketing features and institutional dynamics at work. The draft questionnaire was developed to allow the assessment of the relationship between the dependent variables (farmers' productivity) and the four groups of independent variables (demographic characteristics of farmers, farm and production characteristics, sweetpotato marketing characteristics and institutional dynamics that affect productivity and market access).

After the construction of the draft questionnaire, a pre-testing procedure was carried out. The pre-testing was important to evaluate the question content, wording, structure, sequence,

layout, instruction, and clarity to the targeted respondents (Synodinos, 2003). The draft questionnaire was pre-tested on five African students who have worked with smallholder farmers in Africa in different capacities and had experience on how the targeted respondents would perceive and respond to the questionnaire. After the pre-testing, the questionnaire was reviewed, based on their feedback. Some corrections were made which include; reduction of words that may be too technical to the targeted participants and constructing the questionnaire in a clearer sequence. The modification of the questionnaire led to the construction of the final questionnaire (See Appendix 1).

The final questionnaire was utilised in the survey, which was carried out from March 12 to April 6, 2018. The final questionnaire comprised five sections; farmer demographics, farm and production characteristics, sweetpotato marketing, institutional factors affecting production and marketing, and perception of the export market. The questionnaires were administered to 117 respondents by the researcher and one trained local assistant through face to face interviews. After the collection of all the questionnaires, the consistency and completeness of the data were checked before data coding and entry for analysis. Two questionnaires were found to be incomplete and were excluded from the data that was used for analysis. The face to face questionnaire administration showed a completion rate of 98.3% with 115 completed questionnaires.

4.5 DATA ANALYSIS

The data from the questionnaire were analysed using the statistical data analysis software, STATA version 13. To begin with the analysis of the data, a cleaning process was carried out to detect, diagnose and edit faulty data in order to ensure the validity and completeness of the data. The cleaning process involved checking the data for logical inconsistencies, contradictions, extreme outliers and missing data. The mean values of the variables in the questionnaire were produced using STATA version 13, to confirm if there was missing data. The values generated showed that there was no missing data. The inconsistent, contradicting and out-of-range values were changed by logically characterising the consistent data and changing accordingly. For example, the extreme outliers were replaced with the mean values of the consistent data. After the cleaning process, a name was assigned to each variable based on the content of the question, and the data were coded. After the correction and entry of all data, the data was checked for entry errors. The final data analysed consisted of 115 respondents. The analysis of the data involved both descriptive and inferential statistics. To

perform the descriptive analysis of the data, frequencies, and percentages were generated. Also, the mean, minimum and maximum values were also generated and used where applicable. The descriptive statistics were used in providing general information used in describing the socio-economic and demographic characteristics of the respondents. Also, the researcher was able to identify the constraint to market access, the contributing factors to the low yield of sweetpotato and ways in which the yield could be increased with the aid of the descriptive statistics. An inferential statistical method of analysis was performed to determine the factors that had a significant influence on the yield of sweetpotato farmers' in the study area. The inferential econometric analysis examined how the independent variables influenced the dependent variable and the significance of the influence. The inferential econometric method was a binary logistic regression.

4.5.1 BINARY LOGISTIC REGRESSION

A binary logistic regression model was used to determine the factors that had a significant influence on the yield of sweetpotato farmers' in the study area. Binary logistic regression is one of the most used econometric methods in obtaining the relationships between two or more predictive (independent) variables and a dependent variable (Bucur, Danet, Lehr, Lehr, & Nita-Lazar, 2017). The binary logistic regression model is an appropriate statistical tool for determining the influence of independent variables on dependent variables when the dependent variable has only two (dichotomous) groups, e.g. low yield and high yield (Tiwari, Sitaula, Nyborg, & Paudel, 2008). Binary regression is useful for studying the effects of continuous, categorical and dummy independent variables on a dichotomous dependent variable (Tiwari et al., 2008). Unlike linear regression, binary logistic regression does not require that independent variables be linearly correlated, nor does it require equal variance within each group, which makes it less stringent for statistical analysis (Torosyan, 2017).

In binary regression, an ordinal outcome can be analysed by collapsing the ordinal outcome into two categories (Lall, 2004). The binary regression recognises the impact and strength of each independent variable against the probability that the dependent variable will fall into a particular category (Cramer, 2003). It describes the correlation between the characteristic of interest (dependent variable) and the set of independent variables and evaluates the probability of a binary response based on the independent or explanatory variables (Lall, 2004). That is, binary regression can be used to determine independent variables that satisfactorily describe the factors that influence farmers' yield (Pyke & Sheridan, 1993). In binary regression, the dependent variable is a categorical dichotomy that takes only two numerical values of zero and

one (Field, 2013). Usually, the numerical value of one indicates the presence of an event, that is, the probability of an event occurring as a function of the values the independent variables while the numerical value of zero means the probability of an event not occurring (Bucur et al., 2017). The independent variables in binary regression can be categorical or continuous (Field, 2013). In this study, the categorical dichotomous dependent variable was the probability of farmers getting either a high or low yield based on several independent variables. The relationship that links the dependent variable with the independent variables is expressed in the form of the equation:

$$Log(Y) = log\left[\frac{P}{(1-P)}\right]$$ ---------- (Equation1)

In the equation above, Y is the probability of the interested outcome while the term within the square brackets is the odds of an event occurring (Pyke & Sheridan, 1993). Odds of an event are the ratio of the probability that an event will occur to the probability that it will not occur. If the probability of the presence of the characteristic of interest is P, the probability of the absence of the characteristic of interest is (1-P) (Torosyan, 2017). Then, the corresponding odds are given by the formula:

$$Odds = \frac{P}{(1-P)} = \frac{Probability\ of\ presence\ of\ characteristic}{Probability\ of\ absence\ of\ characteristic}$$ ---------- (Equation 2)

Since binary regression calculates the probability that an event occurs over the probability that an event does not occur, the influence of independent variables is usually explained in terms of odds (Torosyan, 2017). With binary logistic regression, the linear relationship between the dependent variable Y and the independent variables X_1, X_2, X_3 … X_k is given by the equation:

$$Logit\ (Y) = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k$$ ---------- (Equation 3)

In equation 3, α_o is the intercept, β_1, β_2, β_3 … β_k are the logistic regression coefficients and X_1, X_2, X_3 … X_k are the explanatory variables which are also known as the independent variables (Torosyan, 2017). In binary regression, the regression coefficients are compared with the probability of an event occurring (Y=1) or not occurring (Y=0). In order to predict the probability of an event happening (Y=1), the inverse transformation of equation 1 is given by the equation:

$$Probability(Y = 1) = P(Y = 1) = \frac{e^{logit(Y)}}{1+e^{logit(Y)}}$$ ---------- (Equation 4)

In order to express equation 4, based on the independent variables (X_1, X_2, X_3 … X_k). The equation for predicting the probability of an event happening (Y=1) can be transformed as:

$$P = \frac{e^{\alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k}}{1 + e^{\alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k}} = \frac{1}{1 + e^{-(\alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k)}} \text{ ---------- (Equation 5)}$$

The coefficients of the binary logistic regression provide the directions of the effects of the explanatory variables but do not provide any information regarding the magnitude of the effects. Therefore, the marginal effects which represent a change in the dependent variable emanating from a change in the respective explanatory variables give the magnitude of the effect of the explanatory variables on the dependent variable. Following Cameron and Trivedi (2010) the marginal effect is estimated as:

$$\frac{\partial p(Y=1)}{\partial X_j} = \varphi(X\beta)\{1 - \varphi(X\beta)\}\beta_j \text{ ---------- (Equation 6)}$$

Where φ denotes the cumulative density function. The regression coefficients and the marginal effects in the binary logistic regression are estimated using the Maximum Likelihood model. Maximum likelihood is the probability of getting the observed values of the dependent variables which varies from zero to one, given the observed values of the independent variables. (Torosyan, 2017). The maximum likelihood (ML) model helps to find the set of parameters for which the probability of the observed data is the greatest (Czepiel, 2002). The maximum likelihood is the most commonly used method in estimating the parameters of binary logistic regression (Reddy, Likassa, & Asefa, 2015). With the maximum likelihood, all the values of the regression coefficient β for all the predictor variables can be visualized (Bucur et al., 2017) The maximum likelihood function is given by the equation:

$$L(\beta) = \ln[\ell(\beta)] = \sum_{i=1}^{N} \{Y_i \ln(P(Y_i)) + (1 - Y_i) \ln[1 - P(Y_1)]\} \text{ ---------- (Equation 7)}$$

In binary logistic regression, the log-likelihood is used to compute the probability and estimate the values of the regression coefficient while the log-likelihood ratio test is used to test the significance of the parameters estimated by maximum likelihood function.

4.6: MODEL SPECIFICATION, DESCRIPTION OF VARIABLES, AND HYPOTHESIZED SIGNS

The binary logistic regression model used for the analysis to determine the factors that had a significant influence on the yield of sweetpotato farmers' in the study area. The binary regression model was chosen because the probability of the farmers' response was categorised to be dichotomous (low yield and high yield). According to FAOSTAT (2017), the average yield of sweetpotato in Nigeria is 2.6 tons per hectare while the average yield of sweetpotato in Africa is 9.6 tons per hectare. Hence, in this study, the researcher classified the sweetpotato yield below 9.6 tons per hectare as low yields and the yield above 9.6 as high yields. The dependent variable measured the yield of sweetpotato (either low yield or high yield) which was influenced by a set of independent variables derived from farmers' demographics, farm and production characteristics, marketing features and institutional factors. Hence, the model specification for the analysis in this research was given as:

$$\text{Prob (YS=1 OR 0)} = \alpha_o+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4 X_4+ \beta_5X_5+\beta_6X_6+\beta_7X_7+\beta_8 X_8+\beta_9X_9+\beta_{10}X_{10}+\beta_{11} X_{11}+ \beta_{12}X_{12}+\beta_{13}X_{13}+\beta_{14}X_{14}+\beta_{15} X_{15} +\beta_{16} X_{16} \text{ ----------(Equation 8)}$$

YS refers to the yield of sweetpotato (dependent variable) and YS = 1 if the yield of sweetpotato is high (above 9.6 tons per hectare) and YS=0 if the yield of sweetpotato is low (below 9.6 tons per hectare). The independent variables (X_1, X_2, X_3 … X_{16}) for the binary regression analysis in equation 8, was divided four parts namely; the variable describing farmers demographics, variables, the variables describing farm and production characteristics variables, the variables describing marketing features and the variables describing the institutional factors that influenced farmers productivity. The description of the variables X_1, X_2, X_3 … X_{16} is shown in Table 4.1

4.6.1 DESCRIPTION OF INDEPENDENT VARIABLES AND HYPOTHESIZED SIGNS

The following independent variables were hypothesised as influencing the yield of sweetpotato in the study area. The 16 hypothesised independents variables are defined and explained below.

4.6.1.1 FARMERS DEMOGRAPHICS

- **AGE OF FARMERS**: Age since birth measured in terms of the respondent's number of years of existence. With an increased number of years, it was assumed that the farmer

would be less active on the farm and less adventurous, thus reducing their capacity high productivity. Older farmers, due to declining physical strength may have a negative attitude towards innovation that can decrease sweetpotato yield (Guo, Wen, & Zhu, 2015). Hence, it was hypothesised to have a negative effect on farmers' productivity.

Table 4.1: Binary logistic regression variables

Dependent Variable	**Description and measurement type**	**Variable type**	**Expected Sign**
Y =Yield of sweetpotato	Yield measured in metric tons. 1= High 0= Low	Dummy	
Independent Variables			
Farmers Demographics			
X_1=Age	Number of years of existence (years)	Continuous	-
X_2 = Primary education	1 = primary education and 0 otherwise	Dummy	+
X_3=Secondary education	1 = secondary education and 0 otherwise	Dummy	+
X_4=Post-secondary education	1 = post-secondary education and 0 otherwise	Dummy	+
X_5= Farming experience	Years of sweetpotato farming	Continuous	+
X_6 =Off-farm employment	Farmers with another occupation 1= Yes, 0= No (Dummy)	Dummy	+
X_7 = Gender	1 = male and 0 = female	Dummy	+
Farm and Production Characteristics			
X_8= Cultivated land area	Number of sweetpotato acres cultivated (Acres)	Continuous	+/-
X_9 = Yellow variety	1 = Red sweetpotato variety and 0 otherwise	Dummy	+
X_{10} = Red variety	1 = Red sweetpotato variety and 0 otherwise	Dummy	+
Marketing Features			
X_{11} = Payment of sales at delivery	Period of receiving payment for sweetpotato sale 1= At delivery and 0 otherwise	Dummy	+
X_{12} = Payment of sales within a week	Period of receiving payment for sweetpotato sale 1= within a week and 0 otherwise	Dummy	
Institutional Factors			
X_{13} = Market information	Access to market information 1= Yes, 0= No	Dummy	+
X_{14} = Extension services	Access to extension services 1= Yes, 0= No	Dummy	+
X_{15} = Credit	Access to credit facility 1= Yes, 0= No	Dummy	+
X_{16} = Farmers group	Membership of farmers group 1 = Yes, 0 = No	Dummy	+

- **LEVEL OF FORMAL EDUCATION**: There were four educational level categories: no formal education, primary education, secondary education and post-secondary education. Each of these categories was included in the model as a dummy variable. No formal education was used as a base category. There have been several studies that suggest a positive relationship between the educational level of farmers and their productivity (Das & Sahoo, 2012; Oduro-Ofori, Aboagye, & Acquaye, 2014; Reimers & Klasen, 2013). Education has the capacity to enhance farmers' skill and access to information which can increase the yield of sweetpotato. Thus, it was hypothesised that farmers with a higher level of education might have higher farm productivity. Hence, a higher level of education is expected to have a positive effect on farmers' productivity.

- **SWEETPOTATO FARMING EXPERIENCE**: This was measured as the number of years of sweetpotato farming. With increased years of farming sweetpotato, the farmers were expected to have accumulated knowledge of sweetpotato production. Thus, the years of farming experience was hypothesised to have a positive influence on the yield of sweetpotato in the study area.
- **OFF-FARM EMPLOYMENT**: This was captured as a dummy variable with the value of one representing an engagement in off-farm employment and zero representing non-engagement in off-farm employment. Farmers with off-farm employment have additional income that may be used to aid agricultural productivity. Hence, off-farm employment is hypothesised to have a positive effect on farmers' productivity.
- **GENDER**: This was measured as a dummy variable where the numerical value of one represented male farmers and zero for female farmers. It was expected that male farmers were likely to harvest a higher yield than female farmers. The reason is that male farmers in the study area are less constrained in terms of resources such as land, access to extension services, among other support services. In addition, females are actively responsible for the household chores and therefore devote less time to the farming activities.

4.6.1.2 FARM AND PRODUCTION CHARACTERISTICS

- **CULTIVATED LAND AREA (FARM SIZE)**: This is a continuous variable measured in terms of number of acres. Small farmers may be more productive per unit area or land or there could be an inverse relationship between cultivated land area (farm size) and

productivity (Chen, Huffman, & Rozelle, 2011). Hence, it was hypothesised that cultivated land area would have either a positive or negative effect on farmers' productivity.

- **VARIETY OF SWEETPOTATO PLANTED**: This is a categorical variable. The varieties of sweetpotato included white flesh, yellow flesh and red flesh. Each of these varieties was coded as a dummy variable, and white flesh was used the based category. The variety of sweetpotato planted may influence the productivity. Thus, it was hypothesised to have a positive effect on farmers' productivity.

4.6.1.3 MARKETING FEATURES

- **PERIOD OF PAYMENT**: This was the period between when sweetpotatoes are sold and when payments are received. It is a categorical variable (1= At delivery, 2= Within a week, 3= More than a week). Each of these variables was included in the model as a dummy variable and more than payment more than a week was used as the base category. It was hypothesised that prompt payment of farmers for their produce could encourage them to boost their production. Hence, it was hypothesised to have a positive influence on farmers' productivity.

4.6.1.4 INSTITUTIONAL FACTOR

- **ACCESS TO EXTENSION SERVICES**: This was measured as a dummy variable with the value of one representing access to extension services and zero representing non-access to extension services. It was hypothesised that agricultural extension services could assist in transferring important knowledge and information that can assist in increasing farmers' productivity. Thus, it was expected to have a positive influence on farmers' productivity.

- **ACCESS TO CREDIT**: This was measured as a dummy variable with the value of one representing access to credit and zero representing non-access to credit. It was hypothesised that farmer's accessibility to credit might encourage farmers to improve their production practices. Thus, it was to have a positive influence on farmers' productivity.

- **ACCESS TO MARKET INFORMATION**: This was captured as a dummy variable with the value of one representing access to market information and zero representing non-access market information. It was hypothesised that access to market information might

play a vital role in improving farmers' efficiency. Thus, it was to have a positive influence on farmers' productivity.

- **MEMBERSHIP OF FARMERS GROUP**: This was measured as a dummy variable with the value of one representing membership of a farmers group and zero representing otherwise. Involvement of farmers in collective action (farmers group and cooperative) can contribute to higher productivity (Markelova & Mwangi, 2010). Thus, it was expected to have a positive influence on farmers productivity.

4.7 ETHICAL CONSIDERATIONS

This research was evaluated and endorsed by the Massey University Human Ethics Committee as low-risk research without potential harm to the participants (see Appendix 2). The research was also carried out in conformance with the principle of Massey University's Code of Ethical for Research, Teaching and Evaluations Involving Human Participants[2]. The participants were informed about the objectives of the research, its significance, and intended benefits. Also, an information sheet and consent form (see Appendix 3 and Appendix 4) were given to the respondents before participating in the survey. The respondents' participation was voluntary and based on the understanding of adequate and appropriate information of what would be involved. During the interview process, the respondents can decide not to answer a question or opt out of the interview. Also, the anonymity of the respondents was assured.

4.8 LIMITATION OF THE STUDY

Several limitations were encountered in this study. Firstly, the study was carried out in only one State in Nigeria. As a result, the findings of this study cannot be necessarily generalised for all of Nigeria. Secondly, there were several insecurity challenges in most of the major sweetpotato producing State at the time data were collected for this research. The insecurity challenge constrained the researcher to one State. Thirdly, despite the efforts made by the researcher, the researcher was not able to interview any of the exporters of sweetpotato in Nigeria. Lastly, due to the limitation in the timeframe allotted for the completion of the study, the researcher was unable to obtain much deeper information during the process of data collection.

[2] Retrieved online on 4 March, 2018 from http://www.massey.ac.nz/massey/fms/Human%20Ethics/Documents/MUHEC%20Code.pdf?2F3CBE296DD2345CC01794BF9CFCA13A

CHAPTER 5: DESCRIPTIVE STATISTICS OF THE DATA

5.1 INTRODUCTION

This chapter aims to describe the socio-economic and demographic characteristics of the sampling population used in this research. A total of 115 sweetpotato farmers participated in this research. The descriptive statistical analysis describes the farmer demographics, farm and production characteristics, marketing features, and the institutional factors that influence the production, income and marketing of sweetpotato.

5.2 FARMER DEMOGRAPHICS

This section presents a descriptive summary of the demographic characteristics of the farmers that participated in this research. Demographic characteristics such as the farmer's age, gender, level of education, sweetpotato farming experience and off-farm employment are presented descriptively.

