AGRICULTURAL VALUE CHAIN OPTIMISATION IN A TURBULENT ECONOMY: A STUDY OF SMALLHOLDER FARMERS IN NIGERIA

Adebowale Olumide Adewole ADEYEYE

FACULTY OF BUSINESS AND LAW

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This thesis is dedicated to the Glory of God and the loving memory of my beloved father, friend, pillar and confidant. Even in physical death, you have remained the biggest motivation and inspiration. You truly never died my Alujonu!

Festus Oba Adeyeye (1934-2015).

ABSTRACT

This study aims to uncover the factors that impact agricultural value chain optimisation for small-holder farmers in Nigeria amidst economic instability. The study was conducted in the south-west, north-central, and core northern regions of Nigeria, which were selected for their suitability for cashew and sesame production respectively, taking into, account the crops' requirements and environmental conditions. The data used in this study was obtained from primary sources which include structured questionnaires administered to 450 respondents and key informant interviews. Using Stata, the collected data was analysed using descriptive statistics and econometric models. A two-stage least square regression analysis was conducted to explore the factors that contribute to the optimisation of cashew and sesame value chain, and a multiple linear regression model was employed to examine the variables impacting production costs. The findings of the study indicated that household head's age, educational level, cashew yield, cultivated area, and economic instability are crucial factors that influence the optimisation of the value chain for small-scale cashew farmers; the size of the household, monthly income, years of farming experience, sesame yield, land area dedicated to sesame cultivation, and inflation rate has a crucial impact on the value chain optimisation of small-holder sesame farmers. Additionally, the age of the head of the household, literacy level, monthly income, purchasing cost of better seeds, farming equipment, production inputs, and the cost of inbound and outbound logistics are significant contributors to the total production cost for cashew farmers. Furthermore, this study found that monthly income, cost of improved seeds, fertilizers, and labour play a significant role in determining the production cost of sesame farming during economic instability. In conclusion, this study emphasises the significance of the aforementioned factors in enhancing the agricultural value chain for small-scale farmers in Nigeria. These results hold significant meaning for policy makers as they can draw insights from this study to develop and implement targeted initiatives aimed at enhancing the conditions of smallholder farmers.

Key words: Value chain optimisation; smallholder farming; Cashew; Production cost; Sesame; Stata; Two-stage least square regressions.

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This is for you, Dad!

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List of abbreviations and symbols

2SLS	Two-stage least square regressions
ABP	Anchor Borrowers Program
ACGS	Agricultural Credit Guarantee Scheme
ACSS	Agricultural Credit Support Scheme
ADB	African Development Bank
AGE	Age of the Household head
ATA	Agriculture Transformation Agenda
AVC	Agricultural Value Chain
AVCO	Agricultural Value Chain Optimisation
BAU	Business as Usual
BLUE	Best Linear Unbiased Estimator
BOI	Bank of Industry
CBN	Central Bank of Nigeria
CCRM	Climate Change Risk Management
CNSL	Cashew Nut Shell Liquid
CLR	Classical Linear Regression
CONSRT	Constraints
CPI	Consumer Price Index
EDU	Education
EduHH	Education Level of the Household Head
ETF	Economic Turbulence factors
EXCH	Exchange
EXP	Years of Farming Experience

FAO	Food and Agriculture Organisation
FAOSTAT	Food and Agriculture Organisation Corporate Statistical Database
FARMSZ	Farmsize
FFC	functional fragility curve
FMARD	Federal Ministry of Agriculture and Rural Development
FPIS	Federal Produce Inspection Service
GAP	Good Agricultural Practices
GESS	Growth Enhancement Support Scheme
GVCA	Global Value Chain Analytical
GVCAF	Global Value Chain Analytical Framework
GDP	Gross Domestic Product
GVC	Global Value Chain
HSZE	Household Size
IC	Institutional constraints
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
INC	Income
INFL	Inflation
INT	Interest
IR	Intangible Resources
ITC	International Trade Centre
KOR	Kernel Output Ratio
MSMEDF	Micro, Small, and Medium Enterprise Development Fund
NAFDAC	National Agency for Food and Drug Administration and Control
NBS	National Bureau of Statistics

NCAN National Cashew Association of Nigeria

NECASNorth-East Commodity Association (NECAS)

NEPAD New Partnership for Africa's Development

NEPC Nigerian Export Promotion Council

NIRSAL Nigeria Incentive-Based Risk Sharing System for Agricultural Lending

NSSAN National Sesame Seed Association of Nigeria

OECD Organisation for Economic Co-operation and Development

OLS Ordinary Least Squares

PLTAGE Age of farm plot

PPI Producer Price Index

QoL Quality of Life

RBT Resource Based Theory

SCPZ Staple Crops Processing Zone

SCVI Supply-Chain Vulnerability Index

SDG Sustainable Development Goals

SON Standard Organisation of Nigeria

STRT Strategies

TAX Tax

TR Tangible resources

UNCTAD United Nations Conference on Trade and Development

UNIDO United Nations Industrial Development Organisation

UNPFA United Nations Population Fund

UNSD United Nations Statistics Division

USDA United States Department of Agriculture

VaR Value at Risk

VCA	Value Chain Analysis
VCO	Value Chain Optimisation
VRIN	Valuable, Rare, Inimitable, and Non-substitutable
VRIO	Value, Rarity, Inimitability, Organisation
YLD	Yield

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Value chain provides an understanding of the production, purchase, and sale process. In essence, every human has a role in different value chains, such as being a financial provider, product manufacturer, raw material processor, retailer, or consumer. In Nigeria, the Agricultural value chain (AVC) is crucial, particularly for small-scale farmers seeking a stable income by maximising the value of their agricultural products. This quest for value addition is underpinned in its potential to decrease poverty, improve food security and economic stability through export earnings from high-quality products (see Trienekens, 2011 and Devaux, 2018 for review). Janvry and Sadoulet (2010) showed that growth in agriculture has a higher multiplier effect compared to other sectors. In other words, the value added in agriculture induces a proportionate growth in other non-agricultural sectors, while growth in other sectors induces only about one-fifth of this growth in the agricultural sector (de Janvry and Sadoulet, 2008). According to the World Bank report from 2007, the projected growth of the AVC has the potential to drive connected industries and services to contribute a minimum of 30% to the total Gross Domestic Product (GDP). However, the AVC industry in Nigeria is yet to reach its full potential due to political instability, economic turbulence, etc (see Adeyeye *et al*., 2021 for review).

According to Glasner, 1997, economic turbulence is a period of dismal or negative economic growth, and if allowed to continue for a longer period would fall into recession. Other authors consider an economy turbulent if the output of goods and services fall consistently for six consecutive months (Watkins, 2000). In this economic state of decline, every sector experiences this upheaval; businesses fold while start-ups are founded; workers get laid off while recruitment happens, etc. This uncertainty begs this question: “How does economic turbulence impact the performance and survival of a business?”

According to Metcalfe, 2010, the global economy is currently suffering from multiple causes, which emerged from different sectors and countries. For example, the prevailing economic climate in Nigeria is traumatic majorly because of unstable political conditions and the high dependence of the nation on petroleum (see Alloh and Regmi, 2017 for review). Unfortunately, despite the numerous efforts made by the government and many international bodies, the nation’s economy remains obstinately defiant.

Disruptions in the Agricultural Value Chain go beyond just extreme weather events because supply and demand are fundamental aspects of this market (Ngeno *et al*., 2018). An imbalance in either of these factors can negatively impact Agricultural Value Chain Optimisation (AVCO) and precipitate food insecurity. Although there exists myriad of literatures that have assessed the relationship between AVC and economic meltdown (Yusuf *et al*., 2021), economic meltdown and agricultural mechanisation (Yohanna *et al*., 2016), AVCO and infrastructural development (Iyoboyi and Musa-Pedro, 2020), so far, limited studies are available on the connection between Agricultural Value Chain Optimisation and economic instability

1.2 Problem Statement

At the core of Nigeria's current priorities is the dedication to achieving the Sustainable Development Goals (SDGs). Thankfully, enhancing the value chain in agriculture will bolster food production systems, thereby fulfilling SDG 2 and contributing to the realisation of SDGs 1, 3, and 8 in the long term. In essence, the AVC can indeed be the pedestal for the sustainable development of the nation's economy, achievement of self-sufficiency and diversification. A thorough grasp of these relationships is therefore necessary to drive innovation, enhance the value chain, fulfil market needs, and boost competitiveness. The goal of AVCO is to improve connections between firms and foster relationships with smallholder farmers for increased market success e.g., processing and packaging where farmers can make profit, and reduce losses that arises from post-harvest and poor storage facilities.

Unfortunately, despite the huge potential in AVCO, economic upheavals in developing nations are causing ripples of setbacks in the attainment of value optimisation due to the increasing cost of processing and packaging materials. Similarly, the volatility of the current global economy has exacerbated the climate of uncertainty in Africa's agricultural sector, although turbulent times as this is not new to Africa (see Rimmer, 1966 for a review of the crisis in Ghana, Abasimel and Fufa, 2022 for Ethiopia, Munangagwa, 2009 for Zimbabwe, and Madubeko, 2010 for South Africa). However, most data on economic crisis only show the retrospective effects of economic decline on agriculture and supply chains. Many literatures highlight how macroeconomic factors such as inflation, exchange rates, and high interest rates influence the performance of agricultural businesses, yet data on value chain optimisation especially on export crops is hard to come by. Therefore, it becomes important to investigate the effect (whether positive or negative) of economic turbulence on the optimisation of smallholder farmers' processing and packaging activities along the AVC so that smallholder farmers can gain maximum profits even in the midst of a turbulent economy.

1.3 Research Questions

The impact of economic turbulence on AVC is a relevant field of inquiry. As Covid pandemic, and more recently the Ukraine-Russia crisis have shown, exogenous factors precipitate economic turbulence, which in turn slows growth in foreign economies and consequently reduces import demand for agricultural commodities. An example would be a decrease in Nigeria's agricultural export revenue impacting the country's GDP and employment in the agricultural export sector negatively (Osabohien *et al*., 2013). Similarly, according to Ifabiyi and Banjoko (2018), economic turbulence triggers credit crunch which makes it impossible for many smallholders to secure farm inputs that could enable AVCO. This brings about high occurrence of poverty in farming households, and overall, the effect of this is a slow and negative economic growth. Within this context, this study raises the following questions:

1. What is the relationship between economic turbulence and AVC optimisation?
2. What is the cost-efficiency of resources deployed along the AVC?
3. What are the institutional barriers to AVC optimisation?

1.4 Research Aims and Objectives

The overarching objective of this work is to investigate the participation of small-scale farmers in processing and packaging to optimise AVC in a turbulent economy. This would be achieved via these specific goals:

- Investigation of the impact of a turbulent economy on the value chain optimisation of cashew and sesame smallholder farmers in rural communities.
- Assessment of the impact of economic turbulence factors on the value chain optimisation.
- Investigation of the effects of resources costs along the value chain on smallholder farmers’ cashew/sesame seeds production costs.
- Identification of institutional constraints to value chain optimisation.
- Analysis of the strategies required to overcome the institutional challenges of economic turbulence.

1.5 Scope of the study

This study was confined to certain agrarian communities in three geopolitical zones of Nigeria: South-west, North-west and North-central. This selection is because these are the leading agricultural regions in the country, and they are the most affected by environmental constraints that stifle agricultural productivity.

1.6 Significance of the Study

Insights from this work would furnish us with key elements that would help attain sustainable food value chain without permanently depleting natural resources. It would also provide insights that would help restore stability and security for all stakeholders- all geared towards the economic development of Nigeria through AVCO. Furthermore, this study aims to interrogate the synergistic relationships among the main players along the AVC, and potential opportunities for collective action to improve processing efficiency. Over all, an analysis of the entire chain can help identify the obstacles and opportunities that can help policy makers, and assist relevant stakeholders in seeing the need to invest in the agricultural value chain activities.

This research would also:

1. Help in identifying the barriers faced by rural communities in harnessing befitting benefits from agricultural trade, and ways by which these barriers can be eliminated.
2. Assist in proffering solutions using AVC analysis as a tool to achieve economic stability.
3. Support and enrich the existing agricultural trade policies on ways to optimise the AVC.
4. Acquaint the primary actors in AVCs of the available strategies for improvement- this would boost economic growth in developing nations like Nigeria.

1.7 Study approach

This study focuses on small-holder farmers in Nigeria by examining theories and concepts in the context of small-holder value chain and turbulent economy. Details of the research design are provided in the Methodology chapter. This thesis examines the challenges faced by small holders in the agricultural value chain and to explore the strategies that could be employed to optimise their operations in a volatile economic environment. To comprehend how small-holder farmers optimise agricultural value chain especially at the processing and packaging stages of the chain in a turbulent economy, this study examines impact of agronomic activities, economic turbulence factors, constraints to AVCO and strategies to ameliorate the challenge of economic turbulence.

The study also investigates the cost efficiency of various resources deployed along the AVC on the production cost to ascertain whether AVC is optimised.

This study utilised a mixed-methods approach, integrating both qualitative and quantitative research components, to gain a comprehensive understanding of the agricultural value chain optimisation of agrarian populations in three geopolitical zones in Nigeria. The study was therefore carried out in two phases. Phase one involved the key informant interviews with key stakeholders in the value chain, including farmers, suppliers, wholesalers, retailers, processors, government agencies, financial institutions, and logistics providers. It also entailed the document review to gather information on the policies and programs that impact the agricultural value chain in a turbulent economy. The second phase was the surveying of smallholder farmers to gather data on the impact of economic turbulence on their production costs, income, and participation in the value chain; and analysis of secondary data from government and non-government sources to understand the trends and patterns in the value chain over time. The mixed-model approach sought to maximise the benefits of both quantitative and qualitative methods in order to identify the gaps in knowledge regarding the effect of economic turbulence on the AVCO of small-scale farmers in Nigeria.

In December 2021, a pilot study was performed with 54 small-scale farmers in Ibadan, located in south-western Nigeria, and Kano in North-western Nigeria, to evaluate the research instrument before the full study. The main survey for the study was carried out in April to June 2022 on 480 small-holder farmers located in Oyo, Kogi and Kano States in Nigeria. Also, key-informant interview was conducted for 18 stakeholders across the three locations with six participants from each geo-political zone.

Quantitative data elicited from the respondents was analysed using two-staged least square regression and multiple linear regression models to understand the present state of Nigeria's agricultural value chain, and to identify potential solutions for optimising the operations of small-holder farmers.

1.8 The structure of the thesis

The thesis is structured into eight chapters divided into four parts. Part 1 consists of four chapters: Chapter 1 gives the background and problem statement, Chapter 2 introduces the topic and develops the theoretical and conceptual frameworks, Chapter 3 provides an overview of the agricultural value chain in the empirical context, and Chapter 4 outlines the methodological approach, including hypothesis development and a step-by-step explanation of model construction. Part 2, composed of Chapters 5 and 6, concentrate on the examination of operational models. In investigating the impact of economic turbulence on the agricultural value chain optimisation of cashew and sesame smallholder farmers, we look at the stated research questions of the thesis and seek to provide answers to them. Chapter 5 addresses the research question one and three which centred on the relationships between economic turbulence and agricultural value chain optimisation. We take the situations of cashew and sesame seeds smallholder farmers in Nigeria and look at the various determinants of their value chain optimisation especially at the processing and packaging stages and the institutional constraints to smallholder farmers' optimisation of value chain. Chapter 6 evaluates cost efficiency, indicating the factors that impact the expenditure along the production value chain for optimisation. These questions become particularly relevant for smallholder farmers because they need to optimise value chain especially at the packaging and processing end of the chain.

In Part 3, Chapter 7 evaluates stakeholders' views on the effect of economic instability on optimising the agricultural value chain for cashew and sesame smallholder farmers. Additionally, the analysis of the various stages and actors in the value chain of these two commodities is carried out in the study area. Chapter 7 focuses on the qualitative analysis of stakeholders' perception, the value chain analysis of the stages and actors along the value chain of both cashew and sesame seeds. In Part 4, the conclusion is drawn in Chapter 8, which summarises the findings, highlights the contributions to theories, practical applications, and policies, acknowledges the limitations, and suggests directions for future research.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Various agricultural development programs in developing countries have been designed to address constraints being faced by smallholders in the course of optimising their agricultural value chain. This chapter aims to present a review of the extant literature regarding value chain optimisation in the contexts of economic instability. The chapter will focus on the following areas: the concept of value chain optimisation, the impact of economic turbulence on the AVC sector, the effects of economic turbulence factors on the AVC and the strategies used to overcome the challenges faced by smallholder farmers in a turbulent economy. The literature review will be based on both theoretical and empirical studies and will provide insights into the current state of knowledge on the subject. The purpose of this chapter is to establish a strong base for the thesis' research questions and goals, and to highlight the shortcomings in the current literature that will be addressed in the investigation.

2.2 The history and concept of value chain

The value chain concept was first described by Michael Porter in the 1980s as a set of activities that businesses carry out in order to create value for consumers. Ever since, the Porter value chain has been a powerful tool that has strategically assisted many businesses to disaggregate many of their activities in order to identify the activities that bring the most returns at the lowest costs (Van Rensburg, 2006). Typically, a value chain is a partnership between separate businesses that work together in a series of processes to meet the demands of a particular market, which is determined by consumers. The agricultural value chain encompasses all activities that increase the value of a product beginning from its production, all the way to the final consumer. A firm's competitiveness is reliant on the value chain of its products. Many businesses have adopted this idea over time as a way to understand the complexities of business operations, with the aim of continuously reorganizing activities to increase their competitive advantage (Van Rensburg, 2006).

Analysis in the early days placed emphasis on the local economic impact of the connections between firms in the input-output process and aimed at enhancing efficiency. Subsequent studies added the dimension of political economy to the analysis (Schmitz, 2005). A company's competitive edge stems from the value chain of its product as all organisations aim to provide the high value at the lowest cost (Porter, 1985).