5.2.1 AGE OF FARMER

The mean age of the farmers in this study was 49 years old, while the minimum and maximum ages of the farmers were 30 years and 76 years respectively. According to the Nigerian Bureau of Statistics, the Nigerian youth labour force is between the ages of 15 and 34 and the economically active population or working-age population are persons between the ages of 15 and 64 (NBS, 2017b). As shown in Table 5.1, most of the farmers (83.5%) were between the age group of 35-64 years while 15% were over 64 years old and 3.5% of the farmers were between 30-34 years old. This result from the sampled population of this study reveals that 3.5% of the economically active youth population aged between 30-34 years were involved in sweetpotato farming. The majority of the sampled population (87%) falls within the active age structure (15-64years) to engage in sweetpotato farming, and 13% of the sampled population were within the passive age (over 64 years).

Table 5.1. Age of farmers

Mean Age: 49 years Minimum Age: 30 years Maximum Age: 76 years		
Age of farmer (years)	**Frequency**	**Percentage (%)**
30-34	4	3.5
35-64	96	83.5
>64	15	13.0
Total	115	100.0

5.2.2 GENDER

Agriculture in Nigeria is highly dominated by the male gender (NBS, 2010). The distribution of sweetpotato farmers involved in the study reveals that 16.5% of the respondents were female and 83.5% were male (Table 5.2). The results show that males highly dominate sweetpotato farming in the study area.

Table 5.2: Gender of farmers

Gender	Frequency	Percentage (%)
Male	96	83.5
Female	19	16.5
Total	115	100

5.2.3 LEVEL OF FORMAL EDUCATION

There have been several studies that suggest a positive relationship between the educational level of farmers and their productivity (Das & Sahoo, 2012; Oduro-Ofori et al., 2014; Reimers & Klasen, 2013). These studies imply farmers with a higher level of formal education tend to have higher farm productivity. Also, education enhances the skills and ability to make better use of market information, which may lead to reduced marketing cost and ability to participate in the more profitable market (Sigei, 2014). In this study, farmers' level of education was categorised into four groups namely; no formal education, primary education, secondary education and post-secondary education. Those with primary education have 6 years of formal education while those with secondary education have 12 years of formal education and those with post-secondary education have over 12 years of formal education. As shown in Table 5.3, the majority (37.5%) of the farmers had no formal education, 27% had acquired a primary or basic form of formal education, while 17.4% had a secondary form of formal education and 18.3% had a post-secondary or tertiary form of education. Approximately 64% of sweetpotato farmers involved in this study have little (primary) or no formal education (see Table 5.3). It was observed that almost all the farmers with no formal education were illiterate.

Table 5.3: Educational level of farmers

Level of Education	Frequency	Percentage (%)
No formal education	43	37.4
Primary education	31	27
Secondary education	20	17.4
Post-secondary education	21	18.3
Total	115	100

5.2.4 SWEETPOTATO FARMING EXPERIENCE

Although most of the farmers in this study had no formal education, the majority of the sampled population had over 10 years of sweetpotato farming experience. As shown in Table 5.4, the average years of farming sweetpotato was 15 years, the minimum sweetpotato farming experience was 4 years, and the maximum sweetpotato farming experience was 40 years. The average sweetpotato farming experience of 15 years suggests an extended period of farming experience should increase their knowledge of sweetpotato farming activities. 37.4% of the respondents had been farming sweetpotato for 4-10 years, 45.2% had been a sweetpotato farmer for 11-20 years, and 17.4% of the respondent had over 20 years' experience farming sweetpotato (see Table 5.4). The results from this study show that approximately 63% of the farmers surveyed had over 10 years of sweetpotato farming experience.

Table 5.4: Sweetpotato farming experience

Mean Farming Experience: 15years Minimum Farming Experience: 4 years Maximum Farming Experience: 40 years		
Farming experience (years)	**Frequency**	**Percentage (%)**
4 - 10	47	37.4
11 - 20	52	45.2
>20	20	17.4
Total	115	100.0

5.2.5 ENGAGEMENT IN OFF-FARM EMPLOYMENT

Smallholder farmers sometimes participate in off-farm employment to earn an additional source of income. As shown in Table 5.5, 28.7% of the respondents were involved in off-farm employment, which implies they have an additional source of income and farming was not necessarily their primary occupation and source of main income. Some of the farmers earn additional income working as a school teacher, mechanic, civil servant (government worker) or property agent. However, the majority (71.3%) of the farmers were not involved in off-farm employment. This implies that most of the respondents in this research were full-time farmers and were more focused on their sweetpotato farms as the primary occupation and main source of income.

Table 5.5: Off-farm employment of farmers

Off-farm employment	Frequency	Percentage (%)
Yes	33	28.7
No	82	71.3
Total	115	100.0

5.3 FARM AND PRODUCTION CHARACTERISTICS

This section describes the trends of sweetpotato production and the characteristics of the farms where they were produced. The farm and production characteristics analysed and described in this section include cultivated land area and land availability; planting and harvesting period; irrigated and rain-fed production; varieties of sweetpotato planted; source of sweetpotato vines planted; fertilizer and herbicide application; hired labour and activities; fresh root yield and constraint with the production of sweetpotato.

5.3.1 CULTIVATED LAND AREA AND LAND AVAILABILITY

The majority of the sweetpotato farmers in this study are characterised as smallholder farmers. According to World Bank's Rural Development Strategy, Food and Agricultural Organization (FAO) and International Fund for Agricultural Development (IFAD), smallholder farmers are those operating on less than 2 hectares of farmland (Thompson Ayodele, Olusegun Sotola, Olajide Damilola, Khalil Hegarty, & Obe, 2015). The cultivated land area of the respondents ranged from 0.4 hectares to 16 hectares, with a mean cultivated land area of 2.5 hectares (see Table 5.6). As shown in Table 5.6, the percentage of farmers characterised as smallholder sweetpotato farmer with less than 2 hectares of cultivated sweetpotato farmland was 67%.

Approximately 18% of the farmers were categorised as medium scale farmers with a cultivated land area which ranged from 2 to 5 hectares while approximately 15% of the farmers were categorized as large-scale sweetpotato farmers with a cultivated land area of over 5 hectares. Farmers with a larger farm size tend to have a higher scale of production than farmers with smaller farm size if the farm size is being used with greater efficiency (Chen et al., 2011).

Table 5.6: Cultivated sweetpotato land area

Mean farm size: 2.5 hectares Minimum farm size: 0.4 hectares Maximum farm size: 16 hectares		
Farm size (hectares)	**Frequency**	**Percentage (%)**
< 2.0	77	67.0
2.0 – 5.0	21	18.3
> 5.0	17	14.7
Total	115	100

The majority of respondents in this study had access to farmland to increase their scale of sweetpotato production. Farmers with access to farmland will not experience land scarcity if they want to increase their scale of production. As shown in Table 5.7, 92.2% of the respondents had access to farmland to increase their production while 7.8% of the respondents were constrained by land availability to increase their production and therefore experience land scarcity. One of the smallholder farmers stated:

"We have access to land for farming; land is not our problem. The major problem is the finance to cultivate the land and the market to sell the cultivated harvest.

Another smallholder farmer remarked:

> *"I cannot deceive you; I have access to over 50 hectares farmland that I give to people to farm for free. If given access to finance, a steady and reliable market to sell my harvest, I can cultivate more than 40 hectares of sweetpotato."*

Table 5.7: Land scarcity experience

Land scarcity experience	Frequency	Percentage (%)
Yes	9	7.8
No	106	92.2
Total	115	100

5.3.2: PLANTING AND HARVESTING PERIOD

The period of planting and harvesting can have an implication on sweetpotato productivity, income and profitability for farmers. The rainy season in the study area begins at the end of March and lasts until early September. As shown in Table 5.8, 1.7% of the farmers' planted sweetpotato between January and February, while 60.9% (the majority) planted sweetpotato between March and April. Also, 34.8% of the farmers planted their crop between May and June, and 2.6% planted sweetpotato between July and August. One of the reasons the majority (60.9%) of the respondents' planted sweetpotato between March and April, which represents the onset of the rainy season might be because of their high dependence on rainfall (see Table 5.10). Also, the fact that they are smallholders and may not be able to set up irrigation facilities to irrigate their farm due to the cost implication.

Table 5.8: Period of planting sweetpotato

Period of planting	Frequency	Percentage (%)
January - February	2	1.7
March - April	70	60.9
May - June	40	34.8
July - August	3	2.6
Total	115	100

Furthermore, as shown in Table 5.9, approximately 82% of the sampled farmers harvested their sweetpotato around the same period, between July and August, 7.8% harvested their sweetpotato between May and June, 8.7% harvested their sweetpotato between September and November, and 1.7% harvested their sweetpotato between November and December. The difference between the periods most farmers planted their sweet potato (March - April) and harvested their sweetpotato (June - July) shows that the maturity period for the majority of the farmers was about four months. Prices of agricultural product often collapse when there is an excess supply of a particular product in the same period. In other words, harvesting sweetpotato around the same period may result in a glut in the market which will consequently collapse the selling price and reduce farmers' income and profitability.

Table 5.9: Period of harvesting

Period of harvesting	Frequency	Percentage (%)
May - June	9	7.8
July - August	94	81.7
September - October	10	8.7
November - December	2	1.7
Total	115	100

5.3.3 IRRIGATED AND RAINFED PRODUCTION

Almost all the sampled farmers in this research are entirely dependent on rainfall for their sweetpotato production. Table 5.10 shows that 98.3% of the sampled population are dependent on rainfall for their sweetpotato production. As stated by one of the farmers:

> *"We are highly vulnerable to climatic fluctuations, there are periods we expect rainfall on our sweetpotato plantations, but instead we experience a dry spell for a long period which results into crop failure and low yields."*

The availability of water is a significant factor in the growth and productivity of sweetpotato. Variability in the climate which may result in prolonged drought during the raining season may adversely affect the yield of sweetpotato for farmers who are solely dependent on a rain-fed system of producing sweetpotato. The overdependence of sweetpotato farmers on rainfed sweetpotato production in the study area may have a negative consequence on their yield and profitability in periods of prolonged drought. The use of modern irrigation systems was absent amongst the participants as only 1.7% of the farmers who irrigated their sweetpotato farm made use of a hand watering irrigation method which was labour intensive. The lack of modern irrigation systems like automated sprinklers amongst the farmers might be linked to the fact that most of the farmers are small-scale farmers who may not be able to afford a modern irrigation system of farming.

Table 5.10: Water dependency of farmers

Water dependency	Frequency	Percentage (%)
Irrigated	2	1.7
Rain-fed	113	98.3
Total	115	100

5.3.4 VARIETY OF SWEETPOTATO PLANTED

The respondents in this study planted three varieties of sweetpotato. These varieties were the red-fleshed type, white-fleshed type and yellow-fleshed type. As shown in Table 5.11, 6.1% of the farmers planted the red-fleshed sweetpotato variety while 30.4% planted the yellow-fleshed variety and majority (63.5%) of the farmers planted the white-fleshed variety. One of the farmers who planted the white fleshed variety was asked why he preferred the white flesh variety and not other varieties like the red, yellow or orange-fleshed varieties. He stated:

> *"There was a time I was told to plant the orange-fleshed sweetpotato variety by an extension officer, I was told the benefits and was given vines to plants by the extension officer. I planted the orange-fleshed sweetpotato on a large scale, but unfortunately, I ran at a loss and was not able to sell it because the buyers were not familiar with that particular variety. I plant the white flesh variety because it is well accepted in the market and I can easily sell it."*

Another farmer who was asked about the factors that determine the variety of sweetpotato planted expressed:

> *The major factor that determines the variety I plant is the market. What is the essence of planting a particular variety without the market to sell it? I plant the variety I know will be accepted in the market."*

Another farmer was asked if he would plant a variety that is highly resistant to diseases and has a high yielding potential. In his remark, he stated:

> *"Of course, I will plant a variety that is highly resistant to diseases and has high yielding potential if it is accepted in the market and I can easily sell it. I once planted the orange-fleshed sweetpotato that is highly resistant to diseases and had a very good yield, but I regretted planting it because most consumers were not familiar with the orange-fleshed sweetpotato, and as a result, I made huge losses because I was unable to sell it."*

These statements show that the acceptance of a particular variety by buyers/consumers is a significant factor in determining the variety planted by farmers. If a certain variety is well accepted in the markets farmers can easily access, they will be encouraged to plant such a variety. The high percentage (63.5%) of the white-fleshed sweetpotato variety planted among the respondents is an indication that white-fleshed sweetpotato is widely accepted in markets where farmers have easy access.

Table 5.11: Varieties of sweetpotato planted

Variety	Frequency	Percentage (%)
Red Flesh	7	6.1
White Flesh	73	63.5
Yellow Flesh	35	30.4
Total	115	100

5.3.5 INFORMATION SOURCES ON SWEETPOTATO VARIETIES

Information on the best varieties (high yielding, drought, pest, and disease resistant varieties) of sweetpotato to plant may have a positive correlation with their yield. Table 5.12 shows that the majority (48.7%) of the respondents in this study area obtained information on the best variety to plant from other farmers in the region while 1.7% of the respondents obtained their information from their farmers' association and 30.4% had no access to information on the best variety to plant. 19.1% of the respondents obtained information on the variety to plant from extension officers. One of the farmers who received information from extension officers stated:

> *"Some extension officers came to meet me to plant the orange flesh variety; I must say that the variety was resistant to some pest and diseases that affected the white flesh variety I am used to planting, and the yield was okay. Also, it has more nutritional benefits. However, I stopped planting this variety because buyers were not familiar with it and as a result, I was not able to sell it."*

Table 5.12: Information sources on the best variety

Information sources	Frequency	Percentage (%)
Extension officers	22	19.1
Farmers association	2	1.7
Other Farmers	56	48.7
None	35	30.4
Total	115	100

The statement by the farmer suggests that even when information is available on the best variety to plant, farmers tend to make an informed decision on adoption of the information due to various constraints such as market availability and acceptability. This implies that some non-adopting farmers could adopt information on the best variety to plant if limiting constraints, such as market acceptability were addressed.

5.3.6 ACQUISITION OF SWEETPOTATO VINES PLANTED

In Nigeria, sweetpotatoes are usually propagated through vine cuttings. The source and quality of the vine cuttings propagated by the farmers have an implication on sweetpotato yield. In this study, most of the respondents did not purchase the vine cuttings used for sweetpotato propagation. Their primary source of planting materials was vines from their own field or other farmers' field. As shown in Table 5.13, 74.8% of the respondents did not purchase the vines planted while 25.2% of the respondents purchased the vines planted.

Table 5.13: Acquisition of sweetpotato vine cuttings

Vine Purchase	Frequency	Percentage (%)
Yes	29	25.2
No	86	74.8
Total	115	100

Due to the fact that sweetpotato was propagated through vegetative means, the conservation of the highly perishable crop has posed a challenge to farmers. One of the methods used by farmers in conserving sweetpotato vine cuttings is the use of sprouts left in the field from the previous harvest. As shown in Table 5.14, 53.5% of the respondents who did not purchase sweetpotato vines, acquired the vines planted from the post-harvest vines gotten from previous crop cycle on their farm. The remaining 46.5% got the sweetpotato vines for free from the fields of the farmers who are friends and/or members of the same farmers group.

Table 5.14: Source of the unpurchased vines

Source of the unpurchased vine	Frequency	Percentage (%)
Other Farmers	40	46.5
Vines from previous plantings	46	53.5
Total	86	100

Furthermore, 89.7% of the farmers who purchased sweetpotato vines for their farms, obtained the vines from other farmers who had conserved vines from previous crop cycle while the remaining 10.3% purchased their vines from the local market (Table 5.15).

Table 5.15: Source of the purchased vines

Source of the purchased vine	Frequency	Percentage (%)
Other Farmers	26	89.7
Local market	3	10.3
Total	29	100

5.3.7 FERTILIZER APPLICATION

Several studies have shown that the application of fertiliser could be beneficial in significantly improving the yield of sweetpotato (Agbede & Adekiya, 2011; Osundare, 2004; Sowley, Neindow, & Abubakari, 2015). Osundare (2004) evaluated the effect of organic and inorganic fertiliser application on the yield of sweetpotato in Nigeria and found the improved root yield of sweetpotato were 27% and 47% for inorganic and organic fertilisers respectively. Almost all the sampled respondents did not apply either organic or inorganic fertiliser to their sweetpotato plantations. As shown in Table 5.16, 96.5% of the respondents did not apply organic fertiliser while 3.5% of the respondents applied organic fertiliser which consisted of poultry manure. Also, 95.7% of the respondents did not apply inorganic fertiliser while only 4.3% applied inorganic fertiliser which was a combination of Nitrogen (N), Phosphorus (P) and Potassium (K) fertiliser (Table 5.17).

Table 5.16: Application of organic fertilizer

Organic fertilizer application	Frequency	Percentage (%)
Yes	4	3.5
No	111	96.5
Total	115	100

The remark of one of the farmers, on the reason he did not apply either organic or inorganic fertiliser to his sweetpotato plantation, was:

> *"NPK fertilisers are expensive, and we cannot afford to buy it while poultry manure is inexpensive, but we do not usually have access to it because we do not have poultry farms in this area and poultry manure are not sold in the market. You need to go to a poultry farm to get the poultry manure."*

This suggests there may be barriers in accessing organic manure and/or information on where to obtain organic fertiliser is lacking. Also, the lack of adequate finance to purchase inorganic fertiliser which is available in the market could be a barrier in utilising inorganic fertiliser. According to Agbede and Adekiya (2011), in Nigeria, large quantities of organic manure especially poultry manure are available in urban centres, where they pose environmental hazards and disposal problems. This organic manure could be a source of vital nutrient to sweetpotato crops if it is made available and affordable to farmers in rural areas.

Table 5.17: Application of inorganic fertilizer

Inorganic fertilizer application	Frequency	Percentage (%)
Yes	5	4.3
No	110	95.7
Total	115	100

5.3.8 PESTICIDE AND HERBICIDE APPLICATION

Sweetpotatoes are susceptible to pests and diseases which attack the leaves and the vines and adversely influence the production system. The application of pesticides helps to kill or suppress the activity of pests. In this study, the majority of the farmers did not any apply pesticide on their sweetpotato plantations. As shown in Table 5.18, 93% of the respondent did not apply any pesticide on their sweetpotato plantations while 7% applied pesticide on their farms. According to the farmers, the infestation of pests and diseases is one of the major constraints they encountered in the production of sweetpotato. One of the farmers stated:

> *"We want to apply pesticide to control pests and diseases on our sweetpotato farms, but we do not know which pesticide is appropriate for sweetpotato. We have tried a couple of pesticides, but they did not work for sweetpotato."*

Table 5.18: Application of pesticide

Pesticide application	Frequency	Percentage (%)
Yes	8	7.0
No	107	93.0
Total	115	100

Furthermore, sweetpotatoes are susceptible to competition from weeds. Weeds may cause sweetpotato to compete for nutrients thereby adversely affecting the overall crop yield. The use

of herbicides helps to control or suppress weeds. In this study, 64.3% of the farmer made use of herbicides to suppress and control the spread of weeds on their farms while 35.7% did not make use of herbicides (Table 5.19). However, those farmers who did not make use of herbicides stated they manually weeded their farms using a hoe.

Table 5.19: Application of herbicide

Herbicide	Frequency	Percentage (%)
Yes	74	64.3
No	41	35.7
Total	115	100

5.3.9 FRESH ROOT YIELD

The average yield of sweetpotato among the sampled respondents was 7.7 metric tons (MT) per hectare, the yields of the farmers ranged from 2.5MT per hectare to 17.5 MT per hectare. According to statistics from Food and Agricultural Organisation (FAO), the estimated average sweetpotato yield for Nigeria is 2.6MT per hectare while the average yield for Africa is 9.6 MT per hectare and the world average yield is 16 MT per hectare (FAOSTAT, 2017). As shown in Table 5.20, 73% of the sampled farmers have an average sweetpotato yield that is less than the average Africa yield of 9.6MT per hectare. 24.4% of the sampled respondents have an average yield that ranged from 9.6MT to 15.9MT per hectare. About 2.6% of the respondent had an average yield that is greater than 15.9MT per hectare. This shows that about 2.6% of the respondent had an average yield that is similar to the average world yield while the remaining 97.4% of the respondent have an average sweetpotato yield that is less than the average world yield.

Table 5.20: Yield of sweetpotato

Mean root yield: 7.7 tons per hectare
Minimum root yield: 2.5 tons per hectare
Maximum root yield: 17.5 tons per hectare

Root yield (tons per hectare)	Frequency	Percentage (%)
<9.6	84	73.0
9.6 – 15.9	28	24.4
>15.9	3	2.6
Total	115	100

5.3.10 HIRED LABOUR AND ACTIVITIES ON SWEETPOTATO FARMS

Labour is an essential element of sweetpotato production and is referred to as one of the crucial factors of agricultural production (Loughrey, Donnellan, Hanrahan, & Hennessy, 2013). In this study, almost all the farmers hired labour for the production of sweet potato. As shown in Table 5.21 below, 97.4% of the respondents hired labour to work on their sweetpotato farm while 2.6% did not hire labour. As stated by one of the farmers who hired labour;

> *"The work on a sweetpotato farm cannot be done singlehandedly. You need to hire labour."*

The farmers who did not hire labour cited financial constraints as a limiting factor in hiring labour. However, they made use of unpaid family labour to work on their respective farms.

Table 5.21: Labour hire for sweetpotato farming

Labour Hire	Frequency	Percentage (%)
Yes	112	97.4
No	3	2.6
Total	115	100

The activities performed by the hired labour included; land preparation, planting, weeding, spraying, fertilisation, and harvesting. As shown in Table 5.22 below, of the 97.4 % of the respondents who hired labourers all (100%) engaged the activities of hired labourers for land preparation, 71.4% hired labourers for weeding, 54.5% hired labour for harvesting, 50.9% hired labour for planting, 33.9% hired labour for spraying of herbicide and/ or pesticide, and 2.7% hired labour for the application of fertilizer.

Table 5.22: Activities of hired labour for sweetpotato farming

Activities	Frequency	Percentage (%)
Land Preparation	112	100
Planting	57	50.9
Weeding	80	71.4
Spraying	38	33.9
Fertilization	3	2.7
Harvesting	61	54.5

5.3.11 CONSTRAINTS TO THE PRODUCTION OF SWEETPOTATO

The sampled respondents highlighted several factors that limited and affected their production of sweetpotato. The constraints to the production of sweetpotato among the farmers (Table 5.23) include inadequate market outlet to sell increased quantity of sweetpotato; high incidence of pest and diseases; scarcity of vines for planting; lack of knowledge on the appropriate inputs to curtail the infestation of pest and disease; lack of access to capital to buy farm inputs and carry out necessary farm activities; early spoilage of sweetpotato roots after harvest; lack of storage facilities to increase the shelf life of harvested sweetpotato; inadequate rainfall affecting the yield of sweetpotato; grazing of cattle by herdsmen on sweetpotato farms; difficulty in getting farm labourers and, inadequate access to farm machinery like tractors.

The majority of the respondents (52.1%) cited the lack of access to capital to buy farm inputs and carry out necessary farm activities as the primary factor that constrained productivity of their sweetpotato production. Most of the farmers do not have access to finance or loans, and as a result, they depend on their personal finance to carry out farm activities. Another major constraining factor, cited by 42.6% of the farmers, was the grazing of cattle by cattle herdsmen (pastoralists) on farms that belong to sweetpotato farmers. According to the farmers, nomadic pastoralists herd their animals to their sweetpotato farm to feed on their crop, which often results in crop failure. In a study by Imo (2017), nomadic herdsmen in Nigeria neither own lands nor have any permanent abode and occasionally move from one place to another in search of pastures for their cattle, often grazing their cattle on farmers crops. Udemezue and Nwalieji (2017) cited crop destruction and loss of soil fertility, which results in low productivity as the significant effect of cattle threat on farmlands in Nigeria. The third major constraining factor declared by 36.5% of the respondents which limited the output of sweetpotato was limited market outlets to sell the increased quantity of sweetpotato. This implied that the farmers are constrained to produce a limited quantity of sweetpotato as a result of the limited market outlet. Smallholder farmers often suffer a tremendous economic loss in spite of large harvest as a result of limited market outlets to sell increased output (Zhen & Zoebisch, 2006). The fourth major constraining factor cited by 34.8% of the respondents, which limited the production and productivity of sweetpotato was inadequate rainfall. Approximately 98% of the respondents depend on rainfall for their crop productivity (see Table 5.10). This implied that an adequate amount of rainfall boosts their crop productivity and are vulnerable to low yield when the rainfall is inadequate. The high dependence on rainfall makes the farmers highly susceptible to crop production risks.

Furthermore, a high incidence of pest and diseases was mentioned by 22.6% of the respondents as a constraining factor to sweetpotato yield, while 11.3% cited the lack of knowledge on the appropriate inputs to curtail the pest and disease infestation as a constraining factor to sweetpotato productivity. Weevils and grasshoppers were indicated to be the most damaging pests that affect the foliage, stem and storage roots of sweetpotato in the study area. Despite noticing the damage caused by pests and diseases, some of the farmers lack the knowledge of the appropriate inputs to curtail the destruction of their sweetpotato plantation by the pests and diseases. According to Fuller (1994) and Queensland Government (2000), one of the ways of curtailing weevils and grasshoppers in a sweetpotato plantation for small-scale farmers is the introduction of predators that are the natural enemy of weevils and grasshoppers. Predators of weevils and grasshopper that can be introduced to a sweetpotato farm are chickens and guinea fowl (Fuller, 1994). Also, spraying a botanical mixture made with neem (*Azadirachta indica*), soap and kerosene on the sweetpotato plantation, can curtail the spread of grasshoppers and weevils (Nyirenda, 2014). Other chemicals that can be used to curtail grasshoppers include diazinon based product, chlorpyrifos based products and pyrethroid insecticides like deltamethrin based products (Nyirenda, 2014).

Another constraint cited by 21.7% of the respondents was lack of storage facilities to increase the shelf life of harvested sweetpotato while 1.7% of the respondents cited early spoilage of sweetpotato after harvest as a constraint to their production. The farmers stated that they experienced spoilage of sweetpotato within 10 days of harvesting. Some of the factors that contribute to the early spoilage of sweetpotato include its high moisture content (60-70%), free sugar quantity (4-15%), delicate and relatively thin skin and physical damage during harvesting (Woolfe, 1992). Also, sweetpotato undergo a high rate of respiration immediately after harvest which results in heat production that softens the texture, thereby making it a highly perishable commodity especially for people in the tropics (Ray & Ravi, 2005). The early spoilage of sweetpotato roots and the lack of storage facilities amongst smallholders may be one of the constraining factors to sweetpotato exportation in Nigeria. Lack of storage facilities prompts farmers to sell their produce almost immediately after harvest which may result in selling at a loss below the cost of production. As shown in Table 5.9, over 81% of the respondents harvest their sweetpotato between July and August, which results in a glut in the markets and a consequent drop in price owing to the lack of storage facilities and early spoilage of sweetpotato roots. The storage of sweetpotato will provide the opportunity to sell the product out of season when the prices are higher.

Difficulty in getting farm labourers was indicated by 19% of the respondents as a constraint to sweetpotato production. Human labour accounts for about 90% of farm operations in Nigeria (NISER, 2001). This implies that Nigeria is highly dependent on human labour for its agricultural production due to the unavailability and inaccessibility of farm machines to smallholder farmers. Human labour is scarce in rural areas because of the perception of active youth that the income from farm labour cannot sustain them and their families (Chemonics, 2003). This has led to the rapid migration of youth from rural areas to urban areas resulting in a scarcity of labour. Hence, an increase in the income and profitability of smallholders, by exploring more profitable market may provide an opportunity to pay more for farm labour, thereby encouraging the youths to participate in farm labour. Also, the inability to access farm machinery like tractors was indicated by 13% of the farmers as a constraining factor to sweetpotato production. In the remark of one of the farmers, it was stated:

> *"Getting tractors to plough our land is a serious challenge. We have two tractors in our local government for all the farmers. If I book for the tractor, I may not have access to it until after two months when the rain will have stopped, and I will no longer be in need of it."*

On the matter of lack of access to tractors, another farmer stated:

> *"Anytime I request for the service of the tractor from the local government; they often tell me it is faulty, and sometimes they do not repair it for up to five months."*

Given the situation as described by the farmers, it can be implied that lack of access to farm mechanisation equipment like tractors can impact heavily on the timeliness of farm operations and constrain increase in production and productivity of sweetpotato. Mechanisation eases and reduces hard labour, relieves the shortage of labour, improves production and productivity, improves the timeliness of agricultural operations and improves market access (Sims & Kienzle, 2017). Thus, access to farm equipment like tractors can help increase sweetpotato production and productivity, farmers' income and profitability as well as enhance access to markets.

Table 5.23: Constraining factors to sweetpotato production

Variables	Percentage (%)
No access to capital to buy farm inputs and carry out necessary farm activities	52.1
Grazing of cattle by herdsmen on sweetpotato farm	42.6
Inadequate market outlet to sell the increased quantity of sweetpotato	36.5
Inadequate rainfall which affects the yield of sweetpotato	34.8
High incidence of pest and disease	22.6
Lack of storage facilities to increase the shelf life of harvested sweetpotato	21.7
Difficulty in getting farm labourers	19.1
The scarcity of vines for planting	14.0
Inadequate access to farm machinery like tractors	13.1
Lack of knowledge on the appropriate inputs to curtail the pest and disease infestation	11.3
Early spoilage of sweetpotato roots after harvest	1.7

5.4 MARKETING OF SWEETPOTATO

This section describes the business activity associated with the flow of sweetpotato from the producer to the customer. Business activity associated with the marketing of sweetpotato analysed and described in this section include; marketing channel, mode of communication with buyers, a period of payment, prices of sweetpotato per kilogram, quality parameters to prepare sweetpotato for the market, and cost of transporting sweetpotato to the market.

5.4.1 MARKETING CHANNEL OF SWEETPOTATO

Smallholder farmers often consider some factors before deciding on a marketing channel to sell their sweetpotato. Some of the factors considered by smallholder farmers are transportation cost, profits, access to the market, familiarity with the markets, trust among existing brokers and payment period (Makhura, 2001). Table 5.24 shows that most (43.5%) of the farmers in this study marketed their sweetpotato directly to local consumers in the local markets, thereby bypassing brokers or middlemen. Also, 42.6% of the farmers marketed their sweetpotato to urban brokers who are in urban areas. According to Omobolanle (2008), urban brokers of agricultural products in Nigeria, often market agricultural produce to urban traders who may include wholesalers, retailers or processors. The wholesalers and retailers then market the agricultural produce the final consumers. Few (13%) of the farmers marketed their sweetpotato to local collectors. The local collector buys in bulk from different farmers and transports the potato to sell to another locality either to processors, wholesalers, retailers or directly to consumers.

Table 5.24: Marketing channel of sweetpotato

Buyers of Sweetpotato	Frequency	Percentage (%)
Local/Rural Consumers	50	43.5
Local Collectors	16	13.9
Urban Brokers/Middlemen	49	42.6
Total	115	100

Figure 5.1 shows the direct and indirect flow of sweetpotato from the farmers to the consumers.

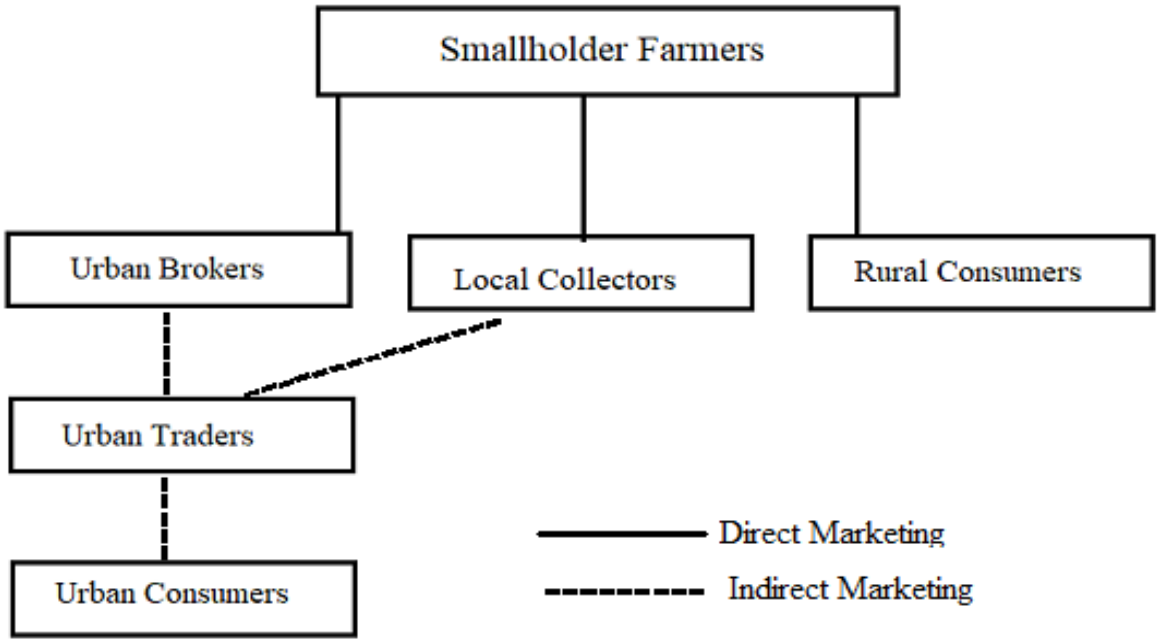


Figure 5.1: Flow of sweetpotato from the producer to the consumer

5.4.2 FARMERS MODE OF COMMUNICATION WITH BUYERS

As shown in Table 5.25, 38.3% of the buyers communicate and sell their sweetpotato through their farmers group which involves collective action. Collective action is an integral strategy in the marketing of agricultural produce because it can help farmers obtain necessary market information, strengthen farmers' bargaining power, reduce transaction costs and help farmers gain access to more profitable markets (Sigei, 2014). Farmers who operate in groups are more likely to reach a distant market to sell their agricultural produce than farmers who operate individually because they can share vital market information and broaden social capital within the group (Jari & Fraser, 2009). The majority (46.1%) of the farmers go to buyers individually to sell their agricultural products, while 8.7% cited that buyers come to their farm to negotiate

the buying terms when they are ready to buy. Farmers who sell their sweetpotato on the field do not need to transport their produce to the market, thereby exonerating them from the cost of transporting sweetpotato to the market. Few (6.9%) of the farmers communicate with buyers through mobile phones.

Table 5.25: Farmers mode of communication with buyers

Mode of communication with the buyer	Frequency	Percentage (%)
Through Mobile phone	8	6.9
Buyer comes to the farm	10	8.7
Farmers go to the buyer	53	46.1
Through Farmers group	44	38.3
Total	115	100

5.4.3 PERIOD OF PAYMENT

The period of payment between when sweetpotatoes are sold and when payments are received is an important factor that influences the choice of outlet for smallholder farmers (Ogunleye & Oladeji, 2007). In this study, the majority (60%) of the farmers received payment for their sweetpotato immediately at delivery, while 32.2% of the farmers were paid within a week after delivery, and 7.8% of the farmers had to wait for more than one week before receiving payments for the supply of sweetpotato to the buyers (see Table 5.26). According to one of the farmers:

> *We often transport our sweetpotato to the urban market which is over 500km from over the village. After the supply of sweetpotato to the brokers, we had to wait in the market until the broker sells the produce before we receive payments for our delivery.*

On most occasions, the broker sells the produce within a week and sometimes, it takes more than a week.

Table 5.26: Period of payment

Period of payment	Frequency	Percentage (%)
At delivery	69	60.0
1-7 days later	37	32.2
More than one week	9	7.8
Total	115	100

5.4.4: PRICES OF SWEETPOTATO PER KILOGRAM

In this study, the average price of sweetpotato per kilogram (Kg) was ₦59[3] while the minimum price per Kg was ₦25 and the maximum price per Kg was ₦117. Table 5.27 Summaries the returns of respondents from the sale of sweetpotato. 16.5% of the respondents sold sweetpotato for less than ₦50/kg while 10.4% sold sweetpotato for prices above ₦70/kg. The majority (73.0%) of the respondents sold sweetpotato for prices between ₦50/kg and ₦70kg. The prices of sweetpotato rise and fall depending on the period of the year. In a period of abundance, when then there is a glut in the market as a result of excess supply and lower demand the prices will fall while the prices may rise in a period of scarcity when the demand is greater than the supply. Also, it was observed that the prices of sweetpotato varied depending on the location where it was being sold.

Table 5.27: Prices of sweetpotato per Kilogram (Kg)

Mean Price per Kg: ₦59 Minimum Price per Kg: ₦25 Maximum Price per Kg: ₦117		
Sweetpotato Prices per Kg	**Frequency**	**Percentage (%)**
<₦50	19	16.5
₦50-₦70	84	73.0
>₦70	12	10.4
Total	115	100

5.4.5: COST OF TRANSPORTING SWEETPOTATO PER KILOGRAM

The average cost of transporting sweetpotato from the farmer's field to the market was ₦12 per Kg while the minimum and maximum costs of transportation of sweetpotato from the farm to the market was ₦3 and ₦50 per kg respectively. Almost all the farmers incurred transportation

[3] ₦ = Nigerian Naira (1 United States (US) Dollar = approximately ₦360 on 07/05/2018) retrieved online from https://www.fx-exchange.com/usd/ngn-exchange-rates-history.html

costs. However, farmers who sold their sweetpotato on the farm did not incur any cost in transporting sweetpotato to the market. As shown in Table 5.28, the majority (51.9%) of the farmers spent less than ₦10 per Kg in transporting sweetpotato from the farm to the market while 40.3% of the farmers spent between ₦10 and ₦20 per Kg in transporting sweetpotato to the market and 7.7% of the farmers spent over ₦20 per Kg in transporting sweetpotato to the market. It was observed that the cost of transportation increased with increased distance from the farm. Also, farmers who transported their sweetpotato to long-distance market individually, incurred higher transportation costs than farmers who transported their sweetpotato collectively, even though the markets were similar.

Table 5.28: Cost of transporting sweetpotato per kilogram (kg)

Mean Transportation cost per Kg: ₦12 Minimum Transportation cost per Kg: ₦3 Maximum Transportation cost per Kg: ₦50		
Transportation Cost per Kg	**Frequency**	**Percentage (%)**
<₦10	54	51.9
₦10-₦20	42	40.3
>₦20	8	7.7
Total	104	100

5.5: INSTITUTIONAL FACTORS

This section describes the institutional factors that influence the productivity of sweetpotato, farmers' income and market access. The institutional factors described include; farmers' access to extension services, access to credit, access to market information and membership of a collective action group (farmers group).