An efficient value chain connects production activities to demand and supply effectively (Henri-Ukoha *et al*., 2015). The premise is for various firms to collaborate in an efficient way to offer services covering production, processing, packaging, marketing, and delivery. In agriculture, value chains are business models in which the producers establish deliberate alliances with other chain actors in order to enhance financial returns (USDA, 2014). The success of Agricultural value chain depends highly on the following: (1) Human and social capital which is the linkage between individuals and groups; (2) Quality of relationships; (3) Advanced planning and risk management; (4) Participation of each actor through the entire chain; and (5) Logistics volume (Diamond, 2014).

These linkages become powerful and easier when smallholders or individuals form alliances to reinforce their bargaining power in accessing farm inputs, support services, marketing information, etc (World Bank, 2018). The value chain idea includes: (1) Elements that undergo transformation, such as inputs, outputs, and activities; (2) Actors with vertical and horizontal ties who carry out specific tasks; (3) Value-generating activities and value distribution; (4) The end product(s); (5) End consumers; (6) Issues and possibilities affecting all involved parties; and (7) Control dynamics and decision-making processes.

A standard value chain encompasses input suppliers, producers, processors, wholesalers, and ultimate consumers (Figure 2.1). Furthermore, multiple financial services may be needed along the value chain, including short-term and long-term working capital loans, insurance, and financing for exporting.

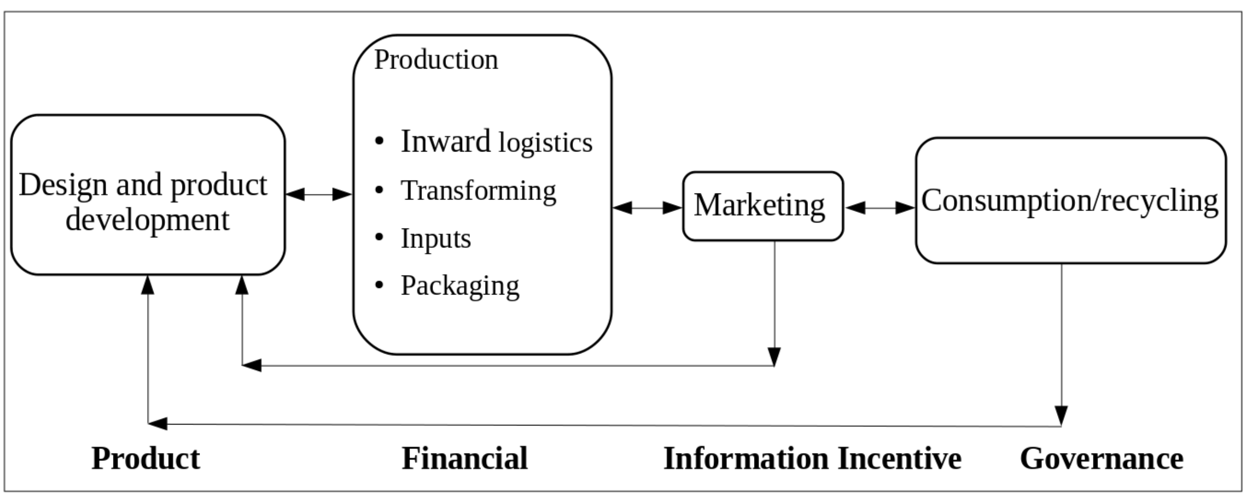

Figure 2.1: The major links of a simple value chain. (Source: Kaplinsky, 2001)

In 1985, Porter evaluated the relationship between organisations, buyers, suppliers, and competitors within the context of the market through the value chain framework. The study suggested that organisations should be divided into multiple activities in order to determine the source of their competitive advantage, which cannot be identified by simply examining the organisation as a whole. The primary activities were distinguished based on their direct impact on value creation and their indirect influence on the final value of the product. These primary activities have been grouped into the following categories:

Inbound Logistics: This entails the connection with suppliers and encompasses the tasks involved in receiving, storing, and distributing inputs.

Operations: This includes all the processes required to transform inputs into outputs.

Outbound Logistics: This covers all activities necessary for the gathering, storage, and distribution of the output.

Marketing and Sales: This involves the activities aimed at informing potential buyers about the products and services and persuading them to make a purchase.

Services: This includes all activities necessary to keep the product functioning optimally for the customer after the sale is completed.

The primary activities are connected to secondary activities that improve their effectiveness, and these secondary activities fall into four categories: Procurement (the procurement of inputs); human resource management (which includes tasks such as recruitment, training, and compensation); technological development; and infrastructure.

2.2.1 Value chain actors

These are the players in the agricultural products' production, processing, trade, and consumption (Getnet, 2009). They are composed of commercial stakeholders directly involved in the chain (producers, consumers, traders, retailers, etc.) and indirect stakeholders providing financial and non-financial services (banks, credit agencies, research institutes, extension services, etc. (KIT *et al*., 2006)). All participants in the agricultural value chain play a vital role in the journey of a product from the farm to the marketplace. The success of the value chain as a whole relies on their effective cooperation and collaboration, and these involved actors may vary based on the specific product and market. Coulibaly *et al*. (2010) noted three tiers of value chain actors:

Micro level actors: Individual actors and entities involved in the agricultural value chain, such as farmers, traders, processors, and retailers, make up the micro level of the value chain. These actors hold significant responsibilities in the creation, processing, sales, and delivery of agricultural goods, and are crucial for maintaining the efficiency and competitiveness of the agricultural value chain. According to the World Bank (2020), it is essential to comprehend the micro level of value chain actors to grasp the relationships, interactions, and dynamics between actors within the agricultural value chain. These stakeholders perform the primary functions, and there exists five groups of actors at this level.

Input suppliers: This cluster provides specific inputs such e.g., farming tools, packaging materials, processing equipment etc. Often times, they are importers who depend on the global market with several input factories. Hence, they work closely with local suppliers.

Producers: These are involved in primary production. They buy specific farm supplies, grow crops, gather the harvest, and market the output. Within the AVC, a lot of the smallholders operate the traditional farming techniques, and so, they are highly vulnerable to pest infestation and the negative effects of the changing climate. This vulnerability issues majorly from the non-cooperation between smallholders; thus, making it impossible for them to jointly impose demands (quality and price) on suppliers and traders.

Sellers: These are intermediaries between primary producers, processors and consumers. They transport, distribute and sell agricultural products. Sellers are important because they notify producers about consumers' requirements. Within the AVC, there are four categories of sellers:

The collectors: These are often natives, and so reside closely to the production site. They collect the crops from growers and package them before offering them to the wholesale distributor.

Wholesalers: They acquire and store goods from either processors or farmers, then distribute them in large quantities to either retailers or other wholesalers. These individuals have substantial financial resources and possess a dealer card. They concurrently market multiple agricultural products, purchasing from collectors and selling them to exporters at a national level. Their job entails collecting products from collectors, loading them onto trucks, and delivering them to buyers. These individuals know the quality standards, but do not enforce this.

Retailers: These buy from wholesalers and redistribute to household consumers and marketplaces. Their supply rate is comparatively higher compared to other players in the chain due to the minimal quantity involved.

Exporters: These are large organisations that operate at the national levels, and they have knowledge of the expected quality standards because they have connections to global distribution networks for export; hence, there is often a strict adherence to these standards. These players are highly organised, they decide the rules in this market, and control the purchase price. Many times, they use advances such as credits and pre-financing to compel producers into selling at low prices.

<u>Processors</u>: They convert raw agricultural goods into value-added items, like converting wheat into flour through milling or extracting oil from sesame seeds through pressing. These individuals process, grade, and package raw products for local, regional and international market. In developing economies, these actors often take charge of products marketing. Following Coulibaly *et al*., 2010, these actors can be put into three categories: (a) individual processors or processors clusters, (b) semi-industrial processors and (c) industrial processors.

<u>Consumers</u>: These are groups that use purchased goods or services for personal use. A consumer is a rational actor who prioritises maximising benefits from a product (Ruffieux, 2004). The information that a consumer has about a product strongly influences its decision. For example, there is increasing demand among consumers about products' composition, side effects, the condition of manufacturing, etc. Unfortunately, in the third world nations, consumers' expectations are not as strong as that found in developed countries and global markets. Nonetheless, the past years has recorded high consumer expectations particularly that which relates to ethics, social and environmental consciousness. Therefore, companies must consider this new consumer segment, the responsible consumer. Linnemann *et al*. (1999) categorised this group as: Hedonistic consumers; price-sensitive consumers; animal welfare-conscious consumers; environmentally aware consumers; convenience-focused consumers; research-oriented consumer; and health-conscious consumers.

<u>Meso level actors</u>: This refers to the pivotal role played by the intermediate players in the agricultural value chain, connecting small-scale farmers to larger markets and facilitating the movement of goods and services throughout the chain. World Bank (2020) reported that the meso level of value chain actors are critical for improving the competitiveness of the agricultural sector and for ensuring the sustainable production and delivery of agricultural products. The study highlights that meso level actors can play a key role in aggregating and processing small-holder farmers' products, improving their quality, and linking them to larger markets. The meso level of value chain actors can also provide important services to smallholders, such as financing, inputs, training, and technical support, helping to improve their competitiveness and increase their productivity. Moreover, meso level actors can decrease the expenses and uncertainties involved in marketing agricultural products, allowing small-scale farmers to actively participate in the agricultural value chain. These players provide services and perform support functions, and they can be put under two groups (Coulibaly *et al*., 2010):

Services providers: These are associations of producers, transporters, and providers of financial services:

Associations of producers: This cluster is not well developed within the AVC, particularly in Africa where agricultural production is deficient in collaborative effort. Therefore, for these actors, formation of cooperative associations is imperative because it allows harmonization of production techniques. Furthermore, such associations could collectively organise supply of farm inputs, cultivation, crop harvesting, management etc.; this enables farmers to benefit from economies of scale.

Transporters: These are agents that provide logistics services for agricultural products from production to consumption sites, serving both private traders and exporters.

Financial service providers: These are often represented by finance institutions and commercial banks. These actors are typically inaccessible to many AVC actors, particularly small producers and processors. Alternatively, wholesalers and exporters have a more streamlined access to financial services, which empowers them to execute their tasks and hold sway in the value chain.

Support services: This encompasses government services, academic and research organisations, and non-governmental organisations that are testing and implementing projects and initiatives within the value chain (Tandjiekpon, 2009). These actors enhance the value chain by offering organisational and technological advancements to other players. They also facilitate communication between stakeholders through platform creation. Government services, such as extension services, regulatory agencies, agriculture, and trade associations, offer information, training, certification and enforcement of products originating from the value chain.

Macro level actors: At the macro level, individuals or organisations establish the institutional and political framework in which the two actors operate. The macro level of value chain actors refers to the overarching entities that shape the structure and functioning of the agricultural value chain. These actors include governments, civil society organisations, international organisations. According to a study by the World Bank (2020), the role of macro level actors in the agricultural value chain is crucial for ensuring its competitiveness, sustainability, and inclusive growth. The study highlights that macro level actors play a critical role in setting policies, regulations, and standards that govern the agricultural value chain, and in providing financing, inputs, training, and technical support to small-holder farmers and other value chain actors. Moreover, macro level actors play a key role in promoting market integration and connecting small-holder farmers to larger markets, thereby increasing their competitiveness, and improving their livelihoods. They also play a critical role in addressing the challenges and constraints that small-holder farmers face along the agricultural value chain, such as limited access to financing and inputs, poor infrastructure, and limited capacity.

The macro level of value chain actors is critical for ensuring the competitiveness, sustainability, and inclusive growth of the agricultural value chain. To support the development and strengthening of the value chain, it is important for macro level actors to engage in policies, programs, and initiatives that support smallholder farmers and the agricultural sector, and to promote market integration, access to financing and inputs, and capacity building.

Table 2.1: Summary of the Meso and Macro-level actors

Levels	Micro-level actors	Meso-level actors	Macro-level actors
Actors	Input suppliers	Service providers	Government
	Farmers	Association of producers	Donors
	Processors	Transporters	Multilateral organizations
	Wholesalers	Financial service providers	Private sectors
	Retailers	Support services	Consumer groups
		Trade associations	
Interactions	Production	Aggregation	Policy
	Processing	Distribution	Regulations
	Distribution	Trade	
Goals	Profit	Profit	Economic growth
	Quality	Efficiency	Food security
		Quality	Sustainable development
		Customer satisfaction	Social welfare

2.3 Approaches to value chain

Cross-disciplinary perspectives have been developed over time to expand the theoretical perspectives of AVC in developing countries. In 2016, Gereffi and Fernandez-Stark discussed the concept of value chain as the complete set of processes involved in taking a product from idea to final use and beyond. In essence, the value chain connects producers, traders, and service providers to enhance efficiency and increase the value of their endeavours (Mauki *et al*., 2014). According to Gwary *et al.* (2014), the value chain is interconnectedness between diversified businesses in bringing products from production to consumption points through known channels.

Buyers value products and services and would offer an appropriate price that matches the value and satisfaction they derive from the product's characteristics. Some of these characteristics include taste, freshness, colour, firmness, smell, size, skin colour, nutritional value, hygiene of production site, etc). All these are product attributes; other product characteristics include the packaging, labelling, ethics and sustainability of production, etc. Value chain analysis (VCA) determines the origin and process of creating attributes; for example, the taste of an agricultural produce is influenced by genetics, growing condition, etc, while freshness is determined by all the actors.

2.3.1 Global Value Chain Approach

This approach examines the various economic factors and constraints involved in a specific product. This approach merges two analytical methods, a management approach that identifies individual firm constraints and a power analysis to uncover the governance structures within these firms. By combining these two aspects, it provides a foundation for developing upgrading strategies that can enhance the value chain. However, the GVC approach has limitations, including a lack of insight into the diverse outcomes for different producers and its limited examination of relevant institutions. This research overcomes these limitations through the integration of literature on institutions, transaction costs, and social capital. Additionally, it considers the impact of upgrading at different levels and among different groups of stakeholders.

Hopkins and Wallerstein, pioneers of the Global Value Chain (GVC), characterised it as a series of processes leading to the creation of the final product. This effort was driven in part by the recognition that many products undergo multiple stages of processing across various countries before reaching consumers. Industrial goods typically involve a mixture of raw materials and inputs. GVC evaluates the value that each resource contributes to the end product. In value chain analysis, there are different ways to add value; (i) Enhancing the customer service components of the product offering. This is especially relevant to products with brief life span and where on-time delivery is important. Here, value is added through delivery reliability, speedy delivery, and creation of new products. In other words, adding value is not limited to the physical modification of products, because large multinational buyers do not purchase only for immediate requirements. Rather, they buy products that are bundled with value-adding services.

2.3.2 The Agricultural value chain analysis approach

There is no set definition of "Agricultural value chain," but it is typically described as the series of activities involved in bringing an agricultural product or service from production to delivery. Some view it as a network of activities that enhance the value of an agricultural product and connect farmers to processors and markets. This viewpoint is shared by the World Bank, Norton (2014), Ajmal *et al* (2013), and Gereffi and Fernandez-Stark (2011). Agricultural value chain analysis focuses on input-output structures, technology, regulations, processes, and dynamics in relationships between industry and location-specific actors, providing a comprehensive evaluation through top-down and bottom-up approaches. In addition, it encompasses the flow of goods, finance, payment, information, and social capital required for organizing producers and communities (Nedelcovych and Shiferaw, 2012). Therefore, the approaches and tools used for analysing the functioning of AVC are relevant for a good understanding of the impact of chain development mediations on small holders and the rural communities. This approach also helps align agricultural development with a systems-based approach (Rich *et al*., 2008). AVC is utilised in development projects aimed at engaging smallholders, either as individuals or in groups for the production of oriented high-value products. Due to the interdependence of these activities, a good understanding of the chain, the market, and the different players is important to make financial and investment decisions. In value chain financing, an assured and profitable market is required for all the actors. An assured market lowers financial risk; and eases accessibility to credit facilities.

Holistically, the AVC is a complex-process that starts with natural resources (e.g., land and water). These resources are then consciously coordinated into croplands and livestock to yield varieties of agricultural produce. With the introduction of additives and preservatives, these agricultural products are processed and packaged for different markets. AVC can be examined and studied through value chain analysis (VCA) that employs both qualitative and quantitative methods. Even though there is no rule dictating the theoretical approach to abide with, there is nevertheless a strong ground for recommendation; this study would employ a qualitative approach first, afterwards, a quantitative study would be conducted. VCA assesses of the factors and actors that impacts the performance of a business. It also studies the relationship between the actors, identifies the constraints causing inefficiency, and lack of productivity, then it investigates how the limitations can be defeated.

2.3.3 Overview of the agricultural value chain

The Agricultural value chain refers to the steps involved in the creation and delivery of an agricultural product from the farm to the marketplace. This concept is crucial in understanding the various parties involved in the production and distribution of agricultural products and in recognizing the potential for value enhancement and expansion throughout the chain. According to Alberta (2018), the aim of the agricultural value chain is to enhance competitiveness through collaboration among value chain actors and supportive groups such as research teams, transportation providers, credit providers, and input suppliers. Olomu *et al*. (2020) stated that the AVC concept focuses on dividing the overall agricultural system into stages with the goal of optimising the entire system.

According to Eboh and Lemchi (2010), the fundamental layer of the agricultural value chain model passes through commodity-specific, market-oriented interfaces that enhance post-harvest handling, preservation, agro-processing, and the business environment with improved infrastructure and regulatory modifications. Furthermore, Olomu *et al*. (2020) assert that prioritising investment in agriculture is crucial for creating a secure economic environment for agricultural producers and all other stakeholders involved in the industry. New Partnership for Africa's Development (NEPAD) 2014 further specified that the value chain's legal framework for interactions, financial policies, price stability, trade inputs, and standards are included.

The Food and Agriculture Organisation (FAO, 2019) conducted a study that emphasised the significance of the AVC in enhancing the agricultural sector's competitiveness and guaranteeing sustainable production and delivery of agricultural goods. The study highlights that the AVC provides a means of linking small-holder farmers to larger markets, allowing them to participate in the production and distribution of high-quality agricultural products, and to improve their livelihoods. Moreover, the AVC provides opportunities for the integration of small-holder farmers into the larger agricultural system, enabling them to access financing, inputs, training, and technical support. This helps to improve their competitiveness, increase their productivity, and enhance the quality of their products. Also, AVC helps to identify opportunities for value creation and growth within the chain. However, the agricultural value chain faces various obstacles that obstruct its growth and optimisation. Some of these challenges include:

Infrastructure inadequacy: The insufficient infrastructure in certain regions has been identified as a significant obstacle to farmers and businesses' effectiveness and efficiency (Adegbite and Adegbite, 2020). The absence of well-maintained roads, inadequate storage facilities, and limited access to basic necessities such as electricity and water all contribute to the problem (Akinbola, Adewuyi, and Akinwale, 2021). These challenges make it difficult for players in the industry to cultivate, store, and transport their agricultural produce in a manner that optimizes output and profitability (Omotesho *et al*., 2018).

Limited access to credit: Despite the crucial role of agriculture in Nigeria's economy, farmers and agribusinesses face difficulties in accessing affordable credit, which hinders their ability to modernize their operations through investments in new technologies (Adesina, 2017). This limited access to credit has far-reaching consequences, as it curtails the growth potential of these key economic actors, leaving them unable to fully contribute to the nation's development (Adegbite and Adedokun, 2020). The consequences of this challenge are not limited to farmers and agribusinesses, as it has broader implications for food security, economic growth, and poverty reduction in the country (Chete and Adeoti, 2019).

Inadequate extension services: The benefits of extension services are many, however, smallholder farmers often lack access to them. According to a report by the Food and Agriculture Organization of the United Nations (FAO), only 15 percent of smallholder farmers in sub-Saharan Africa have access to extension services, while the figure drops to 10 percent in some countries (FAO, 2019). This lack of access to extension services is a major constraint for smallholder farmers, who often struggle to keep up with the latest farming practices and technologies. Research has shown that extension services play a vital role in improving the productivity and profitability of smallholder farmers. For example, a study by the International Food Policy Research Institute (IFPRI) found that farmers who received extension services in Ghana had significantly higher yields and profits than those who did not (IFPRI, 2018). Without access to extension services, smallholder farmers may miss out on opportunities to improve their farming practices and increase their yields. This not only puts a strain on their livelihoods and productivity but also has broader implications for the agricultural sector and the communities it supports. As noted by the World Bank, "extension services are critical for ensuring that smallholder farmers are able to access the latest knowledge, technologies, and markets, and for building the resilience of agricultural systems in the face of climate change and other challenges" (World Bank, 2020).

Lack of processing facilities: One of the major challenges facing Nigeria's agricultural sector is the scarcity of processing facilities, which results in a significant proportion of agricultural products being exported in their raw form (AfDB, 2019). This lack of processing capabilities is detrimental to both farmers and the country as a whole, as it significantly reduces the value of these products, leading to lower returns for farmers and a lower contribution to the national economy (Olagunju and Adepoju, 2018). Processing facilities play a crucial role in adding value to raw agricultural products, transforming them into finished goods that can fetch higher prices and contribute more to the economy. By investing in processing facilities, Nigeria could reap numerous benefits, including increased returns for farmers, improved food security, and a stronger agricultural sector that contributes more to the nation's overall economic growth (World Bank, 2021). However, without adequate investment in processing capabilities, Nigeria risks losing out on the potential benefits of its rich agricultural resources.

Poor quality control: The Nigerian agricultural value chain is plagued by a lack of adequate quality control measures, which can have serious implications for the sector's competitiveness and success (Adeoye and Olowu, 2018). Poor quality control can result in agricultural products of subpar quality, which can limit market access and decrease their value (FAO, 2018). This not only affects the farmers and agribusinesses that rely on the sector for their livelihoods, but also has broader implications for the national economy and food security. Quality control plays a crucial role in ensuring that agricultural products meet the standards demanded by both local and international markets, thereby increasing their competitiveness and value. With strong quality control measures in place, farmers and agribusinesses can be assured of market access and increased returns, while the country benefits from a more robust agricultural sector that contributes more to economic growth and food security (World Bank, 2017). However, without adequate investment in quality control, the Nigerian agricultural sector risks falling behind its peers and losing out on valuable opportunities for growth and development.

Inadequate transportation: The inability of farmers and agribusinesses to effectively transport their products to markets is significantly impacted by the combination of various factors including poor road conditions, limited availability of transportation options, and a persistent lack of dependable logistics services (International Transport Forum, 2019). These challenges result in a hindrance to the smooth transportation of goods and services and ultimately hinder their ability to reach target markets in a timely and efficient manner.

Climate change and natural disasters: The agricultural value chain in Nigeria is constantly facing numerous hurdles and obstacles, among which climate change and natural disasters play a major role (USAID, 2019). These environmental factors, including droughts and floods, pose significant threats to the agricultural sector and can severely impact crop yields, resulting in decreased productivity and reduced output (Adejuwon and Osiname, 2018). Furthermore, they also contribute to a rise in production costs, putting additional strain on farmers and agribusinesses. This further exacerbates the already challenging situation and highlights the need for a robust strategy to reduce the effects of climate change and natural disasters on agriculture in Nigeria.

The challenges faced by the agricultural value chain (AVC) have been well documented in numerous studies. For example, according to a report by the World Bank (2016), issues such as inadequate infrastructure, limited access to finance, and low productivity levels among smallholder farmers have all contributed to the under-performance of the agricultural sector in many developing countries. Similarly, a study by KPMG (2017) found that the lack of technological innovation and poor implementation of best practices are also major impediments to the optimization of the AVC. The study highlights the need for increased investment in research and development, as well as the adoption of innovative solutions to address these challenges. Moreover, the negative impact of these challenges on the overall economic development of countries has also been extensively studied. For instance, a study by the International Food Policy Research Institute (IFPRI) (2017) found that the agricultural sector is a key driver of economic growth and poverty reduction in many developing countries. However, the limitations posed by the challenges within the AVC have hampered the sector's ability to fully realize its potential. Therefore, it is imperative that stakeholders in the agricultural sector work collaboratively to address these challenges and implement effective solutions. As highlighted by a report by the African Development Bank (2019), investments in infrastructure, adoption of new technologies, and implementation of best practices are some of the key strategies that can be used to mitigate the negative effects of these challenges and drive sustainable growth and development in the industry.

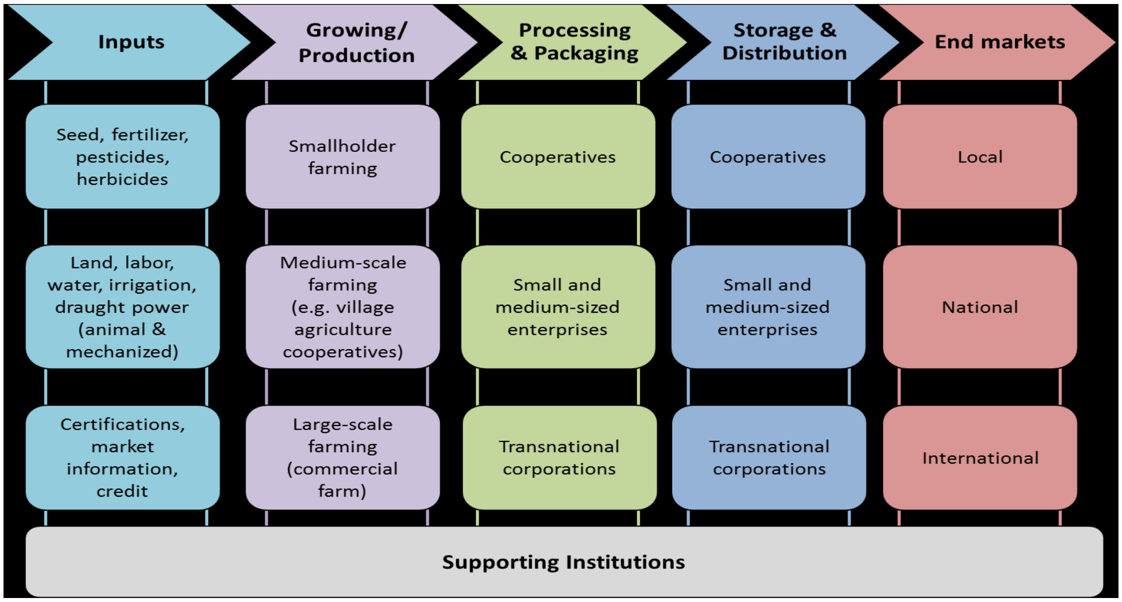

Figure 2.2: A typical agricultural value chain. (Source: Adapted from Abdulsamad *et al*., 2013)

Figure 2.2 shows a typical AVC, highlighting the relevant actors and stages, and these stages are classified as follows:

Pre-production phase: This is also referred to as the input phase, and it consists of the requirements for production. These requirements include land, labour, stock, farming equipment and water, etc., but largely depend on the product in question. Stock may either be indigenous or foreign. Other agricultural inputs include fertilizers, pesticides, and herbicides, irrigation, etc. Some services in this phase consist of veterinary services, market information, credit facilities, etc.

Production phase: This is the cultivation phase in the value chain, and its majority of the materials and services identified in the preceding phase. The actors found in this phase include smallholders, medium-scale and large-scale farmers, etc. The main characteristic of this phase is the scale of operation (Gómez-Limón *et al*., 2018). An example, a smallholder may produce by coordinating with large commercial farms. Also, the large commercial farmers may contract certain products/processes to smallholders in the bid to manage demand, and produce specialised products (Kumar and Nawi, 2019)

Post-production phase: This phase includes the processing, packaging, storage, distribution, and sale of agricultural products: for example:

Processing and packaging: The major actors are local cooperatives, small-medium scaled businesses enterprises, and large foreign corporations. This phase is heavily influenced by product and quality demand from global brands and retailers.

Storage and distribution: Typically, smallholder farmers rely on this stage, which serves as a crucial link between production and post-production phases. The key players in this phase include local cooperatives, small to medium-sized enterprises, and global corporations. To ensure the quality of the products and minimize spoilage, this phase employs specialized capital equipment and necessitates specialized training.

End market: The actors in this phase are served by wholesalers, global brands and retail buyers. In developing countries, buyers tend to be served with substandard products, while developed markets have strict specifications that must be adhered to.

2.3.4 Resources used along the agricultural value chain

Different approaches have been taken by economists to study resources, which are viewed from various perspectives. Muller-Christ (2011) differentiates various definitions of 'resources' through the lens of production theory, competition theory, and systems theory. The first approach examines resources in terms of the input-transformation-output process, the second approach looks at resources through the resource-based view, and the third approach regards resources as part of a means-end continuum. According to the first definition by Muller-Christ (2011), resources are the input elements used in production. The second definition emphasises that resources are key for the achievement of economic success. The third views resources as the means needed to sustain systems. Barney, (1991) classifies resources into two categories as given below:

1. **Tangible Resources:** Tangible resources (TR) are resources that are physical and quantifiable, and that are used in the production of merchandise or delivery of services within an organisation. Physical and material resources are essential in the creation, handling, movement, and marketing of agricultural products within the AVC. They include property, inventory, equipment, securities (e.g., cash, bond, stock, etc.) (Barney, 1997; Jawed and Siddiqui, 2019). Financial investments like bonds, capital, equity positions, and stocks can also be used to measure them. The physical forms of tangible resources vary depending on the stage of the AVC. Fixed assets like land, machinery, equipment is needed across all the stages of AVC while consumable inputs differ from stages to stages. For instance, inputs required in the production

stages are fertilizers, agrochemicals, seeds etc., while the post-production stage requires marketing, processing, and packaging etc. Examples of tangible resources utilised in the agricultural value chain include:

Land: This is a crucial factor in the functioning of the AVC as it provides the necessary resource for the production of crops and raising of livestock (FAO, 2021). The availability of arable land is critical for farmers to meet the demands of a growing global population by cultivating and growing food and other agricultural products (Pretty *et al*., 2018). However, sustainable land management practices are necessary to ensure the preservation of natural resources and the availability of arable land for future generations (FAO, 2018).

Water: Water is an essential resource for agriculture as it is essential for both irrigation and livestock consumption (Smith and Davenport, 2019). Irrigation is a process that involves providing water to crops artificially, which enhances their growth and productivity, particularly in areas with limited rainfall (FAO, 2018). Livestock also require water for hydration and sustenance as it is an essential component of their diet (Brannan and Drouillard, 2020). The availability and management of fresh water resources are crucial for the success and sustainability of the agricultural sector (Rosenzweig *et al.,* 2019).

Seeds and seedlings: These are two essential components in the AVC. These basic inputs play a crucial role in crop production as they provide the foundation for the growth and development of crops (FAO, 2017). The quality of the seeds and seedlings used in agriculture directly affects the yield and productivity of crops, and therefore the overall success of the value chain. It is important to ensure that high-quality seeds and seedlings are sourced and used, as this will help to enhance the efficiency and sustainability of agriculture and promote food security (IFAD, 2020).

Fertilizers and pesticides: These products play a vital role in enhancing soil fertility and protecting crops from pests and diseases, which are two primary challenges facing the agricultural sector (Grewal and Grewal, 2019). By improving soil fertility, fertilizers provide crops with the necessary nutrients for healthy growth and development, leading to increased yields and productivity (Tisdale, Nelson, and Beaton, 2019). Pesticides, on the other hand, protect crops from harmful pests and diseases, which can reduce yields and lead to crop loss (Pimentel and Lehman, 2014). The responsible and effective use of fertilizers and pesticides is crucial for the success and sustainability of the agricultural value chain (FAO, 2018).

Machinery and equipment: The use of various resources, including machinery such as tractors, ploughs, harvesters, and others, plays a significant role in improving the efficiency and productivity of the agricultural value chain (Grainger and Oglethorpe, 2016). These resources are critical in carrying out activities such as planting, harvesting, and processing, which are essential for the successful production of crops. However, it is crucial to maintain and manage the machinery and equipment properly to ensure their effectiveness and readiness for use when required (Grainger and Oglethorpe, 2016). Effective utilisation of these resources is necessary for the success and sustainability of the agricultural value chain (Grainger and Oglethorpe, 2016).

Storage and transportation facilities: These are two critical components in this process (Johnson, 2018). These facilities play an important role in preserving the quality and freshness of agricultural products, and in facilitating the movement of goods from the farm to the market (Gallagher *et al.,* 2016). Proper storage and transportation facilities are necessary for maintaining the quality and value of crops and livestock, and for ensuring that these products reach consumers in a timely and efficient manner (Singh *et al.*, 2020). In addition, the availability of storage and transportation facilities helps to reduce waste and spoilage, which can result in economic losses for farmers and others in the agricultural value chain (World Bank, 2019). Effective utilisation of storage and transportation facilities is essential for the success and sustainability of the agricultural value chain, as well as for ensuring food security and meeting the needs of consumers (Rahman *et al.,* 2021).

labour: The importance of labour in the agricultural value chain has been widely acknowledged (Berdegué & Bebbington, 2019; Reardon, 2018). Skilled and unskilled labours are both crucial for the successful operation of the value chain, and their contributions are essential for the sustainability of the sector (FAO, 2019). Skilled labour provides expertise and guidance in areas such as crop and livestock management, while unskilled labour is necessary for a variety of tasks such as planting, harvesting, and processing crops (World Bank, 2017). Efficient utilisation of labour is necessary to enhance productivity and efficiency in the agricultural sector, and it helps ensure that agricultural products are produced in a timely and cost-effective manner (Jayne *et al.*, 2014).

Energy: Energy is an essential component of the AVC as it is required for several activities. For instance, energy is necessary for pumping water for irrigation, operating machinery, and powering other essential tools and equipment (FAO, 2021). Energy plays a critical role in increasing efficiency and productivity in the agricultural sector while ensuring crops are produced in a timely and cost-effective manner. Additionally, energy is also required for processing agricultural products, such as drying and milling grains, and preserving and storing crops and livestock (UNIDO, 2019). The effective utilisation of energy is critical for the sustainability of the agricultural value chain, food security, and meeting the needs of consumers. Careful management and conservation of energy resources are necessary to ensure their continued availability and minimise the environmental impact of the agricultural sector

The utilisation of tangible resources is crucial for the success and sustainability of the AVC (Avcı and Güngörmüş, 2018). These resources are essential for enabling farmers and agribusinesses to carry out their activities efficiently and effectively, from production and processing, to transportation and sales. By providing the necessary inputs and support, tangible resources help to ensure that agricultural products are produced in a timely and cost-effective manner and that they are of high quality and meet the needs of consumers (Martins *et al.*, 2020). Thus, the effective management and utilisation of tangible resources is critical for the success and sustainability of the agricultural value chain.

2. **Intangible Resources:** Intangible resources (IR) are assets that are not measurable, and cannot be physically touched, and according to Kamasak (2017), this resource type is difficult to acquire, and cannot be easily imitated. Intangible resources (IR), as viewed by Bontis (1998) are intellectual capital that is gained through the acquisition, organisation, and sharing of information, which can be used to acquire new skills. This current work proposes two indicators of IR; entrepreneurship orientation and market orientation. These resources include:

Intellectual property: Intangible resources play a crucial role in the agricultural value chain, and intellectual property is one of the most important components in this process. Intellectual property, such as patents, trademarks, and copyrights, helps to protect the unique and valuable aspects of agricultural products and processes (Fernández-Molina & Malo-García, 2019). This includes seed varieties, food recipes, and other innovations that are critical to the success and sustainability of the agricultural sector. By providing legal protection, intellectual property helps to ensure that the innovations and advancements of farmers and agribusinesses are recognized and rewarded, and that they are able to continue to invest in research and development (Fernández-Molina & Malo-García, 2019). It also helps to prevent unauthorized use and replication of these innovations, which can harm the competitiveness and viability of the agricultural sector (Fernández-Molina & Malo-García, 2019). The effective management and protection of intellectual property is crucial for the success and sustainability of the agricultural value chain, and for ensuring that the industry remains vibrant and innovative (World Intellectual Property Organization, 2021).