5.5.1: ACCESS TO EXTENSION SERVICES

Agricultural extension services can assist in transferring important knowledge and information that can assist in increasing farmers' productivity, income and access to the market (Omobolanle, 2008). Rural farmers can sell their produce to high-value markets present in the urban and international markets with the help of extension services (Van den Ban & Hawkins, 1996). Thus, the role of agricultural extension services to smallholder farmers is vital in providing farmers with information that will improve farmers' crop productivity, access to high-value markets and consequently farmers' income. In this study, a large percentage (81.7%) of the farmers did not have access to agricultural extension services while few (21%)

of the farmers had access to extension services (Table 5.29). According to the farmers who had access to extension services, government officials were responsible for providing those services. The services provided by the extension agents include the provision of production inputs such as improved sweetpotato vines that could aid their yield. Also, some of the farmers stated that they got information about production practices such as planting, inter and intra-row spacing and other planting procedures that could boost their productivity. However, none of the farmers who had access to extension services got information that could aid the marketing of their sweetpotato. A government official working in an agricultural research institute in charge of sweetpotato in Nigeria was asked why most farmers do not have access to an improved variety of sweetpotato that could boost their productivity. He stated:

> *"It is expensive to provide extension service to farmers that will facilitate their access to the improved sweetpotato varieties we have developed. It requires a financial commitment from the government, but the government has not provided us with the money required to extend these services to farmers".*

The lack of connections to sources of improved sweetpotato varieties from research may limit farmers' productivity. According to Van den Ban and Hawkins (1996), a government will invest in agricultural extension services if it understands the value and opportunity it holds in increasing food production and stimulating economic growth. Nigeria, being the second leading producer of sweetpotato in the world has a comparative advantage in the production of sweetpotato. Therefore, investing in extension services may aid in boosting the level of farmers production in terms of yield and assist in accessing high-value markets which have the potential of stimulating Nigeria economic growth and creating an alternative source of foreign earnings. Farmers may be able to increase their sweetpotato yield, sales and income if they have access to vital information from extension services. The lack of access to extension services could be a major constraint to farmers' access to market and productivity in terms of yield.

Table 5.29: Access to extension services

Access to Extension services	Frequency	Percentage (%)
Yes	21	18.3
No	94	81.7
Total	115	100

5.5.2: ACCESS TO CREDIT

Farmers' access to credit may encourage farmers to increase and improve their production and entry into international markets (Baiyegunhi & Fraser, 2014). Thus, the accessibility of financial resources by smallholder farmers can play a significant role in improving the yield of sweetpotato and accessing high-value markets. In this study, almost all the farmers did not have access to credit. Table 5.30 shows that 93% of the farmers did not have access to credit while 7% of the farmers did. The results from Table 5.30, suggest that almost all the farmers relied on their personal finances for the production and marketing of sweetpotato. The lack of access to credit may be a significant constraint in improving the farmer's yield and gaining access into the international market. One the farmers stated:

> *"I farm on one hectare of land because I do not have money to hire labourers."*

Another offered:

> *"I do not use any form of fertiliser on my farm, and I did not buy any pesticide to curb the infestation of pest and diseases because I do not have money."*

The comments from the farmers suggest that the primary reason for not increasing the scale of production and using farm inputs such as fertiliser was because of lack of credit. Credit is needed to increase land under cultivation, hire farm labourers and tractors, prepare farmland for planting, acquire high quality sweetpotato vines, storage facilities as well as herbicides, pesticides and fertilisers and access vital market information. Farmers' access to credit can address some of the financial constraints they experienced. The sources of credit for farmers who had access to credit was from friends and family, and banks. In the remark of one of the farmers on how he was able to access a loan from the bank, he stated:

> *"The only reason I was able to access loan from the bank was because I work with the government and have a guaranteed monthly source of income from the government which is my salary, which was used as collateral".*

Another farmer discussed why he could not access credit from the commercial bank stating:

> *"Getting a loan from the bank is very difficult as a small scale farmer. The banks ask us for collaterals such as houses that are of significant value, and we do not have these collaterals".*

Commercial banks in Nigeria generally require collateral before giving loans to smallholder farmers. However, most of the farmers cannot offer collateral because they are poor. Also,

accessing credit from banks requires lengthy and complicated procedures which may be difficult for most of the farmers to comprehend due to their low level of education.

According to Ololade and Olagunju (2013), some of the factors that result in smallholder farmers' lack of access to credit in Nigeria include a low level of education, small farm size, lack of access to extension services, high-interest rate, and low annual income.

It is therefore important to improve smallholder farmers' access to credit by offering financial systems that address the problems of farmers who lack collateral and minimise complicated procedures. This is needed because easy access to credit not only has the potential to increase farmers' productivity, annual income and access to the high-value market, but it may also help to alleviate poverty and contribute to the economic development of the country.

Table 5.30: Access to extension services

Access to Credit	Frequency	Percentage (%)
Yes	8	7.0
No	107	93.0
Total	115	100

5.5.3: ACCESS TO MARKET INFORMATION

Access to market information plays a vital role in improving farmers' efficiency and income and facilitate market participation (Das & Sahoo, 2012). Thus, the inability of farmers to access reliable and vital market information may be a constraint to their productivity and access to high-value markets. In this study, the majority (65.2%) of the farmers do not have access to market information while 34.8% did have access to market information (Table 5.31). The results revealed that farmers' inability to access market information might be a significant constraining factor to market access nationally and internationally. Respondents who had access to market information indicated the source and type of market information they received. The majority of these indicated that they had access to price information and new marketplaces and that their major sources of information were from other farmers. Access to reliable market information can enable farmers to make an informed decision on what variety of sweetpotato to plant when to sell, how much to sell, where to sell and the market's standard requirements. Farmers who have reliable and adequate information of the selling price in other agriculture markets are able to sell their sweetpotato in other markets. Access to market

information enables farmers to sell in a more profitable market if the cost of transportation is less than the difference in the selling price between different markets.

One of the farmers who did not have access to market information stated:

> *"I do not have access to any market information. After harvesting my sweetpotato, I take it to the village market and sell it based on whatever price the market dictates"*

This statement suggests that farmers can be highly susceptible to low price risk which can result in a remarkable loss due to the lack of access to reliable market information.

Table 5.31: Access to market information

Access to Market Information	Frequency	Percentage (%)
Yes	40	34.8
No	75	65.2
Total	115	100

5.5.4: MEMBERSHIP OF FARMERS GROUP

The involvement of farmers in collective action (farmers groups and cooperatives) can contribute to higher productivity, access into regional and international markets, income growth, poverty reduction and economic growth (Markelova & Mwangi, 2010). In this study, 42.6% of the farmers were members of a farmer group while 57.4% of the farmers did not belong to any of the farmers' group in the region (Table 5.32). It was observed that the role of the farmers' group was primarily in the marketing of sweetpotato. As shown in Table 5.33, 85.7% of the farmers who were members of a farmers group cited sweetpotato marketing as the area of specialisation of their farmer's group while 14.3% cited that the group helped with the provision of inputs such a tractor or herbicide for the production of sweetpotato.

Table 5.32: Farmers group membership

Farmers' group membership	Frequency	Percentage (%)
Yes	49	42.6
No	66	57.4
Total	115	100

The leader of the sweetpotato farmers marketing group stated:

"We collect the sweetpotato of our members, and we take care of the transportation and marketing of sweetpotato in Lagos."

Lagos is the commercial capital of Nigeria and one of the most populous cities in Nigeria. Farmers who are members of collective action may be in a better position to reduce the cost of the transaction of their market exchanges, obtain vital market information and secure access to more profitable markets.

A well-structured collective action, as in the case of tea smallholders in Kenya was instrumental in accessing highly profitable markets in developed countries and also dictating market prices. Thus, members were able to derive sufficient benefit from being members of the collective action (Mwaura, Muku, & Nyabundi, 2010). One farmer said he was not a member of any of the farmers groups because:

"I used to be a member of a farmers group, but I left because I was not deriving any benefit from being a member of the group."

Hence, members of a farmers group should derive incentives for being part of the group for the group to be successful. In this study, none of the respondents were members of a farmers cooperative.

Table 5.33: Farmers group area of specialisation

Area of specialization	Frequency	Percentage (%)
Production	7	14.3
Marketing	42	85.7
Total	49	100

5.6: FARMERS PERCEPTION OF EXPORT MARKET

Exporting agricultural products is considered to be an important way for smallholder farmers in developing countries to scale up their production, expand their markets, increase income, acquire new technology, and mitigate risk (Köksal, 2008). Exporting agricultural products such as sweetpotato helps to increase the level of employment, increase the supply of foreign exchange and contribute significantly to the development of an economy (Köksal, 2008). All the farmers who participated in this study had a positive perception of the export opportunities for their sweetpotato, even though, the respondents had never participated in the exportation of

sweetpotato. The farmers were asked about some of the advantages they will derive from selling sweetpotato to the export market. As shown in Table 5.32, the majority (46.1%) of the respondents identified higher price as the most desirous advantage of selling to the export market. This implies that a higher price will be a significant factor that will motivate farmers to sell their sweetpotato to the export market when they have the opportunity to do so. Furthermore, 25.2% of the farmers identified access to credit as an advantage of selling sweetpotato to the export market while 13% of the farmers stated that access to inputs would be an advantage of selling to the export markets. The increase in the horizon of activity as a result of sweetpotato exportation will create more jobs was indicated by 8.7% of the respondents as an advantage of sweetpotato exportation while 7% of the farmers stated that markets extension would be the advantage of selling to the export markets.

Table 5.34: Advantages of selling sweetpotato to export market

Description	Frequency	Percentage (%)
Higher price	53	46.1
Access to credits	29	25.2
Access to Inputs	15	13.0
Employment creation	10	8.7
Markets Extension	8	7.0
Total	115	100

Despite the advantages farmers may derive from exporting sweetpotato, several factors prevented the farmers from participating in the export markets as shown in Table 5.35. The majority (58.3%) of the farmers identified lack of access to the export market as the major constraining factor to sweetpotato exportation. Also, 19.1% of the farmers identified lack of experience on what it required to export sweetpotato as a constraining factor to exportation. This implied that the farmers do not have the knowledge of the procedure and requirements of sweetpotato exportation. Other constraints identified by the farmers include; buyers do not trust small farmers (16.5%) and small farms and a small quantity (6.1%). According to a study by Gyau, Franzel, Chiatoh, Nimino, and Owusu (2014), when smallholder farmers work together on joint action which involves their common interest, it presents an opportunity to increase economies of scale, enhance market linkages and build trust from buyers of sweetpotato. Thus,

collective action from farmers can enhance their scale of sweetpotato production, enhance linkages to the export market and help buyers to trust the activities of sweetpotato farmers.

Table 5.35: Constraints of selling sweetpotato to the export market

Description	Frequency	Percentage (%)
Lack of access to the export market	67	58.3
Lack of experience	22	19.1
Buyers do not trust small farmers	19	16.5
Small farms and a small quantity	7	6.1
Total	115	100

In addition, government policies can address some of the constraints of selling sweetpotato to the export market. Farmers were asked what they think the government could do to facilitate the sale of sweetpotato to the export market. As shown in Table 5.36, the majority (35.6%) of the farmers' perceived government showed help link farmers to export markets while 23.5% of the respondents perceived that provision of credit facilities could enhance sweetpotato exportation. 18.3% of the respondents want the government to provide training in standard and export requirements, 13.9% want the government to provide training in production methods, and 8.7% want the government to organise farmers into groups so that they can work collectively.

Table 5.36: Perception of government roles in facilitating sweetpotato exports

Description	Frequency	Percentage (%)
Help link farmers to export markets	41	35.6
Provide credits	27	23.5
Provide training in standards and export requirement	21	18.3
Provide training in production methods	16	13.9
Help organise farmers into groups	10	8.7
Total	115	100

CHAPTER 6: DATA ANALYSIS AND DISCUSSION

6.1. INTRODUCTION

The chapter presents the results of the inferential statistics regarding the factors that influenced the yield of sweetpotato farmers in Kwara state, Nigeria. The binary logistic regression was used to determine the factors that influenced the yield of sweetpotato farmers. This chapter illustrates how different explanatory variables influenced the yield of sweetpotato farmers in Kwara state, Nigeria.

6.2. FACTORS AFFECTING THE YIELD OF SWEETPOTATO FARMERS

As already explained, the binary logistic regression was considered the most appropriate model to determine the factors affecting the yield of sweetpotato farmers because the farmers' responses were classified to be dichotomous (low yield and high yield). Sweetpotato yield below 9.6 tons per hectare was classified as low yields while yield above 9.6 tons per hectare was classified as high yields. The dependent variable measured the yield of sweetpotato (either low yield or high yield) which was influenced by a set of explanatory variables derived from farmers' demographics, farm and production characteristics, marketing features and institutional factors.

The binary regressions results for the factors that influenced the yield of sweetpotato farmers are presented in Table 6.1. The table shows the estimated beta coefficients (B), the standard error (S.E), the p-values, the log odds (Exp (B)) and the marginal effect which depicts how the outcome variables change when an explanatory variable change. The beta coefficient (B) values estimate the change in the probability of the dependent variable for a unit change in the corresponding explanatory variable. The sign of the coefficient values indicates the direction of the influence of the explanatory variable. A positive sign, therefore, implies an increase in the likelihood of getting a high yield while a negative sign implies a decrease in the probability of getting a high yield. The diagnostic statistics in Table 6.1 indicates that the mean-variance inflation factor (VIF) was far less than 10, which suggests that multicollinearity[4] was not an issue in the model. The Chi-square value (1.57) from the Breusch-Pagan test was not

[4] Multicollinearity is a state high intercorrelations among independent variables, in which one independent variable can be linearly predicted from the others with a large degree of accuracy.

statistically significant even at 10%. This result showed that heteroskedasticity[5] was not present in the model. The Wald chi-square (50.46) showed statistical significance at 1%, and this indicated that the explanatory variables jointly influenced the probability that a farmer would obtain a high sweetpotato yield.

6.3: DISCUSSION

6.3.1 FARMER DEMOGRAPHICS

Among the farmer demographic explanatory variables, age, gender, and secondary education were statistically significant in determining the probability that farmers would get a high sweetpotato yield.

The results in Table 6.1 showed that the marginal effect of the age of farmers associated with the p-value of 0.001 was negative and statistically significant at 1%. This indicated that a year increase in farmer's age led to 0.138 reductions in the probability that the farmer would harvest a high sweetpotato yield. Also, the beta coefficient of the age of farmers showed a negative effect (-0.258) on the yield of farmers. This result implied that with an increased number of years, the yield of farmers would be low, which means that older farmers are less productive compared to the younger ones. The negative effect that the age of farmers had on sweetpotato productivity in this study is in accordance with previous studies conducted by (Donkor, Owusu, Owusu-Sekyere, & Ogundeji, 2018; Guo et al., 2015). According to Donkor et al. (2018), farmers who are are older are weaker, which results in a decline in labour output and agricultural productivity. Also, the declining physical strength of older farmers may result in a negative attitude towards innovation that can increase their farm output (Donkor et al., 2018). Sweetpotato production is labour intensive; therefore, older farmers are unable to work as efficiently on the farm, particularly if they are faced with budget constraints to hiring extra labour.

Gender had a significant positive effect on the probability of a farmer harvesting a high yield, which was consistent with the priori expectations. The marginal effect of gender associated with the p-value of 0.033 was statistically significant at 5%. Similarly, the beta coefficient of gender associated with the p-value of 0.01 was statistically significant at 1%. The significant

[5] Heteroskedasticity is a condition in which there are different variabilities within a minimum of one independent variable.

Table 6.1. Determinants of the yield of sweetpotato farmers

Variable	Coefficient	Standard Error	p-value	Exp(B)	Marginal effect	Standard error	p-value
Constant	-6.708	7.894	0.395	0.001			
Farmer demographics							
Age	-0.258	1.765	0.884	0.773	-0.138	0.042	0.001***
Gender (Male)	2.298	0.891	0.01***	9.954	0.157	0.073	0.033**
Sweetpotato farming experience	-0.177	1.091	0.871	0.838	-0.009	0.080	0.910
Off-farm employment	0.994	0.852	0.243	2.702	0.067	0.051	0.185
Primary education	1.596	1.271	0.209	4.933	0.087	0.066	0.187
Secondary education	1.352	1.107	0.222	3.865	0.127	0.074	0.085*
Post-secondary education	1.577	1.527	0.302	4.840	0.090	0.088	0.310
Farm and production characteristics							
Cultivated land area	0.627	0.377	0.096*	1.872	0.054	0.026	0.040**
Yellow sweetpotato variety	0.429	0.805	0.594	1.536	0.040	0.059	0.495
Red sweetpotato variety	2.036	1.193	0.088*	7.660	0.132	0.101	0.191
Marketing Features							
Payment of sales at delivery	1.625	1.338	0.225	5.078	0.116	0.096	0.227
Payment of sales within a week	1.943	1.442	0.178	6.980	0.119	0.100	0.234
Institutional factors							
Market information	2.852	0.863	0.001***	17.322	0.212	0.049	0.000***
Extension services	3.621	1.199	0.003***	37.375	0.276	0.068	0.000***
Credit	0.879	1.031	0.394	2.408	0.039	0.083	0.640
Farmer group	1.948	0.736	0.008***	7.015	0.149	0.048	0.002***
Diagnostic statistics							
Wald chi-square	50.46***						
Overall mean inflation factor (VIF)	2.02						
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity: Chi-square value	1.57						

*, ** and *** denote statistical significance at 10%, 5% and 1%, respectively.

marginal effect of 0.157 implied that the male farmers were 0.157 more likely to harvest a higher yield than their female counterparts. The findings from this study on the effect of gender on sweetpotato productivity was consistent with several other studies carried out by other researcher such as Palacios-Lopez and Lopez (2014), Koirala, Mishra, and Mohanty (2015), Udry, Hoddinott, Alderman, and Haddad (1995) and Quisumbing et al. (2014). A study carried out by Udry et al. (1995) on gender differentials in farm productivity in African households found that plots controlled by women for all crops have significantly lower yields in comparison with men controlled plots within the same year and same cropping patterns. Women are often more burdened with off-farm domestic activities than men, which adversely affect their productivity on the farm (Palacios-Lopez & Lopez, 2014). In this study, it was observed that females were mostly engaged in household chores and the upkeep of the household. These responsibilities tend to minimise their labour productivity which adversely affects their sweetpotato output.

Another farmer demographic explanatory variable that significantly affected the yield of sweetpotato farmers was the level of education. The findings from this study as shown in Table 6.1 identified that the returns of formal education on sweetpotato productivity vary for different levels of education (primary, secondary and tertiary). The returns of secondary level of education were the highest on the yield of sweetpotato, followed by tertiary education and primary education as shown by the marginal effect of 0.127, 0.090 and 0.087 for the secondary, tertiary and primary level of education respectively. The marginal effect of secondary education variable associated with the p-value of 0.085 showed a positive effect and was statistically significant at 10%. This finding showed that the farmers with secondary education had a greater probability of 0.127 to get a higher yield relative to those with no formal education. This suggests that formal education is important human capital. At the secondary educational level, individuals can read and write, and apply the knowledge acquired to solve their problems. In the context of the farmers, secondary education improves the cognitive and managerial skills that help to effectively combine productive inputs to raise their farm outputs (Oduro-Ofori et al., 2014). Thus, education can enhance the yield of sweetpotato farmers by improving farmers decision-making ability improving and reducing their technical efficiency. The findings from this study are consistent with the previous studies that observed that education improved the agricultural output of farmers (Das & Sahoo, 2012; Oduro-Ofori et al., 2014; Reimers & Klasen, 2013).