Knowledge and expertise: The success of the agricultural sector relies heavily on the collective knowledge and expertise of farmers, agribusinesses, and other stakeholders involved in the value chain (Chen and Sharma, 2018). This includes technical knowledge and expertise, such as agronomic practices, animal husbandry, and processing techniques, which are essential to producing and processing high-quality agricultural products (Moyo *et al.*, 2019). These skills and knowledge help farmers and agribusinesses to optimize their operations, increase their efficiency and productivity, and respond effectively to changing market demands and conditions (Fernandes *et al.*, 2021). They also play a crucial role in advancing the agricultural sector, by enabling farmers and agribusinesses to adopt new technologies, implement best practices, and develop innovative products and processes (Levitt *et al.*, 2020). The effective acquisition, sharing, and application of knowledge and expertise are critical for the success and sustainability of the agricultural value chain, and for ensuring that the industry remains competitive and dynamic.

Brand reputation: A reputable brand, established through the consistent delivery of high-quality products and exceptional customer service, plays a significant role in building trust and loyalty among consumers, thereby boosting sales and driving success within the agricultural value chain.

Relationships: Maintaining robust relationships with suppliers, customers, as well as various stakeholders like government bodies, non-profit organizations, etc., is crucial for the smooth functioning and overall success of the agricultural value chain (Liu & Zhan, 2020). These relationships can help to ensure a steady supply of inputs, a reliable market for outputs, and access to resources, knowledge, and support that can help to enhance the efficiency and effectiveness of the value chain (Makinde, Oni, and Olukunle, 2020).

Network and connections: A comprehensive and well-established network within the industry can bring numerous benefits to the agricultural value chain (Smith, 2018). These benefits include access to new markets, customers, and suppliers, as well as valuable information and support that can contribute to the success of the agricultural value chain (Jones, 2020). Having a strong network and connections can help to drive growth and profitability, and provide a competitive advantage over others in the industry (Brown, 2019).

Culture and values: A well-defined corporate culture and values emphasising sustainability, ethical practices, and commitment to quality can play a critical role in enhancing the reputation, competitiveness, and long-term success of the agricultural value chain (Mills & Wong, 2021). These cultural and value-based principles serve as a guide for decision making and provide a foundation for building strong relationships with suppliers, customers, and other stakeholders, which are essential for the success of the value chain (Mills & Wong, 2021).

Despite their intangible nature, these resources are no less important in determining the success of the agricultural value chain (Smith, 2018). In fact, they can offer a significant competitive advantage and help to build and maintain a positive reputation for the industry as a whole (Jones & Brown, 2020). Unlike tangible resources, which can often be easily measured and quantified, intangible resources such as brand reputation, knowledge and expertise, and culture and values are often more difficult to quantify (Doe, 2019). However, they can have a lasting impact on the success and sustainability of the agricultural value chain (Smith, 2018).

Table 2.2: Division of resources along the agricultural value chain stages. (Source: Adapted from Rajchelt-Zublewicz *et al*., 2019)

Resource Type	Groups of internal factors	Example	Stages of the AVC deployed
Intangible	Human	Labour • Formal education • Professional experience • Hard and soft skills Social skills • Commitment to work • Human skills • Management skills • Leadership skills etc	Along the entire value chain
	Relational	Relationships with: • Local/central authorities • Opinion makers • Clients • Local community • Foreign cooperation etc	Along the entire value chain
	Knowledge	• Ease of accessing informal information • Databases • Technical knowledge • Duration of product development cycle. • Tacit knowledge	Along the entire value chain

Tangible	Physical	• Fixed assets • Technical facilities • Agricultural consumables • Equipment for processing and packaging	Resources are stages specific
	Technological	• Technological solutions • Communication channels • Security systems • Knowledge database • Software	Along the entire value chain
	Financial	• Financial reserves • Equity capital • Liabilities	Along the entire value chain

2.3.5 Cost efficiency of resources deployed along the agricultural value chain

The cost efficiency of resources deployed by small-holder farmers along the AVC in Nigeria is a critical issue that affects the competitiveness of the farmers and the overall agricultural sector. A study by the International Fund for Agricultural Development (IFAD, 2018) found that small-holder farmers in Nigeria encounter numerous difficulties in effectively and efficiently utilising resources along the AVC. The study also found that they encounter limitations in accessing finance and inputs, leading to inefficiencies in their operations and reduced competitiveness. Furthermore, the lack of infrastructure and transportation facilities in rural areas can lead to higher costs and longer transit times for farmers, reducing the efficiency of their operations and increasing the costs of their products.

The rising costs of agricultural resources (farm inputs) have become a major challenge for smallholder farmers in Nigeria, affecting the AVC in several ways. The International Food Policy Research Institute (IFPRI, 2019) reported that the prices of crucial inputs, including seeds, fertilizer, and pesticides, have significantly risen in recent times, putting stress on farmers' profitability and competitiveness. The high costs of farm inputs reduce the farmers' margins, making it difficult for them to invest in their operations and improve the quality of their products. This can lead to a decline in productivity and competitiveness, reducing the farmers' ability to participate effectively in the AVC. The IFPRI report also highlights that the rising costs of inputs are affecting farmers' access to credit, as they are unable to secure loans to cover their production costs (IFPRI, 2019).

Additionally, small-holder farmers often face limitations in their capacity to manage and use inputs effectively, leading to inefficiencies in their operations and reduced competitiveness. This includes a lack of access to information, training, and technical support, as well as limited access to market information, which affects their ability to make informed decisions and optimise their operations (IFAD, 2018). Moreover, the high costs of farm inputs can lead to a decline in the quality of agricultural products, affecting their competitiveness in local and international markets. This can result in lower prices for farmers and reduced consumer demand, further reducing their ability to participate effectively in the AVC.

There are several factors that contribute to the rise in the price of farm inputs in Nigeria. These include:

1. Exchange rate fluctuations: The devaluation of the Nigerian Naira against the US dollar has led to an increase in the cost of imported farm inputs, such as fertilizers and seeds (Central Bank of Nigeria, 2020).
2. Transportation costs: The deterioration of infrastructure, particularly roads, has resulted in a hike in transportation expenses, thereby elevating the total cost of agricultural inputs (Central Bank of Nigeria, 2020).
3. Fuel price increases: The increase in fuel prices has led to higher costs for the production and distribution of farm inputs (Central Bank of Nigeria, 2020).
4. Lack of government subsidies: The Nigerian government has not provided enough subsidies to farmers to offset the high cost of inputs, which has further contributed to the increase in prices (Central Bank of Nigeria, 2020).
5. Limited domestic production: Nigeria relies heavily on imports for farm inputs, and limited domestic production leads to higher prices (Central Bank of Nigeria, 2020).

These factors have combined to cause a significant increase in the price of farm inputs in Nigeria, making it more difficult for farmers to access the resources they need to produce crops and livestock. To address this challenge, there is a need for government and industry intervention, such as the provision of financing, inputs, infrastructure, and capacity-building support, to help small-holder farmers optimise their operations and improve their competitiveness. Also, there is a need for government and industry intervention, such as the implementation of policies to improve the supply and distribution of inputs, and support for farmer-led initiatives to increase productivity and competitiveness.

2.4 Optimising Agricultural value chain

Optimising the agricultural value chain in Nigeria involves making improvements throughout the entire supply chain, from the production of crops and livestock to their distribution and sale. This requires implementing various strategies to improve efficiency and profitability, including reducing waste and utilising cutting-edge technology. Enhancing the infrastructure in the agricultural sector, such as modernising transportation and storage facilities, can also have a positive impact on the value chain. Providing smallholder farmers with access to financial resources, training, and market information can empower them to grow their businesses and contribute to the overall economic growth of the agricultural sector. This involves acquiring technical know-hows, and establishing market connections that allow businesses to be more competitive, and advance into higher-value activities (Kaplinksy and Morris 2001).

An increasing emphasis on optimising the AVC is being placed on adopting an agricultural systems approach that considers supply and demand for food sustainably. To enhance the optimisation of the AVC, interventions should take into account the entire process of food production, including processing, distribution, marketing, and delivery to consumers (Hawkes *et al.*, 2012). To optimise from the demand perspective, it is essential to understand the factors that drive consumer demand and how they do so, so that appropriate measures can be taken (World Bank, 2014).

To optimise the AVC, consideration must be given to all aspects of food production, processing, distribution, marketing, and delivery to consumers, as well as examining the entire series of actions within the value chain for a particular product (Kaplinsky and Morris, 2001). By analysing every step of this process with an optimisation mindset, specific entry and leverage points can be identified. Similarly, relevant policies and programmes can be initiated to mould the value chain (Dorward, 2009). Having multiple value chains in place can also aid in creating a more efficient and optimised agricultural system by making sure that a variety of high-quality products are available and affordable throughout the year (Reardon *et al.*, 2009).

Optimisation of the AVC through demand and/or supply interventions can also transform the agricultural system. This will result in more efficient supply chains. It will include traditional systems such as farmers selling to traders and markets, as well as modern systems where manufacturers source from farmers and sell to supermarkets. In addition, it may involve a blend of the two, where large corporations sell through traditional traders and supermarkets, or supermarkets source from smallholder farmers.

It is essential to note that each product has its own specific supply chain. Hence, it is vital to understand each product, the intermediaries, and the relevant stakeholders within its supply chain in order to effectively optimise and capitalize on each step of the process. Similarly, a specific value chain serves a specific market, which can be local, domestic or international which are consumer-driven. In practice, a fresh tomato supply chain can be transformed into a supply chain for tomato paste, both of which must be analysed individually. However, good considerations must be given to the impacts that these changes have on the actions and income of tomato producers and the markets within which they operate.

For example, because of its perishable nature, tomatoes have a shorter shelf-life in local markets, while tomato paste stand lasts longer, and may be sold at a higher price in international markets. Studies have shown that understanding the dynamics of supply chain growth and successful outcomes requires considering context-specific factors (Gereffi and Lee, 2016). For instance, the shea nut supply chain analysis revealed that intermediaries have effectively adapted to changes brought about by the end of government control, market liberalization, and political upheavals, and have prevented processors and NGOs from sourcing shea nuts directly from growers (Bacon *et al*., 2012). However, small-scale farmers may be excluded from high-value markets due to their inability to cope with market risks (Dorward *et al*., 2004). Therefore, the focus on the changes in product value throughout the process distinguishes a value chain analysis from a supply chain analysis (Gereffi and Lee, 2016).

Optimising the agricultural value chain can lead to increased efficiency, cost reduction, and improvement in the quality and competitiveness of agricultural goods (Kaplinsky, 2008). Some methods for optimising the agricultural value chain include:

<u>Improving productivity</u>**:** This can be achieved through the incorporation of innovative technologies, enhancement of farming practices, and offering training and assistance to farmers to improve their skills and knowledge.

<u>Strengthening linkages between actors</u>**:** This objective can be accomplished by fostering better communication and cooperation between the various stakeholders such as farmers, processors, and others involved in the agricultural value chain, so as to maximise efficiency and profitability for all parties involved.

<u>Maximising value augmentation:</u> According to Vagneron *et al.* (2009), optimising the agricultural value chain by converting raw agricultural goods into value-added products, such as milling wheat

into flour or extracting oil from sesame seeds through pressing, can result in an increase in the overall value of the product while reducing post-harvest losses. This method not only enhances the quality of the final product, but it also helps to maximise the profitability of the agricultural value chain.

Improving market access**:** One way to enhance the efficiency and effectiveness of the agricultural value chain is by improving market access (Adegbola and Ayinde, 2020). This can be accomplished through the establishment of robust marketing and distribution networks that facilitate the efficient distribution of agricultural products both in the local and international markets (Adegbola and Ayinde, 2020). Additionally, it involves increasing the visibility of these products by utilising various marketing strategies that make them more noticeable to potential buyers (Govindasamy *et al*., 2002). By doing so, farmers are able to reach a larger customer base, which can result in higher sales and greater profitability (Govindasamy *et al*., 2002).

Enhancing financial availability**:** Ensuring financial availability for all participants, particularly farmers, is crucial. This involves offering a wide range of financial support and services to farmers and other crucial players in the supply chain, such as loans, insurance, and training programs focused on financial management (Lerman, 2020). Through these efforts, we can support farmers and other participants in obtaining the necessary resources and understanding to optimise their operations, leading to the overall growth and progress of the agriculture industry.

Adopting Sustainable Methods**:** Improving the agriculture supply chain can be advanced through the implementation of sustainable methods throughout the chain (Kumar *et al*., 2020). This can be accomplished by promoting eco-friendly and socially responsible agriculture practices, such as reducing waste, preserving resources, and advocating for fair labour practices (Stevens *et al*., 2018). These steps ensure that the agriculture industry operates in a manner that is both economically feasible and environmentally sustainable (Gao *et al*., 2021). The methods required for optimizing the agriculture value chain will vary based on the specific circumstances and the needs of the different participants, including farmers, processors, and suppliers (Shaw *et al*., 2019).

The value chain approach is a key element in development discourse as it prioritizes market-led approaches to development and optimisation (Kaplinsky, 2000). Governments and development partners are particularly interested in this approach because it emphasizes the creation of greater economic value for value chain players, which is not as thoroughly addressed in a simple supply chain analysis (Gereffi and Frederick, 2010). From a perspective geared towards economic development and poverty reduction, the value chain approach offers a comprehensive framework for evaluating all elements of the chain (Kaplinsky, 2000).

The approach focuses on the interactions between value chain actors, and how such relationships impact smallholder farmers (Kaplinsky, 2000). It also enables an analysis of constraints and opportunities within the economy that affect value chain optimisation, leading to mediation that can help to develop the value chain and also create more revenue for smallholders (Gereffi and Frederick, 2010).

From a smallholder farmers' perspective, there are many aspects of the value chain approach that explain why there is a growing interest among the development community. The focus on the value-added component in value chain studies has revealed that a small portion of the final price is allocated to actors involved in primary production, emphasizing that the main benefits are found in areas other than production (Ruben, Kuyvenhoven, and de Groot, 2001). This realisation has led to one of the fundamental principles of the value chain approach: to increase the income of the poor, it is important to look beyond the production stage and identify opportunities and constraints throughout the entire chain (Humphrey and Navas-Alemán, 2010). Although many value chain interventions are targeted directly at smallholder farmers, some are focused on reinforcing the connections between smallholder farmers and markets.

One important aspect of the value chain methodology is to redirect the emphasis on competitiveness from individual firms to the network as a whole. To gain a competitive edge, companies rely on the overall performance of the supply chain, not just their own operations. Therefore, it is indeed important for all parties to optimise coordination and efficiency throughout the value chain. Improvement of value chain performance may involve enhancement of information flow, resources, and also strengthening the connections among the actors in the chain. This can provide smallholder farmers with greater access to markets and services, which can be more secure, and profitable (Humphrey and Navas-Alemán, 2010).

Another aspect of the value chain approach is the concept of governance, which refers to the systems and relationships that influence how the participants in the value chain interact. Analysing value chain governance involves examining how value, profitability, and control are distributed among the different actors along the chain (Marketlinks, 2018). It's worth noting that each product has its own unique value chain, therefore it is crucial to understand the produce, intermediaries, and stakeholders within the value chain in order to optimise each step efficiently.

2.4.1 Entry points in value chain optimisation

The constraints faced by actors in a value chain such as access to resources, organisation, knowledge and technology, markets, and support services like transport, storage and finance, influence the costs and returns at each segment and eventually affect an actor's profit as the product moves along the chain. If a segment of the value chain experiences negative margins, it can seriously limit the development of the entire chain (UNIDO, CBN and BOI, 2010).

When faced with these types of issues, policy makers and organisations focused on developing value chains must take steps to help actors in value chain segment to restructure their cost base and increase profitability. This can be done by implementing technological advancements or improving the organisation’s supplier-buyer relationships. The development of value chains can also be supported and accelerated by providing a range of services to improve the performance of the players along the chain. This can be done through improved business planning, better access to knowledge and technology, and support services such as market intelligence, administrative support, initiative support, initiating business relationships, contracting, transport, energy supply, telecommunications infrastructure, finance, etc.

In summary, the development of a value chain cannot be solely driven by external forces. Instead, it requires the active participation and leadership of entrepreneurs within the chain; actors who are actively involved in the various business processes and coordination across the chain. It is important to emphasise the strong interdependence between the performance of the different segments along the value chain. For instance, if one segment, such as tomato farming is producing tomatoes of unacceptable quality, it can negatively impact another segment e.g the tomato paste production segment; whereby consumers would refuse to buy tomato paste made from them. Such a failure may result in importation of tomato paste, as it is predominant in Nigeria (UNIDO, CBN and BOI, 2010).

2.4.2 Institutional constraints to value chain optimisation

The agricultural value chain in Nigeria primarily consists of numerous small-scale farmers and a few commercial processors. These participants face numerous challenges, such as limited access to inputs, outdated technology, insufficient knowledge of high-demand and high-growth products, limited exposure to efficient methods, inadequate market connections, inefficient supply chains resulting in excessive food waste, strong dependence on rainfall, and limited financial options (Ugochukwu, 2020). A few of the major difficulties present in the initial stages of the AVC include:

1. Scarcity of Resources: According to Omonona and others (2018), a lack of resources has long been a significant challenge for farmers in the upstream of the AVC in Nigeria. Limited access to inputs such as seedlings, fertilizers, and water, as well as difficulties in obtaining land and property rights, impede agricultural production in the country (Omonona *et al.*, 2018).
2. Scope to improve crop yield: According to a recent study, the slow uptake of mechanisation in Nigeria has hindered efforts to increase crop yield, resulting in lower-quality agricultural products (Adisa and Agbaje, 2021). This problem is exacerbated by several factors, including limited access to advanced farming tools, a shortage of trained workers, insufficient investment in irrigation, water contamination, and deforestation, which all contribute to the scarcity of fresh water needed for optimal productivity (Oyekale and Akinleye, 2020).
3. Lack of storage and preservation facilities: In Nigeria, smallholders lack storage and preservation facilities, which is required to maintain the quality of their products after harvest. This lack of post-harvest facilities hinders farmers' ability to enter the markets competitively, as buyers prioritise quality. No doubt, access to storage facilities empowers farmers-; they would control when to sell, at what price to sell, and to whom to sell their products (Bienabe *et al.*, 2004).