The farmer demographic explanatory variable 'sweetpotato farming experience' showed a negative and a non-significant effect on the yield of sweetpotato farmers. This implies that farmers who had more extended experience in farming sweetpotato did not necessarily have a greater possibility to produce higher sweetpotato yields. The findings from this study agreed with the findings of Onogwu, Audu, and Igbodor (2017) who also discovered farming experience had a negative and non-significant effect on smallholders farmers productivity in Nigeria. However, the finding was in variance with the priori expectation.

Also, off-farm employment showed a positive effect on the yield of sweetpotato farmers but was not statistically significant. Off-farm employment can serve as an important source of liquidity to purchase farm inputs and hire labour which can contribute significantly to agricultural productivity (Reardon, Crawford, & Kelly, 1994). However, Leones and Feldman (1998) argue that rural off-farm employment competes with agriculture for labour which can lead to a reduction in agricultural output, especially for smallholder rural farmers. The findings from this study suggest that the income from off-farm employment did not significantly contribute to the yield of sweetpotato farmers.

6.3.2. FARM AND PRODUCTION CHARACTERISTICS

Among the farm and production characteristics explanatory variables, the sweetpotato cultivated land area (farm size) was statistically significant. Also, among the varieties of sweetpotato, the red sweetpotato variety was statistically significant in determining the probability that sweetpotato farmers would get a high yield.

The cultivated land area showed a positive relationship on farmers yield as expected and was statistically significant. The marginal effect of the cultivated land area associated with the p-value of 0.040 was statistically significant at 5%. Similarly, the beta coefficient associated with the p-value of 0.096 was statistically significant at 10%. This empirical result indicated that an acre increase in the cultivated land area of sweetpotato tended to increase the probability to produce a higher yield by 0.054. This implies that as cultivated land area increase, sweetpotato productivity also increases. It was observed that farmers with large cultivated farms were wealthy and could afford to purchase productive farm inputs that enabled them to increase their sweetpotato yields. This result supports the empirical findings of previous studies by Onogwu et al. (2017) and Nwaru et al. (2011) who posit that cultivated land area (farm size) had a positive impact on the agricultural productivity of smallholders rural farmers. However, Chen et al. (2011) argued that there could be an inverse relationship between cultivated land area and

agricultural productivity depending on the efficiency of agricultural production factors such as labour and capital. This implies that small farms could be more productive than large farms if production factors are used efficiently.

Another farm and production explanatory variable that significantly influenced the yield of sweetpotato farmers in the study area was the variety of sweetpotato planted. The respondents planted three varieties of sweetpotato; white-fleshed, yellow-fleshed and red-fleshed. The marginal effect of sweetpotato varieties was positive but showed no statistical significance. However, the coefficient value (2.036) of the red sweetpotato variety associated with the p-value of 0.088 was statistically significant at 10%. This implied that farmers who planted the red-fleshed variety had a higher probability of harvesting higher yields than farmers who planted the yellow fleshed and white-fleshed varieties. The higher odds ratio (Exp(B)=7.660) of the red sweetpotato variety indicated that farmers who planted the red sweetpotato variety were 7.6 times more likely to harvest higher yields than those who planted white-fleshed varieties. Table 5.11 showed that majority (63.5%) of the respondents planted the white fleshed variety while 6.1% of the respondents planted the red-fleshed variety and 30.4% of the respondents planted the yellow-fleshed variety.

6.3.3. MARKETING FEATURES

The marketing feature explanatory variable that was included in the binary logic regression analysis was the period of payment for the sales of sweetpotato. The empirical findings showed that payment period showed a positive effect on farmers' productivity. However, it was not statistically significant in influencing the yield of sweetpotato farmers.

6.3.4. INSTITUTIONAL VARIABLES

Among the institutional explanatory variables included in the binary regression model, access to market information, access to extension services and membership of farmers group showed a significant positive effect on the yield of sweetpotato farmers. Access to credit demonstrated a non-significant effect on the yield of sweetpotato farmers.

The marginal effect of farmer access to market information associated with the p-value of 0.000 was statistically significant at 1%. Similarly, the beta coefficient of 2.852 associated with the p-value of 0.001 was statistically significant at 1%. The high odds ratio (Exp(B)=17.322) indicated that when keeping all other independent (explanatory) variables constants, farmers who had access to market information were 17.322 times more likely to harvest higher yields than those who do not have access to market information. The findings from this study are

consistent with the report of Das and Sahoo (2012) and Tang, Wang, and Zhao (2015) who concluded that market information about future price, new marketplace and demand can help farmers to improve their production planning decisions and farm productivity. Thus, ready markets can serve as an incentive for farmers to increase their farm output. Also, farmers' access to reliable market information assists farmers to select better marketing opportunities, which tends to encourage farmers to raise their yields (Tang et al., 2015).

Access to extension services is another institutional explanatory variable that had a significant positive effect on the yield of sweetpotato farmers in Kwara State, Nigeria. The marginal effect of farmers access to extension services associated with the p-value of 0.000 was significant at 1%. Similarly, the coefficient value (3.621) of access to extension services associated with the p-value of 0.003 was significant at 1%. The high value of the odds ratio (Exp(B)=37.375) indicated that when keeping all other independent variables constant, farmers with access to extension services were 37.375 times more likely to harvest high yields than farmers with no access to extension services. Extension services provide important advisory services for sweetpotato farmers, particularly on the best farm management practices and inputs which are essential to increase yields of farmers. The findings from this study support the empirical evidence of Jwanya, Dawang, Mashat, and Gojing (2014) and Omobolanle (2008). Jwanya et al. (2014) found that farmers contact with extension agents increased the technical efficiency and yield of Irish potato in the Plateau State of Nigeria. Also, Omobolanle (2008) found that extensions activities had a significant effect on farmers productivity in the south-western region of Nigeria.

Another important institutional factor that showed a significant positive effect on sweetpotato yield was membership of a farmers' group. The marginal effect of membership of a farmers' group linked with the p-value of 0.002 was statistically significant at 1%. Similarly, the beta coefficient of 1.948 associated with the p-value of 0.008 was statistically significant at 1%. The finding showed that farmers who were members of farmer groups were likely to increase their probability to generate a higher yield by 0.149 when compared to those who were not members of farmer groups. Different scholars such as Markelova and Mwangi (2010) and Kirui and Njiraini (2013) acknowledge that membership of farmers group contributes significantly to agricultural productivity. Farmers group are formed with a common goal to assist farmers in improving their wellbeing. Sweetpotato farmers who belong to farmers groups tend to share relevant information regarding the best farm practices that are necessary to increase their yields. More importantly, extension agents and non-governmental organisations mostly

provide assistance to farmers through the farmer group. These benefits associated with farmer associations empower their members to be more productive in their farming activities.

Access to credit showed a positive non-significant effect on the yield of sweetpotato farmers in Kwara state, Nigeria. The likely reason for the non-significant relationship was because most of the farmers (93%) did not have access to credit facilities which could significantly affect their sweetpotato yields. This non-significant effect of access to credit on the yield of sweetpotato farmers is in variance with the findings of other researchers such as Owusu (2017) and Awotide, Abdoulaye, Alene, and Manyong (2015) who concluded that access to credit had a positive and significant effect on the agricultural productivity of farmers in Nigeria.

CHAPTER 7: SUMMARY, CONCLUSION AND SUGGESTION FOR FUTURE RESEARCH

7.1: SUMMARY AND CONCLUSION

The discovery of crude oil in Nigeria and the subsequent dependence on the exportation of crude oil led to the consistent neglect of the agricultural sector which was the previous mainstay of the Nigeria economy. Crude oil accounts for over 90% of its export earnings and over 80% of the federal government budget. However, the over-dependence on one product has severe consequences on the growth of an economy if the prices of the product fall considerably. The consequences include lack of jobs, hyperinflation and hunger. As a result, it is important to explore the opportunities in other products that Nigeria has a comparative advantage in producing such as sweetpotato. Sweetpotato is the seventh-ranked staple food crop in the world and also one of the most valuable and versatile food crops. It is regarded as a food security crop because of its ability to produce reasonable yields in agro-ecological regions where most crops would fail and its short growth cycle of about three to five months. Nigeria is the second largest producer of sweetpotato in the world and the largest producer in Africa.

Although, Nigeria is a major producer, the total average yields of sweetpotato in Nigeria is comparatively low (2.6 tons per hectare) when compared to the rest of Africa (9.6 tons per hectare) and the world (16 tons per hectare). Furthermore, Nigeria is not ranked among the top 150 global exporters of sweetpotato, and several researchers have reported the unavailability of market as one of the major constraints to sweetpotato production in Nigeria (Fawole, 2007; Mbanaso et al., 2012). The global export value for sweetpotato was over US$1.5 billion dollars between 2012 and 2016. Sweetpotato exports can play a significant role in the economic development of Nigeria because it can enhance domestic production and increase the supply of foreign exchange (Köksal, 2008). The central problem of the low yield of sweetpotato in Nigeria, the unavailability of market being a constraint to sweetpotato production and the need to diversify Nigeria's source of income drove this research to explore the opportunities in the sweetpotato value chain that can contribute to the growth of the economy. The first objective of this research was to determine and analyse the factors that influence the yield of sweetpotato in Nigeria. Secondly, this study sought to identify ways in which sweetpotato yield can be increased. Thirdly, the study sought to uncover the constraints to market access and finally, to identify the market opportunities for sweetpotato in Nigeria and internationally.

A mixed methods research approach has been applied which involved a combination of both quantitative and qualitative methods. The quantitative component was used as the main research strategy while the qualitative component was used to support the quantitative findings. A structured questionnaire survey was used as the quantitative data collection method to obtain information from 115 farmers who were selected through non-probability convenience sampling. The findings from the structured questionnaire were complemented by an open-ended face-to-face interview (qualitative data collection method) from a smaller population sample in order to have a deeper understanding of the issues surrounding the research objectives. The findings from the quantitative and qualitative primary data collection methods were used to respond to the research objectives. The findings captured information regarding farmer demographics, farm and production characteristics, marketing features and institutional factors affecting sweetpotato productivity and market access. The analysis of the findings from the questionnaire survey involved descriptive and inferential statistics using STATA version 13. The descriptive statistics provided general information in describing the socio-economic and demographic characteristics of the farmers. Also, with the aid of the descriptive statistics, the contributing factors to the low yield of sweetpotato were identified along with the constraints to market access and market opportunities for sweetpotato nationally and internationally. The inferential analysis using the binary logistic model was used to determine the factors that had a significant influence on the yield of sweetpotato.

The descriptive analysis indicated that most of the sweetpotato farmers who fall within the active age structure of the Nigeria economy engage in sweetpotato farming and that the farming of sweetpotato is dominated by males. This study found that the majority of the sweetpotato farmers had no formal education and farmers with no formal education were mostly illiterate. Formal education has the potential to enhance the skills of farmers to make better use of market information which may lead to reduced marketing cost, ability to participate in profitable markets and higher sweetpotato productivity. Although most of the farmers did not have a formal education, the majority of the farmers had over 10 years of sweetpotato farming experience. Some of the farmers were involved in off-farm employment in order to earn additional income. However, most of the farmers were not engaged in off-farm employment and were more focused on their sweetpotato farms as the primary occupation and source of income.

The majority of the farmers were characterised as smallholder farmers operating on less than two hectares of sweetpotato farmland. It was also shown that the majority of the farmers had

access to farmland to increase their scale of production if given access to finance and reliable market to sell their sweetpotato produce. Almost all the farmers in this study planted their sweetpotato between March and April annually which was the onset of the raining season, and they harvested around the same period between July and August. Harvesting and selling of the sweetpotato around the same period often result in a glut in the market which consequently collapses the selling price and reduces farmers' income and profitability. Most of the farmers planted their sweetpotato around the same period because they are entirely dependent on rainfall for their sweetpotato production and the use of modern irrigation like sprinklers was absent amongst the farmers. The overdependence of sweetpotato farmers on rain-fed sweetpotato production may have a negative consequence on the yield and profitability of farmers in periods of prolonged drought because water is a significant factor in the growth and productivity of sweetpotato. The over-dependence on rainfall renders the farmers in this study highly susceptible to crop production risk. The lack of modern irrigation facility among the farmers may be linked to the fact that most of the farmers were small-scale farmers who may not be able to afford irrigation system of farming.

The farmers planted three types of sweetpotato; white-fleshed, yellow-fleshed and red-fleshed. The majority of the farmers planted the white-fleshed type even though some of the farmers complained the white fleshed type was less resistant to pests and diseases and had a lower yielding rate than other types of sweetpotatoes. The farmers did this because the white-fleshed variety was widely accepted in the market by the buyers and they found it difficult selling other types of sweetpotatoes. It can, therefore, be deducted that the acceptance of a particular variety by buyers/consumers is a significant factor in determining the variety planted by farmers. Most of the farmers got information on the best varieties (high yielding and, drought, pests and disease resistant varieties) to plant from other farmers while a few of the farmers got their information from extension officers. Even when information on the best variety to plant was available, farmers tended to make an informed decision on the adoption of the information based on the constraints of market availability and acceptability. The majority of the farmers did not purchase sweetpotato vines used for sweetpotato propagation, the major source of yearly planting materials was vines from their own fields or other farmers' fields. Planting vines from the same vine source year after year has the potential to reduce sweetpotato yield and spread diseases from one farm to the other. Linking farmers with sources of affordable and high disease resistant sweetpotato vines could provide an opportunity to increase the yield of farmers significantly.

Fertilizer, either organic or inorganic can be beneficial in improving sweetpotato yield. However, the findings from this study indicated that almost all the farmers did not apply any fertiliser to their sweetpotato plantations even though they could be beneficial in improving the yield of sweetpotato. Similarly, almost all the farmers did not apply any pesticide to curb the infestation of pests or diseases which can adversely affect the crop yield. The findings from this study indicated that the average yield of sweetpotato amongst the farmers was low and was below the average African root yield of 9.6MT per hectare.

Other constraints identified that limit the production and yield of sweetpotato farmers included: inadequate market outlets to sell increased quantity of sweetpotato; high incidence of pest and diseases; scarcity of vines for planting; lack of knowledge on pest and disease management; lack of access to financial capital to buy farm inputs and carry out necessary farm activities; early spoilage of sweetpotato roots after harvest; lack of storage facilities to increase the shelf life of harvested sweetpotato; inadequate rainfall; grazing of cattle by herdsmen on sweetpotato farms; difficulty in getting farm labourers and inadequate access to farm machinery. Thus, sweetpotato production and yield could be increased when some of the limiting factors are addressed.

Amongst the respondents, it was found that improved storage of sweetpotato could provide the opportunity to sell sweetpotato out of season when prices are higher. Also, an increase in farmers income by exploring more profitable markets may offer the opportunity to pay more for farm labour, which can entice the youths to participate in farm labour. In addition, access to farm equipment like tractors could support sweetpotato production and productivity, farmers' income and profitability as well as enhance access to markets.

Several institutional factors that influenced market access, productivity and income of sweetpotato farmers were: farmers' access to extension services, access to credit, access to market information and membership of a collective action such as farmers group. Almost all the farmers in this study did not have access to extension services, credit facilities and market information. Also, most of the farmers were not members of a collective action such as a farmers group. Agricultural extension services can assist in transferring important knowledge and information that could contribute to increasing farmers' productivity, income and access to reliable and profitable markets. The lack of access to extension services could be a major constraint to farmers' access to market and productivity in terms of sweetpotato yield. Also,

farmers' accessibility to credit may determine the farmers ability to increase and improve their production and access to international markets. This is because credit is needed to increase land under cultivation, hire farm labourers, purchase vital farm inputs and access vital market information. Thus, farmers' access to credit can provide an opportunity for improving the yield of sweetpotato and accessing high-value markets. The farmers in this study have difficulty in getting loans from commercial banks in Nigeria for many reasons including, lengthy and complicated procedures which were difficult for most of the farmers to comprehend due to their low level of education. Also, most of the farmers could not afford the collateral required by banks before giving out loans. Thus, it is important to improve farmers' access to credit by offering financial systems that address the problem of farmers who lack collateral and minimise complicated procedures. This is because easy access to credit has the potential to increase farmers' productivity, access to high-value markets, alleviate poverty and contribute to the economic development of Nigeria.

Access to market information can play a vital role in improving farmers efficiency and facilitate access to market participation. The inability of the farmers in this study to access reliable and vital market information might be a significant constraining factor to access to high-value markets nationally and internationally. Regular access to reliable market information could enable farmers to make an informed decision on factors such as; variety of sweetpotato to plant, when and where to sell, volume to sell, where to sell and market quality requirements. Thus, access to market information could enable farmers to sell in a more profitable market if the cost of transportation is less than the difference in the selling price between different markets. Most of the farmers were not members of a farmers group while those who were members of farmers group were able to sell their produce to more profitable markets in urban areas of Nigeria. The involvement of farmers in collective action such as a farmers group may contribute to higher productivity and access to markets nationally and internationally. When smallholder farmers work together on joint action which involves their common interest, it presents an opportunity to increase economies of scale, enhance market linkages and build trust from buyers of sweetpotato. A collective action should be well structured, and members should derive benefits from being a part of the collective action group.

All the farmers who participated in this study had a positive perception of the export opportunities for their sweetpotato even though none had ever participated in export marketing. The farmers highlighted higher price, access to credit facilities, access to inputs, employment creation and market extension as the benefits they would derive from selling sweetpotato to the

export markets. However, the results of this study showed that the constraints to selling sweetpotato to the export market by farmers include; lack of experience, lack of market access, buyers distrust in small farmers and the limited quantity for supply. Thus, collective action in the form of farmers' cooperatives and groups can enhance their scale of production, strengthen linkages to the export market and help buyers to trust the activities of small farmers. Policies should be put in place by the government to address the constraints of selling sweetpotato to the export market. This is because exports of sweetpotato from Nigeria has the potential to play a significant role in the growth of the economy, help stimulate domestic production and increase the supply of foreign exchange. The role of government identified by the farmers in facilitating the export of sweetpotato from Nigeria includes; helping link farmers to export markets; providing credit; offering training in standards and export requirements; providing training in production methods and helping organise farmers into groups.

The inferential statistics using the binary logistic regression model was utilised to determine the factors that significantly influenced the yield of sweetpotato farmers. The explanatory variables included in the model were: farmers' age; level of formal education; farming experience; off-farm employment; gender; cultivated land area (farm size); sweetpotato variety planted; period of payment; access to extension services; access to credit; access to market information and membership of farmers group. Farmers' age was an important variable that significantly influenced the yield of sweetpotato. It was found that younger farmers had more sweetpotato yield than older farmers. It was also found that gender significantly influenced the yield of sweetpotato. Farms controlled by males had significantly higher yields than their female counterparts. The level of formal education was an important explanatory variable that affected the yield of sweetpotato farmers. Of the level of education, secondary education was found to be statistically significant in influencing the yield of sweetpotato farmers. The cultivated land area showed a significant positive effect on the yield of sweetpotato farmers. This implies that a larger cultivated land area results in a higher the yield per hectare of land. Institutional factors such as, access to market information, access to extension services and membership of farmers group were important variables that showed a significant positive effect on the yield of sweetpotato farmers. This implied that farmers with access to extension services, access to market information and members of farmers groups had a higher sweetpotato yield. Access to credit was not statistically significant in influencing the yield of farmers possible because almost all the farmer did not have access to credit facilities.

7.2 SUGGESTIONS FOR FUTURE RESEARCH

This research focused primarily on one state in Nigeria, which is one of the major sweetpotato producing state in Nigeria. Therefore, the scope of this study can be expanded in future research by taking into consideration other states in Nigeria to have a broader view of the research aim and objectives. Also, this study used non-probability research convenience sampling in selecting the respondents. Therefore, future research should consider using probability sampling as it will help in increasing generalising to the greater population. Future research can also look at the other value chain opportunities such as processing sweetpotato into different innovative products in Nigeria and the export of value-added sweetpotato products from Nigeria. In addition, future studies can look at the export procedure and standard requirements for sweetpotato for different export market destinations.

REFERENCES

Adebayo, P. F., & Ojo, E. O. (2012). Food security in Nigeria: an overview. *European Journal of Sustainable Development, 1*(2), 199-221.

Adeleke, R., & Odedeji, J. (2010). Functional properties of wheat and sweet potato flour blends. *Pakistan Journal of Nutrition, 9*(6), 535-538.

Adewumi, M. O., & Adebayo, F. A. (2008). Profitability and technical efficiency of sweet potato production in Nigeria. *Journal of Rural development, 31*(5), 105-120.

Afuape, S. (2011). Sweetpotato Breeding Efforts at the NRCRI, Umudike, Nigeria: The Role of SSP-WA in Supporting NARIs. Retrieved from http://www.sweetpotatoknowledge.org/wp-content/uploads/2016/01/Pres-12_Solomon-O.-Afuape_Breeding-Efforts-at-Nigeria.pdf

Agbede, T. (2010). Tillage and fertilizer effects on some soil properties, leaf nutrient concentrations, growth and sweet potato yield on an Alfisol in southwestern Nigeria. *Soil and Tillage research, 110*(1), 25-32.

Agbede, T., & Adekiya, A. (2011). Evaluation of Sweet Potato (Ipomoea Batatas L.) Performance and Soil Properties Under Tillage Methods and Poultry Manure Levels. *Emirates Journal of Food and Agriculture*, 164-177.

Agbo, F., & Ene, L. (1994). *Sweet Potato situation and priority Research in west/central Africa.* Paper presented at the CIP proceedings of the workshop held at Douala, Cameroon.

Akoroda, M. (2009). Sweetpotato in West Africa. In *The sweetpotato* (pp. 441-468). Netherlands: Springer.

Akoroda, M., Edebiri, T., Egeonu, J., Bello, Z., & Yahaya, K. (2007). *The status of sweet potato improvement and promotion in Nigeria.* Paper presented at the Proceedings of the 13th ISTRC Symposium.

Allemann, J., Laurie, S., Thiart, S., Vorster, H., & Bornman, C. (2004). Sustainable production of root and tuber crops (potato, sweet potato, indigenous potato, cassava) in southern Africa. *South African Journal of Botany, 70*(1), 60-66.

Amagloh, F. K., Hardacre, A., Mutukumira, A. N., Weber, J. L., Brough, L., & Coad, J. (2011). A household-level sweet potato-based infant food to complement vitamin A supplementation initiatives. *Maternal & child nutrition, 8*(4), 512-521.

Amienyo, C., & Ataga, A. (2007). Use of indigenous plant extracts for the protection of mechanically injured sweet potato [Ipomoea batatas (L.) Lam] tubers.

Anon. (2011). Non-Culinary uses of sweet potato. Retrieved from http://www.sweetsp.com/discovering-some-non-culinary-uses-of.html

Antoniou, P. H., Levitt, C. E., & Schreihans, C. (2012). Managing value chain strategy. *Journal of Management and Marketing Research, 9*, 1.

Anyaegbunam, H., & Nto, P. (2011). Assessment of the performance of sweet potato marketing system in South East Agro Ecological Zone, Nigeria. *American Journal of Experimental Agriculture, 1*(4), 477.

Anyaehie, M. C., & Areji, A. C. (2015). Economic diversification for sustainable development in Nigeria. *Open Journal of Political Science, 5*(02), 87.

Asawalam, D., & Unwudike, S. (2011). Complementary use of cow dung and mineral fertilizer: Effect on soil properties, growth, nutrient uptake and yield of sweet potato (Ipomea batatas). *Publication of Nasarawa State University, Keffi, 7*(1), 36-48.

Astou, D. (2015). Food Imports as a Hindrance to Food Security and Sustainable development: The Cases of Nigeria and Senegal. *CUNY Academic Works*.

Awotide, B., Abdoulaye, T., Alene, A., & Manyong, V. M. (2015). *Impact of access to credit on agricultural productivity: evidence from smallholder cassava farmers in Nigeria.* Paper presented at the International Conference of Agricultural Economists (ICAE), Milan, Italy.

Babatunde, R., Dantata, I., & Olawuyi, O. (2012). Performance of Sweet Potato and Soybeans as Affected by Cropping Sequence in the Northern Guinea Savanna of Nigeria. *Journal of Agronomy, 11*(1), 22-26.

Babatunde, R., Olorunsanya, E., Orebiyi, J., & Falola, A. (2007). Optimal farm plan in sweet potato cropping systems: The case of Offa and Oyun local government areas of Kwara State, North-Central Nigeria. *Agricultural Journal, 2*(2), 285-289.

Babbie, E. (2016). *The practice of social research* (14th ed.). Boston, USA: Nelson Education.

Baiyegunhi, L. J. S., & Fraser, G. C. (2014). Smallholder farmers' access to credit in the Amathole District Municipality, Eastern Cape Province, South Africa. *Journal of Agriculture and Rural Development in the Tropics and Subtropics (JARTS), 115*(2), 79-89.

Baloyi, J. K. (2010). *An analysis of constraints facing smallholder farmers in the Agribusiness value chain: A case study of farmers in the Limpopo Province.* University of Pretoria, South Africa.

Bammann, H. (2007). Participatory value chain analysis for improved farmer incomes, employment opportunities and food security. *Pacific Economic Bulletin*, *22*(3), 113-125.

Bassey, E. E. (2017). Variability in the yield and character association in Nigerian sweet potato (Ipomoea batatas (L.) Lam) genotypes. *World Journal of Agricultural Sciences*, *5*(01), 066-074.

Bergh, K., Orozco, P., Anderson, C. L., & Gugert, M. K. (2012). Crop Value Chains: Sweet Potatoes in Nigeria. *Policy Impact: Evans School Policy Analysis & Research Group (EPAR)*(220), 1-29.

Bibiana, I., Grace, N., & Julius, A. (2014). Quality evaluation of composite bread produced from wheat, maize and orange fleshed sweet potato flours. *American Journal of Food Science and Technology*, *2*(4), 109-115.

Biénabe, E., Coronel, C., Le Coq, J.-F., & Liagre, L. (2004). Linking small holder farmers to markets: Lessons learned from literature review and analytical review of selected projects.

Biénabe, E., Rival, A., & Loeillet, D. (2017). *Sustainable development and tropical agri-chains*. Versailles cedex, France: Springer.

Bijman, J., Ton, G., & Meijerink, G. (2007). *Empowering Smallholder Farmers in Markets: National and International Policy Initiatives*. Wageningen: National and International Policy Initiatives. Retrieved from http://www.esfim.org/wp-content/uploads/ESFIM_Working_Paper_1.pdf

Boeije, H. (2010). *Analysis in qualitative research*. Los Angeles, United States: Sage publications.

Bolo, A. Z., Lorika, J., & Obonyo, P. (2011). Effectiveness of the value chain strategy in the selected producer-owned dairy groups in Kenya. *Prime Journal of Business Administration and Management (BAM)*, *1*(3), 93-100.

Brown, L. D., & Ashman, D. (1996). Participation, social capital, and intersectoral problem solving: African and Asian cases. *World development*, *24*(9), 1467-1479.

Bryman, A., & Bell, E. (2011). *Business research methods* (3rd ed.). USA: Oxford University Press.

Bucur, E., Danet, A. F., Lehr, C. B., Lehr, E., & Nita-Lazar, M. (2017). Binary logistic regression—Instrument for assessing museum indoor air impact on exhibits. *Journal of the Air & Waste Management Association*, *67*(4), 391-401.

Cameron, A. C., & Trivedi, P. K. (2010). *Microeconometrics using stata* (Vol. 2). Texas, USA: Stata press.

CBN. (2018). Central Bank of Nigeria Food Price Statistics: Prices of Major Agricultural Commodities In Nigeria. Retrieved from http://www.cbn.gov.ng/documents/statbulletin.asp

CFS. (2015). Committee on World Food Security High-Level Forum on Connecting Smallholders to Markets. Retrieved from http://www.fao.org/3/a-av042e.pdf

Chen, Z., Huffman, W. E., & Rozelle, S. (2011). Inverse relationship between productivity and farm size: the case of China. *Contemporary Economic Policy, 29*(4), 580-592.

Chima, I., Umoh, M., Njoku, J., & Mbanasor, J. (2012). *A Situation Analysis and Needs Assessment Report in Nigeria*. In Retrieved from http://1srw4m1ahzc2feqoq2gwbbhk.wpengine.netdna-cdn.com/wp-content/uploads/2016/03/OFSP-Situation-Analysis-Report_Nigeria.pdf

CIP. (2006). International Potato Center: World Sweetpotato Atlas. Retrieved from https://research.cip.cgiar.org/confluence/display/WSA/Nigeria

CIP. (2017). Facts and Figures about the Sweetpotato. Retrieved from https://cipotato.org/site/worldfoodprize/pdf/FactsandFiguresSweetpotato.pdf

CIP. (2017b). Pest Distribution and Risk Atlas for Africa. Retrieved from https://cipotato.org/riskatlasforafrica/cylas-puncticollis/

Cooper, M. C., Lambert, D. M., & Pagh, J. D. (1997). Supply chain management: more than a new name for logistics. *The international journal of logistics management, 8*(1), 1-14.

Cramer, D. (2003). *Advanced quantitative data analysis*. Philadelphia, USA: McGraw-Hill Education.

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.): Sage publications.

Crissman, C., Anderson, P., Fuglie, K., Kapinga, R., Lemaga, B., Devaux, A., . . . Bussink, C. (2007). *Trends in the potato and sweetpotato sectors in sub-Saharan Africa and their contribution to the Millennium Development Goals.* Paper presented at the Tropical Root and Tuber Crops: Opportunities for Poverty Alleviation and Sustainable Livelihoods in Developing Countries: Proceedings of the Thirteenth Triennial Symposium of the International Society for Tropical Root Crops (ISTRC).

Czepiel, S. A. (2002). Maximum likelihood estimation of logistic regression models: theory and implementation. Retrieved from http://ww.saedsayad.com/docs/mlelr.pdf

DAFF. (2012). *A framework for the development of smallholder farmers through cooperative development*. In Retrieved from http://www.nda.agric.za/doaDev/sideMenu/cooperativeandenterprisedevelopment/docs/FRAMEWORK-%20OF%20SMALL%20FARMERS%20(2).pdf

Dane, F. C. (1990). *Research methods* (Vol. 120). California, USA: Brooks / Cole Publishing Company.

Das, A. B., & Sahoo, D. (2012). Farmers' educational level and agriculture productivity: a study of tribals of KBK districts of Odisha. *International Journal of Education Economics and Development, 3*(4), 363-374.

Donkor, E., Owusu, V., Owusu-Sekyere, E., & Ogundeji, A. A. (2018). The Adoption of Farm Innovations among Rice Producers in Northern Ghana: Implications for Sustainable Rice Supply. *Agriculture, 8*(8), 1-13.

Ebregt, E., Struik, P., Odongo, B., & Abidin, P. (2007). Piecemeal versus one-time harvesting of sweet potato in north-eastern Uganda with special reference to pest damage. *Njas-Wageningen Journal of Life Sciences, 55*(1), 75-92.

Egbe, O., Afuape, S., & Idoko, J. (2012). Performance of improved sweet potato (Ipomea batatas L.) varieties in Makurdi, Southern Guinea Savanna of Nigeria. *American Journal of Experimental Agriculture, 2*(4), 573.

Ehisianya, C., Lale, N., Umeozor, O., Amadi, C., & Zakka, U. (2011). Evaluation of Effectiveness of Variety, Tillage Method and Time of Harvest on sweetpotato yield and the population of sweetpotato weevil, Cylaspuncticollis (Boheman)(Coloeptera: Brentidae). *International journal of Advanced Scientific and technical Research, 1*(2), 165-183.

Ekwe, K., & Onunka, B. (2006). Adoption of sweet potato production technologies in Abia State, Nigeria. *Journal of Agriculture and Social Research (JASR), 6*(2).

Eneji, M., Agboola, A., & Ubi, B. (1997). Effect of Farmyard Manure and NPK Fertilizers on Growth and Yield of Intercropped Maize and Sweet Potato in South-Western Nigeria. *Rivista di Agricoltura Subtropicale e Tropicale, 91*(1), 63-78.

Eneji, M., Dimis, M., & Rose, I. (2017). Impact of Economic Recession on Macroeconomic Stability and Sustainable Development in Nigeria. *Science Journal of Economics*, 12.

Ensign, P. C. (2001). Value chain analysis and competitive advantage. *Journal of general Management, 27*(1), 18-42.

Etejere, E., & Bhat, R. (1986). Traditional and modern storage methods of underground root and stem crops in Nigeria. *Turrialba, 36*(1), 33-37.

Ezeano, C. (2010). Technology use in sweet potato production, consumption and utilization among households in Southeastern Nigeria. *Journal of Agriculture and Social Research (JASR), 10*(1).

Faida, M. (2006). *Chain empowerment: supporting African farmers to develop markets*. Amsterdam, Netherlands: Royal Tropical Institute.

FAO. (1995). *Irrigation in Africa in figures*. Rome, Italy: Macmillan Publishers.

FAO. (2017). Global Production And Consumption Of Roots And Tubers. Retrieved from http://www.fao.org/wairdocs/tac/x5791e/x5791e0q.htm

FAOSTAT. (2017). Production/Yield quantities of Sweet potatoes in World. Retrieved from http://www.fao.org/faostat/en/#data/QC/visualize

FAOSTAT. (2017a). Commodities by country: Top 10 Commodities Production in Nigeria. Retrieved from http://www.fao.org/faostat/en/#rankings/commodities_by_country

FARMD. (2011). *Questionnaire for Collecting Agricultural Information: Forum for Agricultural Risk Management in Development*. Paper presented at the Price Volatility and Climate Change, Implications for the Ag-Risk Management Agenda, Zurich, Switzerland. https://www.agriskmanagementforum.org/sites/agriskmanagementforum.org/files/Annexes_WII_Paper_Nov_2011.pdf

Fawole, O. (2007). Constraints to production, processing and marketing of sweet-potato in selected communities in Offa Local Government Area, Kwara State Nigeria. *Journal of Human Ecology, 22*(1), 23-25.

Fawole, O., & Claudius-Cole, O. (2000). *Plant-parasitic nematodes as constraints in the production of potatoes and sweetpotatoes in Nigeria.* Paper presented at the African Potato Association Conference.

Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th ed.). Los Angeles, USA: Sage.

Frederick, S., & Gereffi, G. (2009). *Value Chain Governance: USAID Briefing Paper*. https://gvcc.duke.edu/pdfs/Frederick_Gereffi_ValueChainGovernance_USAID_BriefingPaper_Feb2009.pdf

Fromm, I. (2007). Upgrading in agricultural value chains: The case of small producers in Honduras. *German Institute of Global and Area Studies, 64*.

Fuller, B. (1994). Control Grasshoppers and Locusts on Your Farm. Retrieved from http://scripts.farmradio.fm/radio-resource-packs/package-32/control-grasshoppers-and-locusts-on-your-farm/

Gagnon, Y.-C. (2010). *The Case Study As Research Method : A Practical Handbook*. Québec, Canada: Les Presses de l'Université du Québec.

Gary, T. (2011). How to do your case study: A guide for students and researchers. In: Thousand Oaks, CA: Sage Publications.

Gbigbi, M. T. (2011). Economic efficiency of smallholder sweet potato producers in Delta State, Nigeria: A case study of Ughelli South Local Government Area. *Research journal of agriculture and Biological Sciences, 7*(2), 163-168.

Gelb, A. (2010). *Economic diversification in resource rich countries.* Paper presented at the Natural resources, finance and development: Confronting old and new challenges, Central Bank of Algeria and the IMF Institute of Algiers.

Gereffi, G. (1994). *The Organization of Buyer-Driven Global Commodity Chains: How US Retailers Shape Overseas Production Networks*. Westport, London: Greenwood Press.

Ghauri, P., Gronhaug, K., & Kristianslund, I. (1995). *Research methods in business studies: A practical guide*. New York: Prentice Hall.

Giddens, A. (2006). *Essentials of sociology* (3rd ed.). New York, USA: Norton.

Goldman, A. (1996). Pest and disease hazards and sustainability in African agriculture. *Experimental Agriculture, 32*(2), 199-211.

Gorard, S. (2003). *Quantitative methods in social science*. New York; London: Continuum Books.

Guo, G., Wen, Q., & Zhu, J. (2015). The impact of aging agricultural labor population on farmland output: from the perspective of farmer preferences. *Mathematical Problems in Engineering*.

Gyau, A., Franzel, S., Chiatoh, M., Nimino, G., & Owusu, K. (2014). Collective action to improve market access for smallholder producers of agroforestry products: key lessons learned with insights from Cameroon's experience. *Current Opinion in Environmental Sustainability, 6*, 68-72.

Haile, M. (2005). Weather patterns, food security and humanitarian response in sub-Saharan Africa. *Philosophical Transactions of the Royal Society of London B: Biological Sciences, 360*(1463), 2169-2182.

Hair, J. F., Money, A., Samouel, P., & Page, M. (2007). *Research methods for business*: Chichester, West Sussex, England ; Hoboken, N.J. : John Wiley & Sons Ltd., 2007.

Handfield, R. B., & Nichols, E. L. (2002). *Supply chain redesign: Transforming supply chains into integrated value systems*. New Jersey: FT Press.

Hawkes, C., & Ruel, M. T. (2011). Value chains for nutrition. *International Food Policy Research Institute*, 73-82.

Henriksen, L., Riisgaard, L., Ponte, S., Hartwich, F., & Kormawa, P. (2010). Agro-Food Value Chain Interventions in Asia. *Vienna, Austria.: United Nations Industrial Development Organization (UNIDO)*.

Hernández, R., Reardon, T., & Berdegué, J. (2007). Supermarkets, wholesalers, and tomato growers in Guatemala. *Agricultural Economics*, *36*(3), 281-290.

Hobbs, J., Cooney, A., & Fulton, M. (2000). *Value chains in the agri-food sector: What AreThey? How do They Work? Are They for Me?* Canada: Department of Agricultural Economics, University of Saskatchewan.

Huang, Z., Xinsun, Y., Shasha, C., Han, Y., LIU, W., & Zhiqiang, M. (2017). Influences of Different Distances between Ridges or Plants on Yield of Sweet Potatoes. *Agricultural Science & Technology*, *18*(4).

Humphrey, J., & Navas-Alemán, L. (2010). Value chains, donor interventions and poverty reduction: A review of donor practice. *IDS Research Reports*, *2010*(63), 1-106.

Humphrey, J., & Schmitz, H. (2000). Governance and upgrading: linking industrial cluster and global value chain research. *Institute of Development Studies*.

IFAD. (2003). *Promoting Market Access for the Rural Poor in Order to Achieve the Millennium Development Goals*. Paper presented at the Twenty-Fifth Anniversary Session of IFAD's Governing Council, Rome.