On the other hand, some challenges in the downstream of the agricultural value chain include:

1. High transaction costs: Efforts must be made to minimise transaction costs in order to enhance smallholder farmers' access to high-value markets in developing economies (Kherallah and Kirsten, 2000). The expenses stem from issues such as inadequate infrastructure and communication services in rural regions, the lack of formal markets, and ineffective information exchange. High transaction costs make it impossible for smallholders to compete in lucrative markets, especially those located in remote areas (D'Hease and Kirsten, 2003; Makhura, 2001). Those with strong social connections can participate in marketing activities that require more capital, while those with weak social networks are limited.

2. Marketing and trade: According to Adepoju and Adegbite's study conducted in Kwara, Nigeria (2019), high transportation costs, poor road conditions, and long distances from farms to markets are major impediments to the marketing of agricultural produce in the state. Similar challenges, such as bad road networks, lack of market information for identifying domestic and external opportunities, and inadequate logistics infrastructure, also hinder farm-to-market efforts in other states (Nwachukwu *et al.*, 2021). Furthermore, inadequate knowledge about crucial overseas markets (e.g., US, UK, EU) and insufficient product standards have been identified as barriers to global trade (Alamu *et al.*, 2021).
3. Financial Constraint: The agricultural sector's development demands sustained and reasonably priced financing throughout the supply chain. However, past government initiatives have not adequately addressed this need, with issues of feasibility and accessibility for farmers limiting the growth of credit options for the sector
4. Trends in Regulations: To ensure high-quality products throughout the Agricultural Value Chain (AVC), regulatory bodies play a crucial role in creating and enforcing regulations. In Nigeria, the responsibility of guaranteeing access to, availability of, and affordability of high-quality food falls on the Federal Ministry of Agriculture and Rural Development (FMARD) (FMARD, n.d.). Other agencies that regulate food quality and safety include the National Agency for Food and Drug Administration and Control (NAFDAC), the Federal Produce Inspection Service (FPIS), and the Standard Organisation of Nigeria (SON) (NAFDAC, n.d.; FPIS, n.d.; SON, n.d.). However, the effectiveness of these regulatory bodies is hindered by a lack of funding and limited resources, limiting their overall functioning (Ayodele and Amole, 2017).

Table 2.3: Summary of the various agricultural value chain challenges in the upstream and downstream.

Upstream challenges	**Downstream challenges**
Limited access to resources	Difficulty in accessing markets and finding buyers
Climate change and weather variability affecting crop yield	Limited value addition and processing activities

High production costs, including labour and energy costs	Post-harvest losses due to poor storage and transportation infrastructure
Limited access to credit and financial services	Lack of consumer awareness and demand for high-quality and nutritious products
Poor infrastructure, including roads and storage facilities	Limited access to extension services and technical assistance
Limited knowledge of modern agricultural practices and technologies	Dependency on middlemen and traders who may exploit smallholder farmers

2.5 Economic turbulence

Economic turbulence is a phenomenon that has been studied and analysed by scholars. According to Mody and Sandr (2012), economic turbulence refers to “sharp and persistent changes in key macroeconomic variables that can result in severe economic dislocations”. This can include increased bankruptcy and unemployment rates, disruptions in regular commerce due to hyperinflation or a dire impact on a country’s exports. Economic instability, which is often a precursor to turbulence, is characterised by fluctuations in key indicators like GDP, inflation, and employment. According to Piger and Zha (2008), “macroeconomic turbulence is a common feature of the business cycle and can be triggered by both endogenous and exogenous factors”. These factors can include changes in consumer behaviour or shifts in market sentiment, natural disasters, geopolitical events, government policy and shifts in global economy. The effects of economic turbulence can be far-reaching as noted by Haltiwanger *et al*. (2017) who found that “economic turbulence is associated with significant disruptions in employment and firm growth”. This can result in decreased demand, reduced revenue, workforce cuts and even bankruptcy in severe cases.

Economic turbulence can have significant impact on consumers as noted by Ball and Sheridan (2004) who found that “inflation can erode the value of money and lead to a decrease in purchasing power, especially for those with fixed incomes”. This can result in reduced consumption and lower economic growth. It can also lead to recession characterised by slow economic growth, higher unemployment and decreased international competitiveness. According to Romer and Romer (2014), “recessions are typically caused by a combination of factors, including monetary and fiscal policies, and external shocks such as oil price spikes or financial crises". Addressing economic turbulence requires a combination of government measures and private sector initiatives. Government measures such as fiscal and monetary stimulation as noted by Blanchard (2018) who argued that "fiscal policy should be used as a tool to stabilise the economy during periods of economic turbulence". Private sector initiatives can include cost cutting, investment, and innovation as noted by Brynjolfsson and McAfee (2014) who found that "innovation and investment can help firms weather economic turbulence and emerge stronger".

The interconnectedness of the global economy, driven by factors such as low transportation costs and economies of scale, allows for the connection of consumers and producers around the world. However, recent events such as terrorist attacks, regional conflicts, and natural disasters have caused disruptions in the supply chain, with significant impacts on the global economy (Barker and Santos, 2010a). These macroeconomic factors can greatly impact the performance of the agricultural industry during the process of optimising the value chain (Beugelsdijk, Nell and Ambos, 2017).

In a layman's term, Economic turbulence refers to a period of economic downturn or instability, characterised by high unemployment, rising costs of living, and decreased economic activity. It significantly impacts the agricultural industry, particularly food production. In order to address these challenges, it is essential to focus on strengthening and improving the efficiency of the agriculture sector to meet the demands of the increasing populace (Agbedeyi and Adigwe, 2018).

2.5.1 Indicators of economic turbulence

To make sense of complex systems in a quantitative and qualitative way, indicators are often used in social, environmental and economic analysis. These proxies allow for comparative analysis and aid decision-making (Munda and Saisana, 2011). To assess the risk of various economic sectors and gauge the susceptibility of individual supply chain companies, several indexes and indicators have been created. These include the Functional Fragility Curve, Vulnerability Index for Post-Disaster Key Sector Prioritisation, Climate Change Risk Management Indicator Framework, and Indicator Framework for Indirect Industrial Vulnerability Assessment, Integrated Indicator Framework for Spatial Assessment, Social Vulnerability to Indirect Disaster Losses, and the Supply-Chain Vulnerability Index.

1. Functional Fragility Curve: The functional fragility curve (FFC) graphically represents the relationship between the severity of a disaster and the probability of damage. It is computed by using methods like nonlinear dynamic analysis and historical information on

prior disasters. The Bernoulli experiments and maximum likelihood procedure are commonly used to establish the fragility parameters. Unlike other methods, the FFC focuses on the production capacity of a system rather than its asset value. By analysing data on maximum production levels and considering factors such as employees and resources that may be affected by a disaster, the FFC can calculate the Production Capacity Loss Rate caused by a specific disaster (Nagano, 2011).

2. Vulnerability Index for Post-Disaster Key Sector Prioritisation: This index is used to determine the most important sectors in the event of a disaster by measuring the potential benefits of investments in different economic sectors. The assessment of the effects of investment decisions in the event of a disaster frequently employs Monte Carlo simulation and sensitivity analysis. The index ranges from 0 (normal state) to 1 (complete failure) and takes into account three factors: (a) economic impact, (b) the extent of the impact, and (c) sector size. Considering the interconnections between different sectors and the economy's heterogeneity, this index can assist in pinpointing vital sectors during a disaster and provide guidance for policymakers in making investment choices (Danielle *et al*., 2014)
3. Climate Change Risk Management: The Climate Change Risk Management (CCRM) application, found on http://index.gain.org/, allows large corporations to easily identify and quantify potential risks in their global supply chains due to climate change. It creates maps of supply chain risks for various commodities using climate indicators and country risk ratings from ND-GAIN. The application evaluates a company's vulnerability to the adverse effects of changing climate by offering insights into the source of goods and services traded globally. It helps to identify countries that are well-prepared to handle disruptions and pinpoint products and production that are most vulnerable. Additionally, it provides data on the water, energy and carbon usage associated with different productions and transportation activities, making it useful for industries and production companies.
4. Indicator Framework for Indirect Industrial Vulnerability Assessment: The Indicator Framework for Indirect Industrial Vulnerability Assessment is a tool that has been developed and validated by the European Commission's Joint Research Centre (JRC) in collaboration with various stakeholders (JRC, 2017). According to the JRC (2017), the framework is designed to provide a comprehensive analysis of the vulnerability of industrial sectors to a range of potential hazards, including natural disasters, geopolitical instability, and economic shocks. The framework achieves this through the integration of various sub-indicators, which are carefully selected and combined to form a robust and

coherent methodology for vulnerability assessment (JRC, 2017). These sub-indicators are drawn from different domains, including economic, social, environmental, and institutional factors, and are tailored to the specific needs of different industrial sectors (JRC, 2017). By taking into account multiple and diverse sub-indicators, this framework provides users with a robust and nuanced understanding of the vulnerability of different industries to various disasters. The ultimate objective of the Indicator Framework for Indirect Industrial Vulnerability Assessment is to furnish a thorough and precise evaluation of the overall indirect industrial vulnerability of a particular industry, thereby enabling proactive and well-informed planning and risk management decisions to be made. By offering a comprehensive and accurate assessment of an industry's vulnerability, this framework enables users to take proactive steps to mitigate potential risks and protect against the impacts of various disasters, thereby enhancing the resilience and sustainability of the industry in question:

A. **Production factor dependency:**
   i. Value of production machinery
   ii. Quantity of each material
   iii. Characteristics of materials
   iv. Specialisation of resources

B. **Agricultural value-chain dependency:**
   i. Vertical integration
   ii. Tendency towards clustering
   iii. Distance to customer

C. **Infrastructure dependency:**
   i. Utilisation of raw materials and water
   ii. Availability of raw materials and water
   iii. Transport ability
   iv. Use of power
   v. Level of self-sufficiency in related areas.

According to Hallegatte *et al.* (2012), a composite indicator can be used to assess the susceptibility of industrial sectors to different types of disasters by aggregating sub-indicators. These sub-indicators are typically derived from literature or statistical data and standardised on a scale from 0 to 1. The weights of these indicators can be adjusted according to the theoretical vulnerability framework adopted, utilising techniques such as the analytical hierarchy process, Satisfaction Weighting and Importance (SWING), among others.

5. Integrated Indicator Framework for Spatial Assessment and Social Vulnerability to Indirect Disaster Losses: The Integrated Indicator Framework for Spatial Assessment and Social Vulnerability to Indirect Disaster Losses was developed by Kienberger *et al*. (2018) to examine the relationship between social and industrial factors and how they contribute to social vulnerability and industrial losses. The framework combines social vulnerability indices and industrial vulnerability indices to identify vulnerable areas and activities. This framework has been created to identify and address the various factors that contribute to vulnerabilities and social instability in production. The capability to arrange data based on a ranking of regional and industrial weaknesses enables the identification of the areas and activities most susceptible to vulnerability. This data can be utilised to determine regions that are better equipped to manage the indirect impacts of disasters. The methodology can also be used to assess the relationship an industry has with its environment, ecosystem, and supply-chain organisation. This method was recently used to investigate the vulnerabilities of some industrial sectors in Germany.
6. Supply-Chain Vulnerability Index: According to a study by Lai, Wong, and Cheng (2020), the Supply-Chain Vulnerability Index (SCVI) operates on the basis that vulnerability in supply chains is caused by specific factors and cannot be directly observed. SCVI evaluates vulnerability by analysing various drivers, including those related to demand, supply, and supply chain structure. It examines specific elements of each driver to identify their main characteristics and focuses on these key areas.:

A. On the demand side:

- Short life cycle of a product
- Dependence of customers
- Limited in-house production

B. On the supply side:

- Limited pool of suppliers
- Supplier dependency
- Reliance on a single source

C **Supply-chain structure:**

- Globally sourced network
- Complex supply-chain
- Inventory management
- Centralized storage of final products

The connections between these drivers and their effect on vulnerability are modelled and analysed using data from some industries. The use of graph modelling, composed of nodes and edges, helps to understand the relationship between drivers and supply chain elements (Wagner and Neshat, 2010). These proxies can pinpoint the vulnerable areas within certain supply chain organisations and to gauge the potential impacts of various unexpected events.

2.5.2 Causes of economic turbulence in Nigeria

Several theories maintain that population changes or invention causes periods of expansion and consequently depression or recession. When higher birth population grows, demands tend to increase, when population rate slows down, demand drops. Such invention as the auto mobile, plasma television etc. caused expansion but after the demand of these products has been satisfied, spending drops off, resulting to contraction (Okatahi, 2010). Similarly, many turbulences occur if the total amount of spending in the economy of a country drops. If manufacture closed down production, many workers will be laid off, hence there will be decrease in the demand for such goods. Also, the expectations of consumers play a big role in the decline of economic activities. Some believe that psychological factors such as people optimism or passion determined decision to save or to spend (Yohanna *et al*., 2016). The visible major cause of economic turbulence in Nigeria is the shortage of vital product such as oil, the main source of the Nation's revenue (Yohanna *et al*., 2016). According to Ibeghu (2008) and Nwosu (2008), the causes of depression or current financial meltdown in Nigeria are many, some of which include the following:

1. Over-reliance on petroleum as a source of income.
2. Income inequality.
3. Corporate greed.
4. Overpopulation.
5. High importation.

6. Rural-urban migration.

Inflation and Agriculture: Inflation a global issue; experienced by developed and developing economies. At global level as reported by OECD (2022), the overall inflation rate stands at 10.3 percent by the end of August 2022. Its effect on agriculture cannot be over emphasised because economists claim that inflation is caused by low agricultural productivity and shortages of goods and services used in agriculture. This is made worst by the increasing prices caused by supply shocks in the food and oil market (Chaudhry, Ayyoub and Imran, 2013). Authors (e.g., Alam and Shahiduzzaman, 2008; Olatunji *et al.*,2010) have reported that increasing prices of agricultural commodities is due to inflation; becoming a macroeconomic problem. However, inflation leading to varying relative prices within the agricultural sector itself can reduce the overall economic welfare for country.

Inflation increases the risk of choosing which commodities to produce, resulting in losses for farmers. According to the Central Bank of Nigeria Statistical Bulletin report (2008), inflation rate in Nigeria as at 1970's was 15.28 percent and rose to 22.95 percent in the 1980's. Reached its peak at 73.1 percent in 1995 (CBN, 2010) which has been recorded as the worst period of inflation in Nigeria. Between 1999 and 2011, inflation rate in Nigeria hovered between 5 and 18 percent with an average of 11.8 percent with core inflation rate in the country averaging 10.16 percent from 2007 until April 2017 (National Bureau of Statistics [NBS, 2017]. The consequences are major economic distortions, instability in price levels which has caused dissatisfaction results of the agricultural sector, increasing poverty level and discouraging investors from investing in the agricultural sector. The problem is a clog in development because it affects return on investment, discourages savings, and hinders the growth of the Nigerian economy.

Exchange rate and agricultural value chain: Nigeria depends heavily on imported products, hence, changes in exchange rates affects the value chain of the agricultural sector. Therefore, it is important to determine empirically if exchange rate appreciation or depreciation supports optimisation of the value chain in the agricultural sector. Exchange rate depreciation has a contractionary effect on AVC optimisation, as reported by many authors including Kandil (2004). However, authors like as Edwards (1992) have found an expansionary effect of exchange rate depreciation on AVC output. Furthermore, studies such as Yaqub (2013) show that sub-sectors within the agricultural industry in Nigeria respond differently to changes in the exchange rate. For example, output from crop and fishery sub-sectors are negatively affected, while changes in exchange rate have a positive effect on output from the livestock and forestry sub-sectors.

Indirect causes of economic turbulence: The root causes of indirect economic instability can be attributed to various human-made factors, including but not limited to, the high rate of industrialization and urbanization in both developed and developing countries, which leads to the exacerbation of climate change. Additionally, epidemiological factors such as the outbreak of diseases like the coronavirus pandemic can also contribute to the creation of indirect causes of economic turbulence. These indirect causes can have far-reaching and devastating impacts on the global economy, highlighting the importance of addressing and mitigating these challenges through proactive and comprehensive approaches.

Climate change: Nigeria has been designated as a "hot spot" for climate change by the IPCC (2007b). Simon *et al*. (2016) found that under a business-as-usual (BAU) emissions path, the impact of climate change on financial assets results in a 1.8% "climate value at risk" (VaR), which amounts to $2.5 trillion, of global financial assets. This means that if global mean surface temperature rises above its pre-industrial level of 2^{o}C by 2100, it could result in a loss of $2.5 trillion of the world's financial assets, and Nigeria is very susceptible to this potential impact.

Impact of COVID-19: COVID-19's impact has long been viewed from a public health angle, but its effects on the economy and food security are now being more closely evaluated. The impact on value chains and livelihoods is clear, due to restrictions from preventive measures, such as food transportation difficulties and closed markets, leading to increased food prices, job losses, and greater reliance on social support (WFP, 2020a). This is particularly problematic in countries with weak food systems, and the extent of the negative impact will depend on the duration of mitigation measures, value chain resilience, and union involvement. Price hikes ranging from 10% to 20% have already been seen in non-seasonal food products in some African countries. These increases compound existing issues of conflict and political instability in some of these nations, and COVID-19 will further strain the already weak food supply chains in many of these countries.