IITA. (2011). Increasing Crop Productivity in the West African Savannas: Experiences from northern Nigeria. Retrieved from https://www.slideshare.net/IITA-CO/increasing-crop-productivity-in-the-west-african-savannas-experiences-from-northern-nigeria

Ikwelle, M., Ezulike, T., & Eke-Okoro, O. (2001). *Contribution of Root and Tuber Crops to the Nigerian economy.* Paper presented at the 8th Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch (ISTRC-AB) held at the International Institute of Tropical Agriculture, Ibadan.

Ilyas, R. M., Banwet, D., & Shankar, R. (2007). *Value chain relationship-a strategy matrix.* Paper presented at the Supply Chain Forum: An International Journal.

Imo, C. K. (2017). The demographic implications of nomadic herdsmen and farmers clashes in Nigeria. *International Journal of Development and Management Review*, *12*(1), 45-58.

Imoloame, E. O. (2013). Herbicide utilization by farmers in Moro Local Government Area of Kwara State. *International Journal of Agricultural Sciences*, *3*(7), 571-578.

Ishida, H., Suzuno, H., Sugiyama, N., Innami, S., Tadokoro, T., & Maekawa, A. (2000). Nutritive evaluation on chemical components of leaves, stalks and stems of sweet potatoes (Ipomoea batatas poir). *Food Chemistry, 68*(3), 359-367.

ITC. (2017). List of importers for the selected product Product: 1001 Wheat and meslin. Retrieved from http://trademap.org/Country_SelProduct_TS.aspx?nvpm=11001411121211

ITC. (2017a). List of products imported by Nigeria at the same aggregating level as the product. Retrieved from http://trademap.org/Product_SelCountry_TS.aspx?nvpm=15661001411121111

ITC. (2017b). List of exporters for the selected product : 071420 Sweet potatoes, fresh, chilled, frozen or dried, whether or not sliced or in the form of pellets. Retrieved from http://trademap.org/Country_SelProduct_TS.aspx?nvpm=1071420611221211

Iyagba, A. (2010). A review on root and tuber crop production and their weed management among small scale farmers in Nigeria. *ARPN Journal of Agricultural and Biological Science, 5*(4), 52-55.

Jaffee, S., & Morton, J. (1995). *Marketing Africa's high-value foods: comparative experiences of an emergent private sector*. Dubuque, USA: Kendall Hunt Publishing.

Jari, B., & Fraser, G. (2009). An analysis of institutional and technical factors influencing agricultural marketing amongst smallholder farmers in the Kat River Valley, Eastern Cape Province, South Africa. *African Journal of Agricultural Research, 4*(11), 1129-1137.

Johnson, M., & Pace, R. D. (2010). Sweet potato leaves: properties and synergistic interactions that promote health and prevent disease. *Nutrition reviews, 68*(10), 604-615.

Jooji, I. T., Okwara, E. C., & Oguchi, C. B. (2017). Economic Diversification and Infrastructural Development as Effective Strategies for Poverty Alleviation in Africa: the Nigerian Perspective. *International Journal of Development Strategies in Humanities, Management and Social Sciences, 7*, 89-100.

Jwanya, B. A., Dawang, N. C., Mashat, I. M., & Gojing, B. S. (2014). Technical Efficiency of Rain-Fed Irish Potato Farmers in Plateau State, Nigeria: A Stochastic Frontier Approach. *Developing Country Studies, 4*(22), 34-39.

Kaplinsky, R. (2000). Globalisation and unequalisation: What can be learned from value chain analysis? *Journal of development studies, 37*(2), 117-146.

Kaplinsky, R., & Morris, M. (2001). *A handbook for value chain research* (Vol. 113): IDRC Ottawa.

Khachatryan, A., Basonde, R., Labonte, D., Losso, J., Bansode, R., & Labonte, D. (2003). *Identification of sweet potato leaves (Ipomoea batatas) as an excellent source of lutein.* Paper presented at the IFT annual meeting, Chicago, USA.

Kherallah, M., & Kirsten, J. F. (2002). The new institutional economics: applications for agricultural policy research in developing countries. *Agrekon, 41*(2), 110-133.

Kirui, O. K., & Njiraini, G. W. (2013). *Impact of Collective Action on the smallholder agricultural commercialization and incomes: Experiences from Kenya.* Paper presented at the 4th Conference of AAAE, Hammamet, Tunisia.

Koirala, K. H., Mishra, A., & Mohanty, S. (2015). *The Role of Gender in Agricultural Productivity in the Philippines: The Average Treatment Effect.* Paper presented at the Southern Agricultural Economics Association's Annual Meeting, Atlanta, USA.

Köksal, M. (2008). How export marketing research affects company export performance: evidence from Turkish companies. *Marketing Intelligence & Planning, 26*(4), 416-430.

Kolo, M. J. (2004). Herbicide utilization by farmers in Niger State, Nigeria. *Nigerian Journal of Weed Science, 17*, 27-28.

KordİtabarS. B. (2015). A Model for Sustainable Value Creation in Supply Chain. *Cumhuriyet Science Journal, 36*(3), 394-401.

Korieocha, D., Ogbonna, M., Korieocha, J., & Nwokocha, C. (2011). Effect of Fluazifopbutyl and Atrazine/Metolachlor (Tank Mixed) for Weed Control in Sweetpotato (Ipomoea Batatas) in South Eastern, Nigeria. *Journal of Agriculture and Social Research (JASR), 11*(1).

Kula, O., Downing, J., & Field, M. (2006). Globalization and the small firm: a value chain approach to economic growth and poverty reduction. *USAID microREPORT*(42).

Kulembeka, H., Rugutu, C., Kanju, E., Chirimi, B., Rwiza, E., & Amour, R. (2004). The agronomic performance and acceptability of orange fleshed sweetpotato varieties in the lake zone of Tanzania. *African Crop Science Journal, 12*(3), 229-240.

Kumar, D., & Rajeev, P. (2016). Value Chain: A Conceptual Framework. *International Journal of Engineering and Management Sciences, 7*, 74-77.

Lall, R. (2004). *The application of ordinal regression models in quality of life scales used in gerontology.* University of Sheffield. Retrieved from http://etheses.whiterose.ac.uk/6061/1/412143.pdf

Laurie, S., Van den Berg, A., Magoro, M., & Kgonyane, M. (2004). Breeding of sweetpotato and evaluation of imported cultivars in South Africa. *African Crop Science Journal, 12*(3), 189-196.

Laurie, S., & Van Heerden, S. (2012). Consumer acceptability of four products made from beta-carotene-rich sweet potato. *African Journal of Food Science, 6*(4), 96-103.

Laurie, S., Van Jaarsveld, P., Faber, M., Philpott, M., & Labuschagne, M. (2012). Trans-β-carotene, selected mineral content and potential nutritional contribution of 12 sweetpotato varieties. *Journal of Food Composition and Analysis, 27*(2), 151-159.

Lebot, V. (2009). *Tropical root and tuber crops: cassava, sweet potato, yams and aroids*. Cambridge, UK: Cabi.

Leones, J. P., & Feldman, S. (1998). Nonfarm activity and rural household income: Evidence from Philippine microdata. *Economic Development and cultural change, 46*(4), 789-806.

Liu, Q. (2011). Sweet potato omics and biotechnology in China. *Plant Omics, 4*(6), 295.

Loebenstein, G., & Thottappilly, G. (2009). *The sweetpotato*. Louisiana, USA: Springer Science & Business Media.

Loughrey, J., Donnellan, T., Hanrahan, K., & Hennessy, T. (2013). *Agricultural Labour Market Flexibility in the EU and Candidate Countries*. International Agricultural Trade Research Consortium.

Low, J. W., Arimond, M., Osman, N., Cunguara, B., Zano, F., & Tschirley, D. (2007). A food-based approach introducing orange-fleshed sweet potatoes increased vitamin A intake and serum retinol concentrations in young children in rural Mozambique. *Journal of Nutrition, 137*(5), 1320-1327.

M4P. (2008). *Making value chains work better for the poor: a toolbook for practitioners of value chain analysis*. Phnom Penh, Cambodia: Agricultural Development International.

Maître d'Hôtel, E., Lemeilleur, S., & Biénabe, E. (2011). Linking smallholders to efficient markets: background paper. *3rd European Forum on Rural Development*.

Makhura, M. T. (2001). *Overcoming transaction costs barriers to market participation of smallholder farmers in the Northern Province of South Africa.* University of Pretoria, Pretoria, South Africa.

Maphill. (2017). Political Map of Kwara. Retrieved from http://www.maphill.com/nigeria/kwara/maps/political-map/cropped-outside/?most-similar-to=maps/flag-map/

Marconatto, D. A., Barin-Cruz, L., & Pedrozo, E. (2016). Lending groups and different social capitals in developed and developing countries. *Revista de Administração Contemporânea, 20*(6), 651-672.

Markelova, H., & Mwangi, E. (2010). Collective action for smallholder market access: evidence and implications for Africa. *Review of policy research, 27*(5), 621-640.

Maspaitella, M. R. (2015). *Linking smallholder vegetable farmers to high value markets in the Manokwari region, Papua Barat Province, Indonesia: a thesis presented in partial fulfilment of the requirements for the degree of Master of AgriCommerce.* Massey University, New Zealand.

Mbanaso, E., Agwu, A., Anyanwu, A., & Asumugha, G. (2012). Assessment of the Extent of Adoption of Sweetpotato Production Technology by Farmers in the Southeast Agro-Ecological Zone of Nigeria. *Journal of Agriculture and Social Research (JASR), 12*(1), 124-136.

McDermott, G. A. (2007). The politics of institutional renovation and economic upgrading: Recombining the vines that bind in Argentina. *Politics & Society, 35*(1), 103-144.

Meinzen-Dick, R., DiGregorio, M., & McCarthy, N. (2004). Methods for studying collective action in rural development. In: Elsevier.

Merriam, S. B., & Tisdell, E. J. (2015). *Qualitative Research : A Guide to Design and Implementation*. Newark, United States: Wiley.

Methu, J., Nyangaga, J., Waweru, A., & Akishule, D. (2013). *Agricultural innovation systems and value chains development: a training manual*. Entebbe, Uganda: Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA).

Mitchell, J., Coles, C., & Keane, J. (2009). *Upgrading along value chains: strategies for poverty reduction in Latin America*. Paper presented at the Trade and Poverty in Latin America.

Mmasa, J. J., & Msuya, E. E. (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. *Sustainable Agriculture Research, 1*(1), 130.

Mukhopadhyay, S. K., Chattopadhyay, A., Chakraborty, I., & Bhattacharya, I. (2011). Crops that feed the world 5. Sweetpotato. Sweetpotatoes for income and food security. *Food security, 3*(3), 283.

Mwaura, F., Muku, O., & Nyabundi, K. W. (2010). Using research findings to formulate extension tools that incorporate stakeholders' aspirations: The case of tea farming in poverty reduction strategies among smallholders in Kenya. *Outlook on Agriculture, 39*(3), 217-222.

Nationsonline. (2017). Administrative Map of Nigeria. Retrieved from http://www.nationsonline.org/oneworld/map/nigeria-administrative-map.htm

NBS. (2010). Annual Collaborative Survey of Socio-Economic Activities In Nigeria. Retrieved from http://www.nigerianstat.gov.ng/nada/index.php/catalog/36/download/144

NBS. (2017a). Nigerian Bureau of Statistics: Population of Nigeria. Retrieved from http://www.nigerianstat.gov.ng/#pop

NBS. (2017b). UNEMPLOYMENT/UNDER-EMPLOYMENT REPORT Q4 2016. Retrieved from http://nigerianstat.gov.ng/elibrary?queries[search]=unemployment

NBS. (2017a). Consumer Price Index. Retrieved from http://nigerianstat.gov.ng/elibrary?queries[search]=inflation&perPage=50

NBS. (2018). Selected Food Prices Watch. Retrieved from http://nigerianstat.gov.ng/elibrary

NISER. (2001). Annual Survey of Crop Production Conditions in Nigeria. Retrieved from https://www.niser.gov.ng/niser-research-reach

Njoku, J., Nwauzor, E., Okorocha, A., Afuape, S., & Korieocha, D. (2006). Multilocational Evaluation of New Sweetpotato Genotypes. *NRCRI, Annual Report*, 124-157.

NRCRI. (2010). National Root Crops Research Institute: Sweetpotato Programme.

Nwaru, J. C., Okoye, B. C., & Ndukwu, P. C. (2011). Measurement and determinants of production efficiency among small-holder sweet potato (Ipomoea Batatas) farmers in Imo State, Nigeria. *European Journal of Scientific Research, 59*(3), 307-317.

Nyirenda, A. (2014). Pest Management Decision Guide: Grasshoppers on Sweet potatoes. Retrieved from https://www.plantwise.org/FullTextPDF/2015/20157801485.pdf

Oduro-Ofori, E., Aboagye, A. P., & Acquaye, N. A. E. (2014). Effects of education on the agricultural productivity of farmers in the Offinso municipality.

Ogunleye, K., & Oladeji, J. (2007). Choice of cocoa market channels among cocoa farmers in ila local government area of Osun state, Nigeria. *Middle-East Journal of Scientific Research, 2*(1), 14-20.

Ojeniyi, E. T., & Tewe, O. (2001). *Processing and utilization of sweetpotato for food and livestock feed in Nigeria.* Paper presented at the Proceedings of the 8th symposium of the International Society for Tropical Root Crops-Africa Branch, Ibadan, Nigeria.

Okpara, D., Okon, O., & Ekeleme, F. (2009). Optimizing nitrogen fertilization for production of white and orange-fleshed sweet potato in Southeast Nigeria. *Journal of plant nutrition, 32*(5), 878-891.

Olatunde, G. O., Henshaw, F. O., Idowu, M. A., & Tomlins, K. (2016). Quality attributes of sweet potato flour as influenced by variety, pretreatment and drying method. *Food science & nutrition, 4*(4), 623-635.

Olife, I., Jolaoso, M., & Onwualu, A. (2013). Cashew processing for economic development in Nigeria. *Agricultural Journal, 8*(1), 45-50.

Ololade, R., & Olagunju, F. (2013). Determinants of access to credit among rural farmers in Oyo State, Nigeria. *Global Journal of Science Frontier Research Agriculture and Veterinary Sciences, 13*(2), 16-22.

Omoare, A. M., Fakoya, E. O., & Oyediran, W. O. (2015). Value Addition of Sweet Potato (Ipomoea batatas L. Lam): Impending Factors on Household Food Security and Vitamin A Deficiency (VAD) In Southwest and Northcentral Nigeria *Journal of Agriculture and Veterinary Science, 8*(9), 06-14

Omobolanle, O. L. (2008). Analysis of extension activities on farmers productivity in Southwest, Nigeria. *African Journal of Agricultural Research, 3*(7), 469-476.

Onogwu, G., Audu, I., & Igbodor, F. (2017). Factors Influencing Agricultural Productivity of Smallholder Farmers in Taraba State, Nigeria. *International Journal of Agriculture Innovations and Research, 6*(1), 114-118.

Osundare, B. (2004). Effects of fertilizer types and different companion crops on the performance of sweet potato. *Moor Journal of Agricultural Research, 5*(2), 88-94.

Ouma, E., & Jagwe, J. (2010, September 19-23). *Banana value chains in Central Africa: constraints and opportunities.* Paper presented at the Joint 3rd African Association of Agricultural Economists (AAAE) and 48th Agricultural Economists Association of South Africa (AEASA) Conference, Cape Town,South Africa.

Owusu, S. (2017). Effect of Access to Crediton Agricultural Productivity: Evidence from Cassava Farmers in Afigya-Kwabre District of Ghana. *International Journal of Innovative Research in Social Sciences and Strategic Management Techniques, 4*(2), 55-67.

Palacios-Lopez, A., & Lopez, R. (2014). *Gender Differences in Agricultural Productivity: The Role of Market Imperfections*. University of Maryland, Department of Agricultural and Resource Economics.

Pathania-Jain, G. (2001). Global parents, local partners: A value-chain analysis of collaborative strategies of media firms in India. *The Journal of Media Economics, 14*(3), 169-187.

Peppard, J., & Rylander, A. (2006). From value chain to value network:: Insights for mobile operators. *European Management Journal, 24*(2), 128-141.

Podsędek, A. (2007). Natural antioxidants and antioxidant capacity of Brassica vegetables: A review. *LWT-Food Science and Technology, 40*(1), 1-11.

Population Reference Bureau. (2016). 2016 World Population Data Sheet. Retrieved from http://www.prb.org/Publications/Datasheets/2016/2016-world-population-data-sheet.aspx

Porter, M. (1985). *Competitive advantage : creating and sustaining superior performance*: New York : Free Press ; London : Collier Macmillan.

Putnam, R. D., Leonardi, R., & Nanetti, R. Y. (1994). *Making democracy work: Civic traditions in modern Italy*: Princeton university press.

Pyke, S. W., & Sheridan, P. M. (1993). Logistic regression analysis of graduate student retention. *Canadian Journal of Higher Education, 23*(2), 44-64.

Queensland Government. (2000). Sweetpotato Information Kit. Retrieved from http://era.daf.qld.gov.au/id/eprint/1689/5/4keyswp.pdf

Quisumbing, A. R., Meinzen-Dick, R., Raney, T. L., Croppenstedt, A., Behrman, J. A., & Peterman, A. (2014). Closing the knowledge gap on gender in agriculture. In *Gender in agriculture* (pp. 3-27). Netherlands: Springer.

Ray, R., & Ravi, V. (2005). Post harvest spoilage of sweetpotato in tropics and control measures. *Critical reviews in food science and nutrition, 45*(7-8), 623-644.

Reardon, T., Crawford, E., & Kelly, V. (1994). Links between nonfarm income and farm investment in African households: adding the capital market perspective. *American Journal of Agricultural Economics, 76*(5), 1172-1176.

Reddy, O. C. S., Likassa, H. T., & Asefa, L. (2015). Binary Logistic Regression Analysis in Assessing and Identifying Factors that Influence the Use of Family Planning: The Case of Ambo Town, Ethiopia. *International Journal of Modern Chemistry and Applied Science, 2*(2), 108-120.

Regmi, A., & Gehlhar, M. J. (2005). *New directions in global food markets*. In Retrieved from https://www.ers.usda.gov/webdocs/publications/42581/30125_aib794_002.pdf?v=42487

Reimers, M., & Klasen, S. (2013). Revisiting the role of education for agricultural productivity. *American Journal of Agricultural Economics, 95*(1), 131-152.

Rich, K. M., Baker, D., Negassa, A., & Ross, R. B. (2009). *Concepts, applications, and extensions of value chain analysis to livestock systems in developing countries.* Paper presented at the International Association of Agricultural Economists Conference, Beijing.

Rich, K. M., Ross, R. B., Baker, A. D., & Negassa, A. (2011). Quantifying value chain analysis in the context of livestock systems in developing countries. *Food Policy*, *36*(2), 214-222.

Riisgaard, L., Bolwig, S., Ponte, S., Du Toit, A., Halberg, N., & Matose, F. (2010). Integrating poverty and environmental concerns into value-chain analysis: a strategic framework and practical guide. *Development Policy Review*, *28*(2), 195-216.

Robson, C. (2011). *Real world research : a resource for users of social research methods in applied settings* (3rd ed ed.). Chichester, West Sussex, USA: Wiley.

Rufai, A., & Omonona, B. (2012). Rainfall and priority investment commodities in southern Nigeria. *World Rural Observations*, *4*(1), 49-55.