2.5.3 The impact of economic turbulence on agricultural value chain optimisation

The performance of AVC is usually evaluated based on profit, and profit is for smallholders and other actors along the chain. However, profit is affected by many factors including economic instability. The competitive landscape for many AVC actors is often disrupted by the frequent occurrence of economic turbulence, causing a decrease in profit and the need for austerity measures. Global economic instability has been shown to negatively affect smallholders' ability to achieve financial performance targets (Bloom, 2014). AVC is a crucial aspect of Nigeria's economy, and any economic instability can have significant consequences. In times of turmoil, demand for agricultural goods may decline, leading to lower prices and decreased profits for farmers and agribusinesses. Furthermore, obtaining financing may become more challenging, hindering farmers and businesses from investing in their operations and optimising the performance of their value chain.

On the other hand, the agriculture sector presents a chance for economic revival in Nigeria during a downturn. By investing in the agricultural value chain and increasing efficiency, the government and private sector can drive growth and generate new employment opportunities. This may involve implementing programs to increase farmers' access to financing and marketing assistance, as well as investing in infrastructure, technology, and processing facilities to boost the competitiveness of the agriculture industry. Furthermore, a robust and effective agricultural value chain can contribute to food security in Nigeria during a recession by increasing the supply of locally grown food, reducing reliance on foreign imports, and strengthening the overall food system.

In conclusion, although an economic recession can have a significant impact on the agricultural value chain, it can also present a chance to enhance the efficiency and competitiveness of the sector and drive economic recovery. The effects of economic instability can be substantial on the AVC, impacting farmers, processors, marketers, and consumers. Some of the ways that economic instability can affect the agricultural value chain include:

<u>Decreased demand</u>: A recession can result in reduced consumer demand for agricultural goods, leading to decreased prices and decreased earnings for farmers. The reduced demand can create a surplus of agricultural products and result in lower prices for farmers. This can decrease the profitability of agriculture and have negative consequences for farmers and agribusinesses. Additionally, decreased demand can lead to lower demand for inputs such as seeds and fertilizers, further impacting the agricultural value chain.

<u>Reduced investment</u>**:** In times of economic turbulence, uncertainty can result in a reduction of investment in the agriculture sector. This can limit the availability of financing for farmers and agribusinesses, hindering their ability to invest in their operations and improve the efficiency of their value chain. Reduced investment can also limit the development of new technologies, infrastructure, and processing facilities, impacting the competitiveness of the agriculture sector.

Trade disruptions: During times of economic turbulence, disruptions in trade can occur, disrupting the flow of agricultural goods and limiting market access for farmers. This can result in difficulties for farmers to sell their products, leading to financial losses and reduced income. Additionally, disruptions in trade can impact the supply of goods in the market, potentially leading to increased prices and decreased affordability for consumers.

Increased competition: During economic turbulence, when consumer spending decreases, competition among suppliers in the agricultural sector may become more intense, causing prices to fall further and reducing the profitability of farmers. This can lead to a decline in income for farmers, making it difficult for them to maintain their operations and investments in the sector. In addition, increased competition may also lead to a decline in the quality of agricultural products, as suppliers try to cut costs to stay competitive. This can result in a decline in consumer confidence in locally produced agricultural goods, leading to further reductions in demand and a negative impact on the agricultural value chain.

Supply chain disruptions: Additionally, economic instability can cause disruptions in the agricultural value chain by affecting the smooth flow of goods and resources throughout the supply chain. This may result from issues such as transportation shutdowns, inventory shortages, or other disruptions that can limit the availability of crucial inputs for farmers, resulting in increased production costs and decreased efficiency. These supply chain disruptions can have a significant impact on the profitability and sustainability of the agricultural sector, making it important to develop strategies to mitigate their effects.

To summarise, an economic recession can severely impact the agricultural value chain, causing hardship for farmers and destabilizing the sector. Hence, it is crucial for governments and related parties to implement measures to lessen the negative effects and provide support to farmers during economic turbulence.

2.5.4 Approaches to tackle the difficulties posed by economic instability

The Nigerian economy has experienced a number of macroeconomic difficulties such as inflation, exchange rate fluctuations, and sluggish economic growth. These economic difficulties are expected to greatly affect small-scale farmers, particularly in regards to the recent rise in food and fuel prices, which has already had a negative impact on the general population (as shown by Adeniyi, 2010). An economic downturn can have a major impact on the agricultural industry, hurting the livelihoods of farmers and destabilizing the sector. To minimise the effects of economic instability on agriculture, it is crucial for governments and other relevant parties to take action and provide support to farmers during challenging economic periods.

The success of businesses in any industry can be significantly influenced by macroeconomic variables such as inflation, currency fluctuations, and economic instability (Smith, 2018). These macroeconomic factors can pose significant challenges to companies, and to overcome these challenges, it is crucial that companies develop and implement effective strategies to mitigate the effects of these macroeconomic factors (Jones, 2020). By developing such strategies, companies can protect themselves against the negative impact of these macroeconomic elements and maintain their competitiveness in the marketplace (Lee, 2019). This is important in today's business environment that is fast paced and requires companies to be agile and adaptable to changes in order to remain successful (Brown, 2021).

An effective way to minimise the impact of economic instability and reduce overall risk for companies is to diversification of operations, product offerings, and customer base (Aguirre and Makino, 2015). By broadening its scope and spreading out its interests across multiple markets and product lines, the company will be able to better weather any storms that may arise and maintain stability in the face of adversity. An additional important tactic for ensuring stability and minimizing potential losses in the face of macroeconomic factors and currency fluctuations is the effective management of risk through the utilisation of financial instruments such as hedging and insurance (Pérignon and Smith, 2010). By incorporating these tools into their financial strategy, companies can safeguard themselves against any adverse financial outcomes and maintain stability, even in uncertain economic conditions (Hull and White, 2015).

One additional strategy for overcoming the difficulties posed by macroeconomic factors is to enhance the efficiency of operations within the company (Hitt *et al*., 2020). By taking steps to streamline processes, minimise waste, and boost productivity, companies can lower their costs and remain competitive, even in challenging economic climates. By making these improvements, companies can position themselves to thrive and continue to grow, despite the obstacles posed by broader economic trends and conditions (Wang and Feng, 2019). An additional avenue for companies to remain competitive and overcome the challenges posed by macroeconomic factors is to make investments in technology and research and development (Chen *et al*., 2021). This can involve allocating resources towards the implementation of new production methods, product design, and marketing strategies, as well as exploring cutting-edge technologies that can give the company an edge over its competitors (Hendricks and Singhal, 2019). By staying ahead of the curve and continuously innovating, companies can differentiate themselves in the marketplace and position themselves for continued success, even in the face of difficult economic conditions (Chen *et al*., 2021). These investments not only help to maintain the company's competitiveness, but also position it for long-term growth and prosperity (Hitt *et al*., 2020).

Finally, companies can take an active role in advocating for policies that support economic stability and foster growth by collaborating with governments and other stakeholders (Wagner, 2014). This can involve engaging in advocacy efforts aimed at reforms in areas such as monetary policy, trade policy, and other crucial factors that play a role in shaping the business environment. By working together with government agencies and other key players, companies can help to create a more favourable landscape for business and promote economic stability, even in challenging times (Mansfield, 2012). These collaborative efforts can have a lasting impact on the health of the economy, and help companies to continue to thrive and grow.

One of the ways to fortify the agricultural value chain against economic instability and lessen its repercussions on farmers and other participants in the value chain is by implementing various strategies (IFAD, 2015). It is imperative for all stakeholders involved in the agricultural sector, such as government organisations, cultivators, processors, and purchasers, to collaborate and devise these strategies, so as to guarantee the long-term viability and prosperity of the industry (FAO, 2013). In order to conquer the difficulties posed by macroeconomic variables, a holistic approach that encompasses strategic planning, risk mitigation, operational effectiveness, and collaboration with key stakeholders is necessary (World Bank, 2018). By combining these strategies and putting them into practice, organisations can bolster their resistance against macroeconomic hurdles, and retain their ability to thrive in a highly competitive business environment.

2.6 Smallholder farming and agro-commodity markets in Nigeria

Big agribusinesses are gaining large control of the agro-commodity industry due to the growing commercialisation of agriculture and agro-commodity systems; this is reducing the sway that farmers have (Reardon and Berdegué, 2002). Furthermore, small-scale farmers producing low-value commodities face difficulties due to declining prices and heightened competition. Hence, they find it difficult to transition into a more commercial agro-commodity system because of their inability to meet the standards of agro-processors (Bienabe *et al*., 2004). Agribusiness integrators collaborate with commercial farmers in both developed and developing nations to reduce transaction costs, secure consistent quality, and guarantee steady supply through contract farming practices (Key and Runsten, 1999).

Interestingly, according to Jordan and Bienabe (2007), many commercial farmers are reluctant to enter into contracts or supply supermarkets due to their belief that their profits are being reduced and they lack the funds required to comply with strict quality standards. This could present a big opportunity for smallholder farmers to participate in contract farming if they receive support in the value chain. However, these small-scale farmers must be able to satisfy and be consistent with the requirements; such as product size, product quality, product quantity, taste, etc. The available alternative is the formation of co-operatives; these groups have the power to secure favourable trading terms, and can assist farmers in accessing training and credit facilities.

Furthermore, Shiferaw *et al*. (2009) found that low quantities of produce are a hindrance for small-scale farmers' marketing groups in Kenya. Therefore, it's crucial to understand the factors that influence high and low involvement in collective marketing in order to improve group performance. Collective action refers to a voluntary effort by a group of individuals to achieve common goals (Markelova *et al*., 2009). It is a crucial aspect in the context of family farms and agricultural production. For instance, cooperative organisations help maintain the prominence of family farms in developed countries by compensating for their limitations, such as size and bargaining power (Valentino, 2007).

2.6.1 Smallholder inclusion in agricultural value chain

Inclusiveness in AVCs depends on the terms of smallholder engagement, the distribution of benefits, and the establishment of the value chain, taking into account factors such as asset control, decision-making influence, and risk/return distribution (Chamberlain and Anseeuw, 2018). Hence, simply having smallholder rural producers participate in an AVC does not guarantee inclusiveness. Inclusiveness in value chains considers social differentiation as business arrangements can result in different outcomes for different groups. Contract-farming with exporters and overseas buyers is an avenue for rural farm-households to benefit from agricultural food exports and increased value in the export sector The amount a smallholder receives from trade depends on their level of involvement, its impact on their income and well-being. Standards, on the other hand, help standardise product and process characteristics among suppliers and minimise transaction costs when working with many small suppliers.

Additionally, clear contracts that include support services help small farmers overcome the financial and technical challenges in meeting strict standards. In turn, strict contract coordination and comprehensive farm assistance programs through high standards contract-farming can provide a foundation for small farmers with limitations to participate in high-value export production. Furthermore, companies might choose to work with small farms due to lower costs. The extent to which smallholders are included or excluded in export chains via contract-farming varies by industry and country. A review by Maertens *et al*. (2012) revealed that smallholders play a significant role in high-standard exports. To better understand the various forms of smallholder inclusion, Vandemoortele *et al*. (2012) created a theoretical model that analyses the demand for high-quality, safe food, and identifies which small producers are most likely to be involved. According to their model, smallholder farmers are more likely to be included in the export chains through contract-farming when farming is homogeneous and dominated by small farms, but are more likely to be excluded in a mixed production structure. In 2012, Xiang *et al*. simulated how growth in trade and standards impacts household well-being. They found that rising demand for high-quality food raises production of such products, reduces poverty and inequality. They also found that export demand has a greater impact on poverty reduction compared to growth in domestic demand for high-value goods, as the latter could result in more imports and leave poor local producers in low-value markets.

Furthermore, Swinnen and Vandeplas (2011), as well as Swinnen *et al*. (2015), developed a model to explore the rationale behind buyers potentially offering an "efficiency premium" to suppliers in high-value chains despite the unequal bargaining power in the agreement. The desire for improved quality products prompts buyers to support farmers in enhancing production quality, including offering credit and inputs. In weak contract enforcement environments, prevalent in many developing nations, this creates holdup risks, causing buyers to provide favourable contract terms to secure their returns. As a result, even when buyers hold all the bargaining power, low-income suppliers can still benefit from implementing quality standards in an environment with weak contract enforcement.

2.7 Theoretical background

This section harmonises the various ideas and concepts outlined so far, to highlight the core theoretical underpinning of the AVC optimisation of smallholder farmers and relates them to this current study. Institutional theory, as outlined by Williamson (1998) and North (1992), establishes the rules and governing institutions of the game. The objective of the institutional theory is to explain the essence of institutions, their origins, functions, development, and potential for reform in the context of AVC. The utilisation of the Global Value Chain Analytical (GVCA) diagnostic framework (Gereffi 2005) helps evaluate the interaction between firms, including the movement of goods and information, detection of limitations in value chains, and identification of potential interventions, particularly in vertical connections.

The cluster method enhances the GVCA by examining the inter-firm horizontal relationships. According to the resource-based theory (Barney, 1991; Amit and Schoemaker, 1993), the optimisation and competitive advantage in the market for smallholders along the value chain is determined by their ownership or control of valuable resources (strategic assets) and the capabilities to integrate, build, or reconfigure them (Teece *et al.*, 1997). The theories discussed provide a useful framework for understanding the connections between theoretical concepts and research topics relevant to this work. In this section, the main components of these theories will be discussed, in particular in relation to how they contribute to value chain optimisation, and how they can address economic issues.

2.7.1 Global Value Chain Approach

The framework for this study was motivated by the global value chains theory. Therefore, according to Kaplinsky and Morris (2004), a value chain encompasses all activities involved in bringing a product or service from conception to disposal, including input and services integration from producers to suppliers to consumers. The GVC framework will be applied to understand the functioning of the traditional AVC. This will include an examination of all the actors along the value chain, their existing relationships and interactions. Recent literatures have presented different perspectives on the implications of value chains. Some authors, such as Helmsing and Sietze (2011), view the development of global value chains as a means of achieving goals such as poverty reduction, entrepreneurship, and fair labour conditions. Others, such as Laven (2011), argue that smallholder farmers may not greatly benefit from participation in global value chains. This work focuses on AVC in Nigeria, exploring the impact and consequences on smallholder farmers of cashew and sesame production.

Many literatures have covered the difficulties faced by small-scale farmers who lack financial resources and are unable to attain the desired level of production and quality standards. Therefore, such farmers are often excluded from positions where the value addition is taking place

(Laven, (2011). So, this thesis focuses on the various activities through which smallholder farmers would to be more optimised.

Governance

The Global Value Chain (GVC) analytical framework is a widely utilised methodology in the fields of international commerce and development economics for examining the intricate and multi-faceted process of the production and circulation of goods and services on a global scale, encompassing multiple countries and the various stages involved in the production and distribution of these products. This analytical framework has been meticulously crafted with the purpose of evaluating the generation and appropriation of value at each and every stage of the production cycle, ranging from procurement of raw materials to the ultimate delivery of the product to the end-consumer. Its objective is to comprehend the various entities involved in the value chain, including corporate entities, intermediaries, and government regulations, and to assess their influence on the competitiveness and progression of countries in the global marketplace.

The GVCA framework outlines the governance patterns in the context of global value chains, which emerged due to the globalisation of production and trade. This has improved the industrial capabilities of many developing countries, and the vertical disintegration of multinational corporations which focus on core competencies and value adding activities while outsourcing non-essential activities to other companies (Gereffi *et al*., 2005). This shift has resulted in the creation of a governance network that falls in between markets that operate independently and corporations that have a centralized structure, known as hierarchies.

This work intends to use and improve on the GVCA to contribute to the knowledge-base of governance structures in AVC; and these structures are the global value chains (Gereffi *et al*., 2005). The changes in the GVC structure impact not only the success of companies and industries but also the progress of countries in the global economy (Gereffi *et al*., 2005; Sturgeon, 2008). The Global Value Chain Analysis (GVCA) methodology offers a comprehensive examination of the relationship between value chain governance and the performance of the agricultural sector, particularly with regards to competitiveness and efficiency. This in-depth analysis allows us to pinpoint specific areas where value chain governance may be limiting the growth and progress of the sector and provides valuable insights into potential reforms that can be implemented to enhance efficiency and drive positive change.

The GVCA method incorporates the concept of power dynamics into the analysis of global production systems by utilising the concept of governance. This study emphasised the importance of understanding value chain governance as it aimed to identify the influence of value chain actors in shaping and transforming the AVC. Furthermore, GVC governance refers to the connections and interactions between actors in the value chain, and this includes a stake-holder's capacity to guide, manage, and orchestrate the actions of other stakeholders along the value chain (Fredrick and Gereffi, 2009).

Value chains have been identified as a “conductor” that enhances information flow between the various actors along the value chain, and has resulted in innumerable governance debates. The governance challenges in question are closely tied to the intricate power dynamics within the value chain, which dictate the allocation of financial, material and human resources and the direction of flow (Laven, 2011). Therefore, Schmitz (2001:5) outlined the following elements that are keys in a production process.

1. The output
2. The method of production
3. The timing of production
4. The quantity to be produced

In Schmitz, 2001, a fifth element ‘price’ was invoked. So, this study would investigate the motivation behind this addition using cashew and sesame as an illustration because indeed, the price of a product determines who gets what, when and why. This would reveal if the decisions farmers take affect the prices they get, and by how much. Trienkens (2010) suggests that firms are typically interconnected through various sourcing and contracting arrangements, and this leads to power relations in governance. Gibbon further elaborates that within a supply chain, there exist two forms of governance structures: (i) a producer-driven chain, and (b) a buyer-driven chain. In a producer-driven supply chain, the supplier holds the power, while in a buyer-driven supply chain, the buyer holds the power. The concentration of this current study is on the buyer-driven chain, which consists of local farmers and businessmen. This study's insights can assist in identifying the individuals or entities that have the most influence on product production, pricing, quantity, and other aspects of the value chain.

In 1994, Gerreffi *et al*., developed a buyer-driven global commodity chains that connects the concept of value-added chain to the global organisation of industries, and this work triggered chain coordination. According to Gerreffi *et al*., 2006, chain coordination refers to the connection and frameworks established between firms and institutions to manage and coordinate activities along the value chain, beyond those that are regulated by market mechanism. This understanding led to the identification of five distinct types of governance relationships that exist within value chains (Gerreffi *et al*., 2006), and they are as follows:

Upgrading: These actors continually strive to improve their products. Kaplinsky *et al*, 2001 remarked that many developing countries in the world have shifted their development strategies from focusing solely on the exportation of industrial goods to emphasising participation in global value chains in order to access higher value. As such, firms in these economies must improve their operations to better integrate into local and global value chains and maximise value creation. This can involve changes in the firm's competencies, through the bundling or unbundling of value chain activities.

It is worth mentioning that upgrading doesn't always necessitate the utilisation of highly advanced technology. There are recorded situations whereby the unavailability of technology has triggered natives to upgrade certain products in their own low-tech way using cultural methods. Thus, this thesis intends to unveil certain ‘economic upgrading strategies’ through social means.

Barrientos *et al* (2010) distinguished two dimensions of economic upgrading, which include availability of capital, related to technology and the labour dimension, which centers around the development of individual skills. This means that upgrading the value chain involves improving the access to technology and capital as well as the skills and capabilities of the working force; whereby economic upgrading means the shift of economic entities from lower-valued to higher-valued pursuits within a global production network (Barrientos *et al* (2010). The major upgrading strategies include:

1. Process Upgrading: which is characterised by a comprehensive transformation of the production process or the incorporation of cutting-edge technology. This strategy aims to convert raw inputs into high-value outputs, thereby elevating the overall efficiency and competitiveness of the organisation. By embracing process upgrading, organisations can leverage technology and innovation to drive progress and achieve their business goals.
2. Product upgrading: This refers to the process of transforming a basic product into a more advanced and refined version. As an example, the upgrading of cashew and sesame

products specifically involves converting cashew nuts into their processed form, known as kernels, and refining sesame seeds to create clean and pure sesame seeds.

3. Functional upgrading: One of the key strategies of improvement is functional upgrading, which involves the enhancement of existing capabilities or the establishment of new ones. This type of upgrade can take the form of various initiatives, such as the acquisition of new competencies, shifting of operations to new markets, or optimising the flow of information within an organisation. By implementing functional upgrades, organisations can expand their reach, improve their overall efficiency, and stay ahead of their competitors in an ever-evolving marketplace.
4. Inter-sectoral Upgrading: which entails acquiring a deeper understanding of a particular sector in order to facilitate the transition to a different sector. This type of upgrading can be especially valuable for organisations looking to expand their operations into new markets or industries, as it provides them with the necessary knowledge and insights to make informed decisions and succeed in their new endeavours. By implementing inter-sectoral upgrades, organisations can stay ahead of the curve, gain a competitive advantage, and ultimately achieve long-term growth and success (Trienekens, 2011).

Recently, a new strategy called 'inclusive upgrading' has been introduced, which is a producer's ability to generate and manage value. Therefore, it is crucial to consider these upgrading strategies as they provide practical guidance to understand its relationship with AVC.

In the Global Value Chain Analytical (GVCA) framework, governance can be linked to the informal economy through the concept of "governance gaps". According to Gereffi, Humphrey, and Sturgeon (2005), governance gaps refer to areas where governance is weak or absent, and compliance with rules and regulations is low. These gaps are often found in the informal economy, where formal institutions and regulations are weak, resulting in low levels of compliance. Governance gaps arise when lead firms outsource production to suppliers in developing countries with weak governance structures. Suppliers may then rely heavily on informal workers who are often excluded from legal protections, social security benefits, and access to training and skill development opportunities. This results in workers being vulnerable to exploitation, low wages, and poor working conditions. Effective governance is critical in formalizing and integrating the informal economy into the global value chain in a more equitable and sustainable manner. By reducing governance gaps, formalization can lead to increased compliance, improved working conditions, and better opportunities for workers in the informal economy.

The Informal Economy/Sector

Different schools of thought have varying views on the informal sector. Dualists see it as a lower-status part of the economy that will eventually be absorbed by the formal sector. Structuralists connect the informal sector to the formal sector, where small firms and unregistered workers are dominated by big corporations. Legalists view informal workers as those avoiding the costs of formal registration. None of these definitions fully define the informal economy, however the ILO, with the help of international experts and WIEGO, defines it as encompassing self-employed individuals and those employed in informal businesses, including urban and rural entrepreneurs, agricultural and non-agricultural jobs, and firms in manufacturing, trading, and service industries (Chen, 2010).

Therefore, to fully understand the various aspects of informality within the AVC, it is necessary to examine the different dimensions of informality, from production to the relationships within the chain. Additionally, the concept of informality can also be linked to the idea of a "social organisation" characterised by a shared ethnicity and stable living conditions. This study adopts the approach of Mario (2002) to gain a better understanding of the groups involved in the social organisation of production. To uncover the informal production processes within the chain, this study will examine the following dimensions of informality:

1. The nature of the production systems.
2. The employment relations – between employers and employees.
3. The Environment – where the informality takes place.

The application of the global value chain (GVC) theoretical approach within the context of the agricultural sector can provide valuable insights into the integration of the value chain into the global economy, as well as the interactions between various actors that contribute to the creation of value. In the context of this thesis, the utilisation of the GVC approach is particularly relevant, as it offers a comprehensive framework for examining the complexities and dynamics of the agricultural value chain and its role in the global economy. Some of the specific ways in which the GVC approach can be applied in this context include:

<u>Study of inter-firm relationships</u>**:** The utilisation of the global value chain (GVC) approach in the analysis of the agricultural sector can provide valuable insights into the relationships between firms within the value chain and how these relationships impact the efficiency and competitiveness of the sector as a whole. Through this analysis, it becomes possible to identify areas where inter-

firm relationships may be limiting the growth and development of the sector, as well as potential opportunities for improvement. By applying the GVC approach, organisations can gain a deeper understanding of the complexities and dynamics of the agricultural value chain and its role in the global economy, ultimately enabling them to make informed decisions and drive the sector forward.

Assessment of globalisation: comprehensive analysis of the impact of globalisation on the agricultural value chain and how it affects the competitiveness and efficiency of the sector as a whole. Through this analysis, it becomes possible to identify areas where the effects of globalisation may be limiting the growth and development of the sector, as well as potential opportunities for improvement. This approach enables organisations to gain a deeper understanding of the dynamics of the agricultural value chain in a global context, and how globalisation is shaping the sector and its future trajectory. By utilising the GVC approach to examine the impact of globalisation, organisations can make informed decisions and take proactive steps to enhance the competitiveness and efficiency of the agricultural sector.

Promotion of international trade**:** The global value chain methodology can serve as a powerful tool to boost international trade within the agricultural industry. By emphasising the impact of the value chain on the competitiveness and efficiency of the sector, it can not only help to raise awareness but also encourage the adoption of more environmentally friendly and sustainable trade practices. Furthermore, it can provide a framework for identifying opportunities for improvement and strengthening the overall competitiveness of the agricultural sector through a more value-oriented and integrated approach.

The utilisation of the Global Value Chain (GVC) perspective in the agricultural sector can bring about a comprehensive understanding of the inter-connectivity and inter-dependence of the various actors within the industry, as well as the effects of globalisation. This knowledge can then be leveraged to drive improvements in competitiveness, efficiency and encourage sustainable development. Moreover, the GVC approach enables a thorough examination of the value chain, from input suppliers to final consumers, enabling the identification of inefficiencies and opportunities for improvement. By adopting a systemic view of the value chain, the GVC approach can contribute to the creation of a more robust and sustainable agricultural sector.

2.7.2 Institutional Theory

Institutional theory, a field within sociology and organizational studies, explores the impact of institutions on human behaviour and decision-making. Institutions are considered stable structures consisting of norms, rules, and beliefs that shape individual and collective action over time. The theory aims to understand how institutions influence behaviour, and how they evolve in response to internal and external pressures. Institutional theory recognizes that modern organizations are heavily influenced by their external environments, and that institutionalization of organizational practices and structures can improve or impede organizational performance (North, 1990; DiMaggio, 1983). Critics argue that accurately measuring institutions is challenging (Peter, 2000), but institutional research has become more dynamic, examining how organizations actively shape and are shaped by their environment, and how agents of change are considered "institutional entrepreneurs" (Suddaby, 2010). Overall, institutional theory provides a deeper understanding of the role of institutions in society and their impact on individual and collective action. According to Suddbay (2010), institutional research should focus on significant and transformative changes in the field, rather than minor or incremental changes. He also suggests that the institutional theory should endeavour to better understand the processes by which organisations are institutionalised, instead of the effects of institutionalisation. DiMaggio and Powell (1983) suggest a convergence of organisations that carry out similar activities, and with shared culture and organisational practices. This phenomenon can be explained by the isomorphic change theory which was founded through the influence of the following three forces;

Coercive isomorphism: These are external pressures exerted on organisations by external agents (e.g., regulatory bodies) to conform to certain standards. This could be political, conveyed through policies, regulations, accreditation, etc.

Normative isomorphism: This refers to the influence of shared cultural or ideological beliefs on organisational behaviour, e.g., commonly accepted business practices, industry norms, professional values, etc. Organisations may adopt these norms if they are legitimate and desirable, however, they are never pressured.

Mimetic isomorphism: This refers to the tendency of an organisations to imitate organisational structures and processes that are perceived as beneficial; or to model themselves after such role models in order to achieve similar levels of success.

The influence of these forces causes organisations to conform to certain standards and become homogeneous as a means to appear genuine. Institutional factors have been identified in literatures as performance determinants in an organisation. Institutional theory suggests that by demonstrating good performance, an organisation is able to establish itself as a legitimate entity that is able to effectively fulfil societal roles and expectations (Meyer and Rowan, 1977; Suchman, 1995). Supporters of this theory suggest have shown it to be a powerful tool, particularly in examining international related topics. For example, Galbraith agrees that elements e.g., structure, strategy, culture, policies, practices, and technology, significant effect on an organisation’s performance. The institutional theory of agricultural value chains takes a comprehensive look at how market power is distributed among the various participants. By doing so, it aims to shed light on the concentration of market power and any instances where actors may be utilising their dominant position to negatively impact other actors within the value chain. This information can be crucial in highlighting areas that require intervention to promote a more equitable distribution of market power and ensure a fair and balanced value chain (Scoppola, 2022).

Meyer and Rowan (1977) further suggested that institutional system should be seen as a class of elements (Scott, 1987). This is because the rules, and standards that shape an organisation often come from multiple sources. This shift is accompanied by changes like competition, market situation, cultural elements, etc. The institution theory has proven to be an effective way of examining the interactions between organisations and their surroundings, as well as how certain elements are established and accepted over time. Institutional theory has gained widespread acceptance and is now commonly applied in the examination of policies, and these become institutionalised as the organisation interacts with its environment. This of course has a huge effect on the organisation’s performance in today's dynamic and competitive economy (Cox, 2016; Izotov and Obydenkova, 2020; Constantinides, 2022).

Institutions play a crucial role in economic development and value chain functioning, providing coordinated low-cost exchanges, resource management, and trust among actors (Webber *et al*., 2010). Formal regulations and policies, as well as customary practices and cultural norms, influence the actions and decisions of actors within the agricultural value chain. Institutional theory provides a framework for identifying areas where existing regulations may be limiting growth and development and exploring potential changes or reforms to enhance efficiency and productivity. This theory can also shed light on the ways in which regulations and informal institutions can promote sustainability and long-term success within the agricultural sector, providing valuable insights for policymakers and practitioners (Ouma *et al.*, 2020).

Institutional theory is focused on how different social regulations and economic structures influence behaviour, the distribution of resources, and final results in an organisation (Kirsten, 2009). The study categorises institutions into three types: (1) formal economic institutions and rules, also known as political dimensions, (2) cultural values and conventions that provide moral guidance for economic actions, and (3) social networks that define each economic actor's role within the network.

2.7.3 Resource Based Theory

Resource Based Theory (RBT) is a comprehensive and widely recognized framework in strategic management that focuses on the internal resources and capabilities of a firm as the foundation for attaining a sustained competitive advantage. This theory suggests that a firm's resources and capabilities, when properly leveraged and utilised, can provide a distinct advantage over competitors and contribute to improved performance and financial success. By emphasising the importance of a firm's internal resources and capabilities, RBT provides valuable insights for managers and executives looking to drive growth and enhance the competitiveness of their organisations (Utami and Alamanos, 2023).

The RBT is a significant perspective in the study of strategic management (Barney *et al*, 2001), with the central idea being the organisational resources. It is easy to think of resources as tangible things like land, buildings, vehicles and machinery, but they can also include intangible things that can give a company an advantage or disadvantage (Wernerfelt, 1984). As such, resource is all-encompassing (Forsman, 2004). A resource audit, as proposed by Grant (2008), can be used to determine the operational level strategic value of a resource based on its impact on unit margin, according to Bowman and Ambrosini (2007).

The theory highlights the importance of four key types of resources and capabilities:

Tangible resources: These refer to the physical assets that a firm possesses, such as facilities, machinery, and equipment. These assets play a crucial role in enhancing the competitiveness of a firm as they can be leveraged and utilised to improve performance and gain a competitive edge. By focusing on the importance of tangible resources, the Resource Based Theory provides valuable insights for managers and executives looking to optimise the use of their assets and drive growth and success for their organisations.

Intangible resources: These refer to non-physical assets that a firm possesses, such as knowledge, expertise, reputation, and intellectual property. These intangible resources are critical in enabling a firm to achieve a competitive advantage as they can be leveraged and utilised to improve performance, differentiate from competitors, and create value. By focusing on the importance of intangible resources, the Resource Based Theory provides valuable insights for managers and executives looking to harness the full potential of their non-physical assets and drive growth and success for their organisations.

Organisational capabilities: which refers to a firm's ability to effectively manage and coordinate its resources, such as its ability to innovate, implement new ideas, and efficiently run its operations. These capabilities play a vital role in enhancing the competitiveness of a firm as they enable the effective utilisation and coordination of resources to improve performance and gain a competitive edge. By focusing on the importance of organisational capabilities, the Resource Based Theory provides valuable insights for managers and executives looking to optimise the effectiveness of their operations and drive growth and success for their organisations.

Dynamic capabilities: which refer to a firm's ability to continuously evolve and transform in response to the dynamic and constantly changing competitive environment. This includes the ability to quickly adopt new technologies, enter new markets, and respond to changing customer demands. These dynamic capabilities play a vital role in enabling a firm to maintain its competitiveness and remain relevant in a rapidly changing business landscape. By focusing on the importance of dynamic capabilities, the Resource Based Theory provides valuable insights for managers and executives looking to continuously innovate and adapt to changing circumstances, and drive growth and success for their organisations.

Tangible resources are physical and measurable resources (e.g., furniture, equipment, land, etc). These resources appear on the organisation’s balance sheet, and lose value with time (Prahalad and Hamel, 1990). Intangible resources on the other hand include brand recognition, brand culture, manufacturing capabilities, etc). It is important to note that classifying resources as either tangible or intangible has its limitation. For example, a company’s most important resource is its employees and their “technical know-how” (Phelan and Lewin, 2000). Human capital is an intangible resource, and it is indeed challenging to classify because while people are TR, their knowledge, judgement and relationships are not. In the actual sense, resources are not productive by themselves; they must be effectively utilised and sometimes marshalled to perform an activity. According to Prahalad and Hamel (1990), "capabilities" are the abilities of an organisation that lead to a positive reputation or exceptional customer service, and if these capabilities give the organisation a competitive edge, they are referred to as "core competencies".

According to RBT, resources that enable a company to maintain a competitive advantage are typically long-lasting, difficult to acquire and imitate, and superior to those of competitors. These resources are also hard to substitute with alternatives. This theory, proposed by Collis and Montgomery (2008) and Peteraf (1993), suggests that the key to a company's success lies in its ability to effectively utilise and manage these resources. Resources are classified as "strategic" if they have value, rarity, difficulty to imitate, and no readily available substitute, whereas resources without these traits are referred to as "basic. According to Amit and Schoemaker (1993), strategic assets are a group of resources and skills that are rare and difficult to replicate. They can be controlled by the firm, are specialised, and provides the company with a competitive edge. These assets are mostly considered intangible, instead of tangible (Itami and Roehl, 1987; Hall, 1992; Spender, 1996a).

RBT asserts that a firm's resources and capabilities are the key drivers of its competitiveness and success, and that these resources must be valuable, rare, inimitable, and non-substitutable (VRIN/VRIO) to provide a sustainable source of competitive advantage. VRIN/VRIO frameworks are built on RBT by providing a more in-depth evaluation of a firm's resources and capabilities, beyond just the VRIN criteria, to determine their competitiveness and potential for providing a sustainable source of competitive advantage. VRIO, in particular, also evaluates the firm's organisational capabilities to effectively utilise and exploit its resources and capabilities, which is an important consideration for RBT.

VRIN and VRIO are frameworks used to assess the value, rarity, Inimitability, and organisation of a firm's resources and capabilities. VRIN is a framework used to evaluate the competitiveness of a firm's resources and capabilities. The VRIN framework considers whether the resources and capabilities provide value, are rare, are difficult to imitate, and are not easily replaced by competitors. If a firm's resources and capabilities me*et al*l of these criteria, they are considered to be a sustainable source of competitive advantage. VRIO Value, Rarity, Inimitability, Organisation) is a more in-depth version of the VRIN framework. In addition to considering the value, rarity, and Inimitability of a firm's resources and capabilities, the VRIO framework also evaluates the organisation of the firm in terms of its ability to effectively utilise and exploit its resources and capabilities. A company's resources and abilities are viewed as a lasting source of competitive advantage if they meet the VRIN criteria and the firm possesses the necessary organisational abilities to efficiently use and leverage them.