Salami, D. (2015). How Does the Changing Price of Oil Affect Economies around the World? Retrieved from http://insights.som.yale.edu/insights/how-does-the-changing-price-of-oil-affect-economies-around-the-world

Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students* (5th ed.): Pearson Education Limited.

Schippers, R. (2002). *African indigenous vegetables: an overview of the cultivated species*. Great Britain: Natural Resources International Ltd.

Schmitz, H. (2005). *Value chain analysis for policy-makers and practitioners*. Geneva, Switzerland: International Labour Organization.

Sekaran, U., & Bougie, R. (2013). *Research methods for business : a skill-building approach* (6th ed.). Chichester, West Sussex, USA: Wiley.

Sigei, G. (2014). *Determinants of Market Participation Among Small-Scale Pineapple Farmers in Kericho County, Kenya.* Egerton University, Nairobi, Kenya.

Sims, B., & Kienzle, J. (2017). Sustainable agricultural mechanization for smallholders: What is it and how can we implement it? *Agriculture*, *7*(6), 50.

Sowley, E., Neindow, M., & Abubakari, A. (2015). Effect of poultry manure and NPK on yield and storability of orange-and white-fleshed sweet potato [Ipomoea batatas (L.) Lam]. *ISABB Journal of Food and Agricultural Sciences*, *5*(1), 1-6.

SSP-WA. (2012). Sweetpotato Support Platform for West Africa : Sweetpotato Value Chain Study in Nigeria. Retrieved from http://www.sweetpotatoknowledge.org/wp-content/uploads/2016/01/Pres-3_Sweetpotato-Value-Chain-Study_Nigeria-SSPWA.pdf

Sturgeon, T. J. (2001). How do we define value chains and production networks? *IDS bulletin*, *32*(3), 9-18.

Sugri, I., Maalekuu, B. K., Gaveh, E., & Kusi, F. (2017). Sweet Potato Value Chain Analysis Reveals Opportunities for Increased Income and Food Security in Northern Ghana. *Advances in Agriculture*.

Synodinos, N. E. (2003). The "art" of questionnaire construction: some important considerations for manufacturing studies. *Integrated manufacturing systems, 14*(3), 221-237.

Tang, C. S., Wang, Y., & Zhao, M. (2015). The implications of utilizing market information and adopting agricultural advice for farmers in developing economies. *Production and Operations Management, 24*(8), 1197-1215.

Tavva, S., & Nedunchezhiyan, M. (2012). Global status of sweet potato cultivation. *Fruit Veg. Cereal Sci. Biotechnol., 6*(SI 1), 143-147.

Tewe, O., Ojeniyi, F., & Abu, O. (2003). *Sweetpotato production utilization, and marketing in Nigeria*. Peru: Lima.

Thompson Ayodele, Olusegun Sotola, Olajide Damilola, Khalil Hegarty, & Obe, I. (2015). Nigeria: A smallholder case study. Retrieved from www.simedarbyplantation.com/sites/default/files/sustainability/high-carbon-stock/consulting-reports/socio-economic/hcs-consulting-report-13-nigeria-a-smallholder-case-study.pdf

Tiwari, K. R., Sitaula, B. K., Nyborg, I. L., & Paudel, G. S. (2008). Determinants of farmers' adoption of improved soil conservation technology in a middle mountain watershed of central Nepal. *Environmental management, 42*(2), 210-222.

Torosyan, N. (2017). *Application of binary logistic regression in credit scoring.* University of Tartu. Retrieved from http://dspace.ut.ee/bitstream/handle/10062/57102/torosyan_nare_msc_2017.pdf?sequence=1&isAllowed=y

Trejo-González, A., Loyo-González, A., & Munguía-Mazariegos, M. (2014). Evaluation of bread made from composite wheat-sweet potato flours. *International Food Research Journal, 21*(4).

Trienekens, J. H. (2011). Agricultural value chains in developing countries; a framework for analysis. *International Food and Agribusiness Management Review, 14*(2), 51-83.

Udemezue, J., & Nwalieji, H. (2017). Effect of Cattle Menace on Farm Land in Anambra State, Nigeria. *Current Trends in Biomedical Engineering & Biosciences, 7*(5).

Udry, C., Hoddinott, J., Alderman, H., & Haddad, L. (1995). Gender differentials in farm productivity: implications for household efficiency and agricultural policy. *Food Policy, 20*(5), 407-423.

Ugonna, C., Jolaoso, M., & Onwualu, A. (2013). A technical appraisal of potato value chain in Nigeria. *International Research Journal of Agricultural Science and Soil Science, 3*(8), 291-301.

Ukom, A., Ojimelukwe, P., & Okpara, D. (2009). Nutrient composition of selected sweet potato [Ipomea batatas (L) Lam] varieties as influenced by different levels of nitrogen fertilizer application. *Pakistan Journal of Nutrition, 8*(11), 1791-1795.

Ukpabi, U., Ekeledo, E., & Ezigbo, V. (2012). Potential use of roots of orange-fleshed sweet potato genotypes in the production of-carotene rich chips in Nigeria. *African Journal of Food Science, 6*(2), 29-33.

Umoh, M., & Njoku, J. (2013). Facts and myths about sweetpotato in nigeria. Retrieved from http://www.sweetpotatoknowledge.org/files/flyer-facts-and-myths-about-sweetpotato-in-nigeria/

USAID. (2017). Value Chain Development. Retrieved from https://microlinks.org/good-practice-center/value-chain-wiki

Van den Ban, A. W., & Hawkins, H. S. (1996). *Agricultural extension* (2nd ed.). Cambridge, USA: Blackwell Science Ltd.

Van der Heijden, T. (2010). *Good for who?: supermarkets and small farmers in South Africa: a critical review of current approaches to market access for small farmers in developing countries.* Stellenbosch: University of Stellenbosch.

Vaughan, I. O., Afolami, C. A., Oyekale, T. O., & Ayegbokiki, A. O. (2014). An analysis of Nigeria food imports and bills. *International Journal of Economics, Commerce and Management, 2*(9), 1-14.

Walker, T., Thiele, G., Suárez, V., & Crissmann, C. (2011). *Hindsight and foresight about potato production and consumption*: International Potato Center.

Webber, C. M., & Labaste, P. (2009). *Building Competitiveness in Africa's Agriculture : A Guide to Value Chain Concepts and Applications*. In (pp. 1-187). Retrieved from https://openknowledge.worldbank.org/bitstream/handle/10986/2401/524610PUB0AFR0101Official0Use0Only1.pdf?sequence

Woolfe, J. A. (1992). *Sweet potato: an untapped food resource*. New York, USA: Cambridge University Press.

Yngve, A., Margetts, B., Hughes, R., & Tseng, M. (2009). Food insecurity–not just about rural communities in Africa and Asia. *Public health nutrition*, *12*(11), 1971-1972.

Zamora, O. B., de Guzman, L. E. P., Saguiguit, S. L. C., Talavera, M. T. M., & Gordoncillo, N. P. (2013). Leveraging agriculture to improve nutrition in the Philippines. *Food security*, *5*(6), 873-886.

Zhen, L., & Zoebisch, M. (2006). *Resource use and agricultural sustainability: Risks and consequences of intensive cropping in China* (Vol. 86): kassel university press GmbH.

APPENDICES

APPENDIX 1: RESEARCH QUESTIONNAIRE

Location: _____ Village: _____	Questionnaire No: _____ Code No: _____	Date: _____

Section A: Farmer demographics		
1.Name: _____	2.Age: _____	3. Gender: ☐ Male ☐ Female
4. Level of education ☐ No formal education ☐ Adult education ☐ Primary ☐ Secondary ☐ Post-secondary	5.Farming as a main occupation ☐ Yes ☐ No	6. If no, what is your main occupation? _____

Section B: Farm and Production characteristics			
7. Source of farm land: ☐ Family ☐ Inherited ☐ Leased ☐ Outright purchase ☐ Others_____	8. Size of land cultivated (acres): _____	9. Period of planting (Jan. to Dec): _____	
	10. Do you experience agricultural land scarcity? ☐ Yes ☐ No	11. Period of harvesting (Jan. to Dec): _____	
12. Fresh tuber yield per acre (kg): _____ ☐ Do not know	13. Fresh vine yield per acre (kg): _____ ☐ Do not know	14. Can you identify the characteristics of soil under cultivation ☐ Yes ☐ No (go to ques. 20)	15. If yes, please specify the characteristic: _____ _____
16. What variety of sweetpotato do you plant and tuber colour? _____	17. What is your major source of information regarding the best variety planted? ☐ Extension officers ☐ Farmer association Others_____	18. Is your sweetpotato production rainfed or irrigated ☐ Rainfed ☐ Irrigated ☐ Both	19. What type of irrigation do you use? ☐ Manual ☐ Sprinklers Others_____
20. Did you purchase the sweetpotato vine planted? ☐ Yes ☐ No (go to ques. 27)	21. If yes, from whom? _____	22. What was the average price you purchased the vines? _____	23. If no, how did you get the vines? _____

24.Production input used for sweetpotato production (Y=Yes or N=No)

Items	Y or N	Name	Amount (Litres, Kg/ Acre)	Price per Acre	Months Applied
Organic fertiliser					
Chemical fertiliser					
Pesticide					
Herbicide					
*Others _____					

25. Source of inputs: ☐ Farmers' association
☐ Cooperatives
☐ Retailers
Others_____

26. What are the major problems you face with sweetpotato production? e.g (pest and diseases)
1._____
2._____
3._____

27. Did you hire labour for the sweetpotato production in the last season?
☐ Yes
☐ No (move to question 30)

28. What activities did you hire labour for?
☐ Land preparation
☐ Planting
☐ Fertilization
☐ Weeding
☐ Spraying
☐ Harvesting
Others_____

29. Number of labour hired:
_____

30. Why did you not hire labour?
_____

31. Did you apply any mechanisation in your sweetpotato farm?
☐ Yes
☐ No

32. What type of machinery/ equipment did you use?
☐ Tractors
☐ Sprayers
☐ Mechanical harvesters
Others_____

33. How do you finance your input/equipment costs? (Tick where applicable)

Do not buy inputs	Own Finances	Loan from Banks	Money Lenders	Other sources	Interested in finance but no access

34. What is your total cost of production of sweetpotato per acre?
N_____

Section C: Sweetpotato marketing

35. Who is your main buyer for sweetpotato produced? (please tick indicate where applicable)

Buyers	
Local Consumer	
Local Collector	
Farmers group	
Cooperative	
Wholesaler	
Supermarket	
Processor	
_____	

36. What is the price of sweetpotato sold per Kg

Price (Naira/kg)	Quantity (Kg/year)

37.What is your total income from sweetpotato production per acre_____

38. When are you paid for sweetpotato sold?
- ☐ Before Harvest
- ☐ At delivery
- ☐ 1-7 days later
- ☐ More than one week later

39. How do you usually communicate with your buyers?
- ☐ Mobile Phone
- ☐ Buyer comes to the farm
- ☐ Farmers go to the buyer
- ☐ Through farmer's group
- ☐ Through cooperative
- ☐ Through intermediary person
- ☐ Others_____

40. Describe your bargaining power:
- ☐ Accept price offered
- ☐ Sometimes bargain
- ☐ Set price offered

41. Where does the sale take place?
- ☐ On farm
- ☐ Road side
- ☐ Collection place
- ☐ Cooperative
- ☐ Village market
- ☐ Wholesale market
- ☐ Others_____

42. If the sale is not on the farm, how do you transport it there?
- ☐ On foot
- ☐ Bicycle
- ☐ Motorbike
- ☐ Car
- ☐ Bus
- ☐ Truck
- ☐ Others_____

43. Did you hire transport for selling sweetpotatoes in the last season?
- ☐ Yes
- ☐ No

44. Please indicate the cost of transporting sweetpotato in the last season?
_____

45. Please indicate the state you sold your sweetpotato distance
_____

46. What do you do after harvest to prepare your sweetpotato for sale?

a. Remove foreign materials	☐ Yes ☐ No
b. Remove bad sweetpotato	☐ Yes ☐ No
c. Sort into different groups by size	☐ Yes ☐ No
d. Sort into different group by quality	☐ Yes ☐ No
e. Wash sweetpotato	☐ Yes ☐ No
f. Put into bags and boxes	☐ Yes ☐ No
g. Keep in storage facility	☐ Yes ☐ No
h. Others_____	☐ Yes ☐ No

47. Do have a storage facility to preserve and keep your sweetpotato? ☐ Yes ☐ No (go to ques. 49)	48. If yes, what kind of storage facility do you have? _____

Section D: Institutional factors

49. How long have you been a sweetpotato farmer (number of years) _____	50. Are you a member of either a farmers' association or cooperative? ☐ Yes ☐ No (go to question 53)
51. What is the name of the association or cooperative? _____	52. In what area does the farmer's group operate? ☐ Production ☐ Marketing ☐ Others_____

53. Do you have agricultural extension support? ☐ Yes ☐ No (go to ques. 56)	54. Who is the extension service provider that you have attended? ☐ Government ☐ Research Institute ☐ NGO ☐ Others_____	55. What area does the extension service provide assistance? ☐ Production Input ☐ Production practice ☐ Marketing ☐ Others_____
56. Did you have access to financial assistance in the last two years? ☐ Yes ☐ No (go to ques. 59)	57. Where did you access it? ☐ Bank ☐ Government ☐ Cooperative ☐ Farmer's group ☐ Friends and Family ☐ Others_____	58. In what area did you spend the credits that you have borrowed? ☐ Inputs ☐ Labour ☐ Marketing ☐ Others_____
59. What is the average amount you borrowed in the last one year? N_____		

60. How many times did you have access to market information in the last one year? ☐ None ☐ One ☐ Two ☐ Three ☐ Greater than Three	61. What type of information did you access? ☐ Price ☐ New Marketplaces ☐ Marketing Method ☐ Grades/Standard ☐ Others	62. Please indicate your source of market information? ☐ Radio ☐ TV ☐ Newspaper ☐ Internet ☐ Extension agent ☐ Farmers group ☐ Cooperative ☐ Ohers_____

Section E: Perception of high market Value

63. Do you have any experience of selling sweetpototoes into export markets such as supermarket or export market?
- ☐ Yes
- ☐ No (go to ques. 65)

64. How is your experience selling into the supermarket or export market?
- ☐ Positive
- ☐ Negative
- ☐ Do not know

65. Do you think most farmers would be interested in selling into the export markets?
- ☐ Yes
- ☐ No
- ☐ Do not know

66. Do you think that farmers can get advantages of selling into export markets?
- ☐ Yes
- ☐ No
- ☐ Do not know

67. What do you see as the main advantage of selling into the export market?
- ☐ Higher price
- ☐ Access to production inputs
- ☐ Access to credit
- ☐ No advantages
- ☐ Do not know
- ☐ Others_____

68. What factor do you think prevent farmers from selling into export markets?
- ☐ Small farms, small quantities
- ☐ Location far from buyers
- ☐ Low quality of products
- ☐ Buyers do not trust small farmers
- ☐ Buyers do not pay immediately at delivery
- ☐ Not enough experience
- ☐ Cannot meet buyers specification
- ☐ Cannot supply all year
- ☐ Do not know
- ☐ Others_____

69. What do you think the government could do to help you sell sweetpotato in the export market?
- ☐ Provide credits
- ☐ Provide training in standards and export requirement
- ☐ Provide training in production methods
- ☐ Help organise farmers into groups
- ☐ Help link farmers to the export market
- ☐ Do not know
- ☐ Others_____

APPENDIX 2: ETHICS EVALUATION AND APPROVAL

Date: 07 February 2018

Dear Adebowale Adesina

Re: Ethics Notification - **4000018916** - **EXPLORING THE OPPORTUNITIES IN THE SWEETPOTATO VALUE CHAIN IN DIVERSIFYING THE NIGERIAN ECONOMY**

Thank you for your notification which you have assessed as Low Risk.

Your project has been recorded in our system which is reported in the Annual Report of the Massey University Human Ethics Committee.

The low risk notification for this project is valid for a maximum of three years.

If situations subsequently occur which cause you to reconsider your ethical analysis, please contact a Research Ethics Administrator.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel Overseas. In addition, the supervisor must advise the University's Insurance Officer.

A reminder to include the following statement on all public documents:
"This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named in this document are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research that you want to raise with someone other than the researcher(s), please contact Dr Brian Finch, Director - Ethics, telephone 06 3569099 ext 86015, email humanethics@massey.ac.nz. "

Please note, if a sponsoring organisation, funding authority or a journal in which you wish to publish requires evidence of committee approval (with an approval number), you will have to complete the application form again, answering "yes" to the publication question to provide more information for one of the University's Human Ethics Committees. You should also note that such an approval can only be provided prior to the commencement of the research.

Yours sincerely

Dr Brian Finch
Chair, Human Ethics Chairs' Committee and Director (Research Ethics)

Research Ethics Office, Research and Enterprise
Massey University, Private Bag 11 222, Palmerston North, 4442, New Zealand **T** 06 350 5573; 06 350 5575 **F** 06 355 7973

Human Ethics Low Risk notification

APPENDIX 3: INFORMATION SHEET FOR DATA COLLECTION

INFORMATION SHEET

Introduction

My name is Adebowale Adesina. I am a student at Massey University, Palmerston North, New Zealand. I am studying for a degree in Master of AgriCommerce, and this study is a requirement for the completion of a degree in Master of AgriCommerce.

Research Description and Invitation

The title of my research is *"Exploring the Opportunities in the Sweetpotato Value Chain in Diversifying the Nigerian Economy"*. The objectives of this research are to (1) determine and analyse the factors that influence the yield of sweetpotato in Nigeria; (2) identify ways in which the yield can be increased; (3) Identify the constraints to market access and (4) Identify market opportunities for sweetpotato nationally and internationally.

As part of the data collection process, I intend to have interviews with sweetpotato farmers as the main participants in this research. Also, I am looking forward to interviewing other stakeholders, such as Sweetpotato traders (local traders and exporters), leaders of farmers association/ cooperatives and research institute involved in sweetpotato.

I, therefore, invite you to be a part of this research. If you decide to participate in the interview process, you will be asked to sign a consent form on which you can choose to have your name acknowledged in this study. The interview will take approximately one hour. With your permission, I will like to record the interview session.

Participant's Rights

If you decide to participate in this interview, you have the right to:

- Ask any questions about the study at any time during participation;
- Decline to answer any particular question;
- Withdraw from the study at any time during the interview session

- Provide information on the understanding that your name will not be used unless you permit the researcher;
- Ask for the recorder to be turned off at any time during the interview;
- Be given access to a summary of the project findings when it is concluded.

Data Management

Data gathered will be analysed and used for the completion of my thesis and for academic publications. All data will be stored securely in a safe place. Where required, names will be changed, and assumed name will be used to ensure confidentiality. After completion of the thesis, it can be assessed through Massey University Library using the following web link: http://www.massey.ac.nz/massey/research/library/library_home.cfm

Project Contacts

For your convenience, feel free to contact my supervisor and me via the contact details below:

Researcher

Adebowale Adesina

[redacted]

Supervisor

Associate Prof. Nick Roskruge

School of Agriculture, Massey University,

Palmerston North,

New Zealand

+6463569099 ext.84876

N.Roskruge@massey.ac.nz

APPENDIX 4: PARTICIPANT CONSENT FORM

Exploring the opportunities in the sweetpotato value chain in diversifying the Nigerian economy

PARTICIPANT CONSENT FORM – INDIVIDUAL

I have read the Information sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree to the interview being sound recorded.

I agree to participate in this study under the conditions set out in the Information sheet.

Signature: _____

Full Name: _____

Date: _____