VRIN and VRIO frameworks can be applied to analyse the resources and capabilities of smallholder farmers in the context of AVC optimisation in a turbulent economy. This analysis can help to identify the sources of competitive advantage and disadvantages of the smallholder farmers in the AVC and provide insights into how they can optimise their operations. For instance, if a smallholder farmer has access to high-quality seeds and technology that is difficult for other farmers to imitate, this would be considered a rare and inimitable resource. However, the VRIO framework would also consider whether the smallholder farmer has the organisational capability to effectively utilise and exploit these resources.

Similarly, if a smallholder farmer has access to a reliable network of buyers for their produce, this could be considered a valuable resource. However, the VRIN framework would also consider whether this network is rare and difficult for other farmers to imitate, and whether it is non-substitutable. The VRIN and VRIO frameworks can also be used to identify areas where smallholder farmers may be at a disadvantage, such as a lack of access to transportation and storage infrastructure, or a lack of marketing and distribution channels. By understanding their strengths and weaknesses in these areas, smallholder farmers can take steps to improve their competitiveness and participate more effectively in the agricultural value chain. By applying the VRIN and VRIO frameworks, smallholder farmers can identify the resources and capabilities that can be leveraged to optimise their operations in a turbulent economy and develop strategies to effectively utilise and exploit these resources.

The more an organisation diversifies and differentiates its resources, the more likely its competitive advantage will be strong and long-lasting. (Grant, 2008). RBT argues that if resources are not utilised effectively in the market, it can lead to their relocation to other industries, making diversification a strategy for greater efficiency (Montgomery and Wernerfelt, 1997). As such, Wernerfelt (1984) was of the conviction that the RBT is the most comprehensive approach to understanding strategic management in AVC, and it is thus a valuable framework for analysing and optimising these chains, due to the significant role of resources. As stated by some authors (e.g., Forsman, 2004 and Rantamaki-Lahtinen, 2009), the optimisation of a value chain often depends on the availability of resources, and these resources do not necessarily have to be solely owned by a farmer but can also be shared through cooperatives, which can provide an additional benefit of farmers learning from one another.

According to the resource-based theory, for a firm to attain a sustained competitive advantage, its resources and capabilities need to be aligned with its external environment. This can be accomplished through thorough strategy formulation, effective management, and successful implementation. This theory has been widely utilised in the field of strategic management research, and it has been employed to explain the source of competitive advantage for firms across various industries, including the agricultural sector. A firm operating in the agricultural sector can attain a competitive edge and achieve better performance and higher profits by effectively utilising its internal resources and capabilities. The resource-based theory posits that these internal resources and capabilities can be leveraged to gain a sustainable advantage over competitors in the market. The resource-based theory can be utilised to study the impact of resources and capabilities on the competitiveness and performance of firms and actors within the agricultural value chain. By applying RBT in this context, it is possible to explore several different aspects of the value chain, including:

Analysis of resource endowments**:** This type of analysis can provide valuable insights into the resources and capabilities available to actors within the value chain, and how they contribute to their competitiveness. Additionally, it can help to identify areas where actors may be deficient in critical resources and capabilities, and offer opportunities for improvement through the acquisition or development of these resources. By considering these factors, RBT can aid in promoting competitiveness and performance within the agricultural value chain.

Study of resource utilisation**:** Through the use of RBT, researchers and analysts can gain a more comprehensive understanding of how the actors within the agricultural value chain are utilising their available resources and capabilities to attain success. This examination can reveal areas where resources may be misallocated or underutilised, and provide insights into potential ways to enhance resource utilisation for greater efficiency and competitiveness.

Assessment of resource acquisition**:** This approach allows for a closer examination of the acquisition strategies employed by the actors within the value chain, and how these strategies contribute to or detract from their competitiveness. This analysis can provide valuable insight into potential opportunities for actors to enhance their resource endowments, as well as any challenges that may arise in the process of acquiring new resources and capabilities.

Promotion of resource development**:** This analysis can help to promote the development of new resources and capabilities within the sector and enhance the competitiveness and performance of actors within the value chain. Through this application, a deeper understanding of the resources and capabilities that shape the agricultural sector can be gained, and potential areas for improvement can be identified. As a result, this approach can lead to a more efficient and sustainable agricultural sector by promoting the development of the resources and capabilities that are essential to its success.

2.8 Conceptual Framework

This section would provide a concise description of the phenomena under study; it would provide a basic structure consisting of certain abstract concepts that represent the observational, experimental and synthetically aspects of the process being conceived (Bogdan & Biklen, 2007) (see illustration in Figure 2.2).

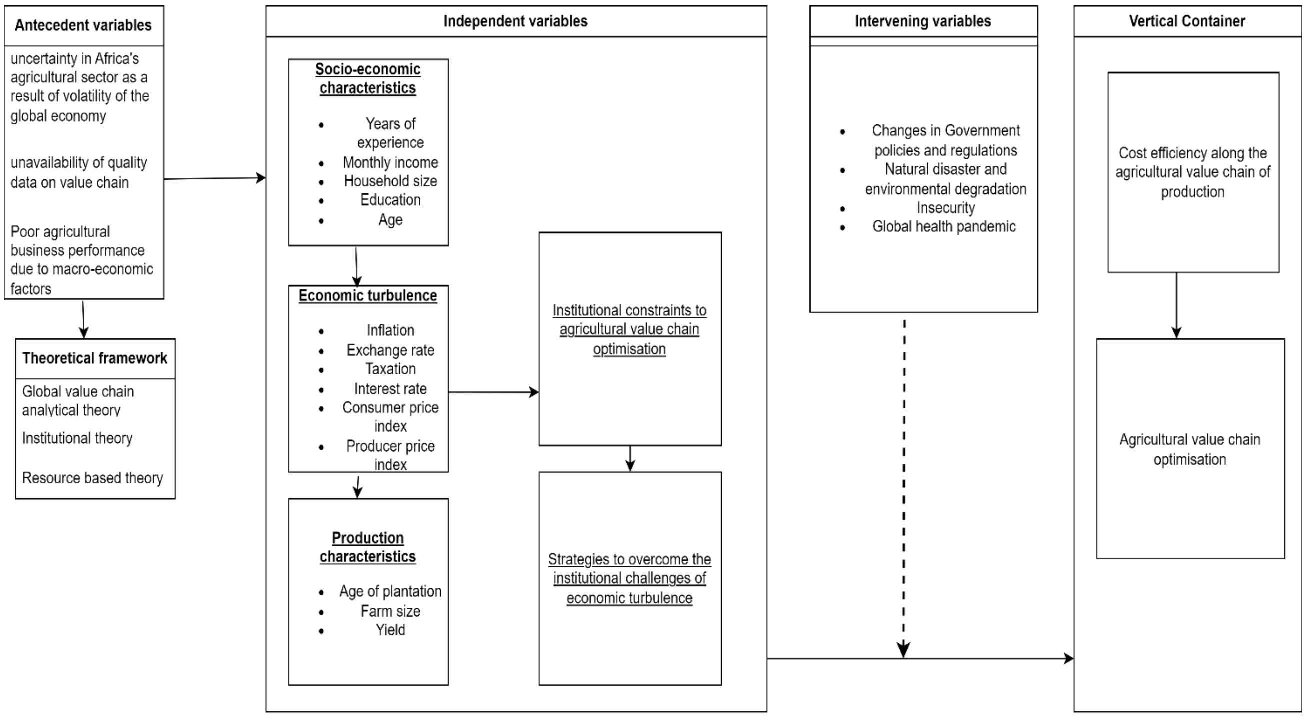

Figure 2.3: Conceptual framework.

2.9 Hypotheses development

Economic stability is a critical factor in the efficient operation of a region's production value chain, which encompasses the movement of goods, people, and information. Economic instability can cause disruptions in these activities, particularly affecting smallholder communities. Such turbulence can impose significant constraints on economic actors within the value chain, often resulting in a high-cost environment (Iyobiyi and Musa-Pedro, 2020). However, there is potential for improvement. By transforming the agricultural sector from a rudimentary system to a more efficient one, it is possible to enhance supply chain activities. This transformation could lead to job creation, increased industrial participation, and the effective utilisation of other production factors. Ultimately, addressing economic instability could provide an enabling environment for other sectors within the economy, leading to overall economic growth (FAO 2012a; FAO, 2020).

Global Value Chains (GVCs) are complex networks that connect various stages of production for a multitude of goods and services across geographical boundaries and time periods. The impact of GVCs on an economy, society, and politics varies due to factors such as positioning within the value chain, production phase, location, and product type (Jones *et al*., 2019). While many studies have explored the economic impact of GVCs using traditional indicators (Truelove *et al*., 2023), there is a gap in research focusing on optimisation (Nicolas *et al*., 2020).

In the context of Nigeria's smallholder farmers, these principles hold true. Economic turbulence can significantly affect their operations and yield (Chiaka *et al*., 2022; Uwagboe *et al*., 2010). However, with strategic interventions and support systems in place, these farmers can optimise their value chains despite economic instability (Ayeni and Adewumi, 2023). For instance, advances in digital and analytics technologies offer a way to optimise the agriculture supply chain (Nicolas *et al*., 2020). The agriculture industry is capturing more data than ever, on everything from agronomy to the weather to logistics to market price volatility (Nicolas *et al*., 2020). This data can be leveraged to make informed decisions and improve efficiency.

Given this context, this study proposes theses hypotheses:

$H_0$1: Economic turbulence does not significantly influence the optimization of smallholder value chains.

$H_0$2: Factors associated with economic turbulence do not significantly influence the optimization of smallholder value chains.

$H_0$3: Economic turbulence has no effect on the total production cost of smallholders along the value chain.

Hypothesis one is concerned with the overall state of economic instability and its impact on the optimization of smallholder value chains. It posits that fluctuations in the economy, such as inflation, recession, or financial crises, do not have a significant effect on how smallholder value chains are optimised. Justification for testing this hypothesis could be drawn from the resilience of smallholder farmers, who may have adapted their practices over time to withstand economic shocks. Hypothesis two goes a step further to examine specific factors associated with economic turbulence, such as changes in market prices, availability of credit, or government policies. It suggests that these individual elements do not significantly influence how smallholder value chains are optimised. The justification for testing this hypothesis could stem from the idea that while the broader economic climate may not impact value chain optimisation, specific factors within that climate could have a more direct and measurable effect. Testing both hypotheses allows for a more nuanced understanding of the relationship between economic turbulence and value chain optimisation. While H01 provides a broad overview, H02 offers a more detailed analysis, enabling us to identify and understand the specific factors at play.

Nigeria, a developing nation, has seen a shift towards market-oriented corporate farms as agriculture is largely dominated by subsistence and low-scale farming, leading to low productivity (Ikenwa *et al*., 2017). This situation has resulted in a significant income gap among Nigerians and has negatively impacted other macroeconomic variables, leading to high importation of processed agricultural products. However, smallholder farmers have been noted to be more efficient than large-scale farmers. By fully utilising the potential of smallholding farms, Nigeria could achieve food self-sufficiency and even have surplus production for export (Ikenwa *et al*., 2017; Ufiobor, 2017). There is a positive relationship between resources (tangible and intangible) and firm performance. For value chain optimisation, it is critical for smallholder farmers to identify the cost efficiency of every resource (Joshi *et al*. 2013). Therefore, this study seeks to understand the cost efficiency of each resource and how they impact the value chain optimisation of smallholders. Thus, this work hypothesised that:

$H_0$4: There is no significant correlation between the costs of resources used and the total cost of production for smallholder farmers along the value chain.

$H_0$5: The agronomic characteristics of smallholders have no effect on their value chain optimisation.

The agricultural sector is a critical component of the economy, particularly in developing countries where it plays a significant role in providing livelihoods for the majority of the population. In Nigeria, agriculture is largely dominated by smallholder farmers who engage in subsistence and low-scale farming. This has led to low productivity and a significant income gap among Nigerians, negatively impacting other macroeconomic variables and leading to high importation of processed agricultural products (Ikenwa *et al*., 2017). However, it's worth noting that the dominance of market-oriented family farms/firms and corporate farms/firms in a country's agribusiness model is dependent on the country's level of economic development and the favourable environment for agribusiness operations. As such, there has been a shift towards these types of farming models in Nigeria.

Institutions play a crucial role in shaping these agribusiness models. Established through human-created rules and regulations, institutions shape political, economic, and social interactions (North, 1990). They determine the costs of transactions through resource allocation and influence the organisation on Agricultural Value Chains (AVC) (Widyarini, 2012). Therefore, institutions can either hinder or enhance value chain optimisation of smallholders. Institution theory posits that as processes become institutionalised, they can have an effect on optimising the value chain. Institutional constraints have been theorised as an important determinant of performance of the AVC (Ibua, 2014). These constraints can come in various forms such as policies that favour large-scale farmers, lack of access to credit facilities for smallholder farmers, or even infrastructural challenges that make it difficult for smallholder farmers to get their products to the market. Understanding the role of institutions in agricultural value chains is crucial for improving productivity and reducing income inequality among farmers in Nigeria. By addressing institutional constraints and implementing effective strategies to overcome these challenges, it is possible to optimise the value chain for smallholder farmers and promote a more equitable distribution of resources in the agricultural sector. Given this, this study proposes that:

$H_0 6$: Institutional constraints to value chain optimisation have no influence on the value chain optimisation of smallholders.

$H_0 7$: Strategies to overcome the institutional challenges of environmental turbulence has no impact on the value chain optimisation of smallholders.

2.10 Empirical framework

Undoubtedly, smallholder farmers stand to gain a lot by learning from the global value chain analytical framework (GVCAF), resource-based theory (RBT) and the institutional theory (IT) (Smith, 2018). The GVCAF posits that smallholders have the responsibility to contribute to the economy, but do not have the appropriate tools, resources, information, and network to become competitive (Johnson & Johnson, 2020). RBT advocates that farmers should identify key resources along the value chain and cultivate the necessary skills to effectively manage them, in order to gain a competitive edge and maximise value (Brown & Green, 2021). On another hand, the institutional theory advocates for farmers to consider the institutional context prior to crafting strategies and taking actions (Williams, 2019). In addition to that, while the institutional theory delves into the examination of how formal and informal institutions influence and direct the actions of participants within the agricultural sector (Williams, 2019), the resource base theory focuses on the evaluation of the resources and capabilities that drive the competitiveness of firms and players within the value chain (Brown & Green, 2021). On the other hand, GVC is a comprehensive examination of how the agricultural value chain is integrated into the worldwide economy and the inter-connections between the various actors within the chain (Johnson & Johnson, 2020).

Oliver (1997) corroborates the idea of considering the institutional context when making strategic decisions. Similarly, the study highlights the impact of resource-based and institutional factors on managerial decision-making; this in turn influences a firm's resource selection, accumulation, and deployment. This is largely responsible for the observed heterogeneity between businesses, and allows business to sustainably gain competitive advantage along the value chain. Peng (2002) and Peng *et al*. (2009) advanced the concept of an institution-based view of strategy and advocated for its recognition as the third major perspective in strategic management, alongside the industry-based view and resource-based view established by Porter (1980) and Barney (1991) respectively. By utilising knowledge from various theories, small-scale farmers can come up with more efficient plans and improve their ability to handle external influences on their operations from institutions. These institutions may exert pressure on the farmers, but they can also come up with creative ways to comply with institutional demands while utilising resources that are consecrated to them, ultimately optimising the value chain.

Institutional theory, when applied to the agricultural value chain, can shed light on how the formal and informal structures, regulations, and policies that govern the behaviour of actors within the chain impact their resource endowments and utilisation, and thereby affect their competitiveness and performance (Truelove et al., 2023). By examining the interaction between institutions and resource endowments, one can understand how favourable or unfavourable institutional arrangements can provide opportunities or constraints for actors to effectively access, use and develop their resources and capabilities, thereby impacting their competitiveness and efficiency within the value chain (Truelove et al., 2023).

Moreover, the integration of the agricultural value chain into the global economy through globalisation is significantly impacted by a variety of factors, including institutional arrangements, regulations, and the resource endowments of actors within the chain (OECD, 2022). The availability and utilisation of resources and capabilities play a crucial role in determining the competitiveness of actors in the value chain, which ultimately affects their ability to participate and compete in the global economy (OECD, 2022).

The integration of institutional theory, the resource-based view, and the global value chain framework provides a comprehensive and holistic perspective on the challenges and opportunities faced by smallholder farmers in the agricultural sector (Truelove et al., 2023; OECD, 2022). By examining the role of institutions, resources, and integration into the global economy, it becomes possible to identify gaps and limitations in the resources and capabilities of smallholder farmers, and to propose effective strategies for improvement, leading to increased competitiveness, efficiency, and sustainable development in the sector sector (Truelove et al., 2023; OECD, 2022). It accentuates the significance of both formal and informal institutions, examines the impact of globalisation on small-scale farmers, and provides a road map for their improved integration into the worldwide value chain (OECD, 2022).

To sum up, the connection between institutional theory, resource-based theory, and the global value chain framework within the context of the agricultural value chain provides a comprehensive view of the interaction between institutions, resources and capabilities, and worldwide economic integration in determining the competitiveness and efficiency of the agricultural sector (Trienekens, 2011). By exploring this interplay, it sheds light on the importance of these factors in shaping the success and viability of the agricultural value chain (Devaux et al., 2018) and offers valuable insights into the strategies that can be adopted to enhance its competitiveness and efficiency. By incorporating all three perspectives, a more thorough and insightful understanding of the agricultural value chain can be achieved (Truelove et al., 2023), thus allowing for the identification of areas for improvement and enhancement. This multi-faceted approach takes into account all critical factors that contribute to success and competitiveness of agricultural value chains (Hernandez et al., 2017) providing a comprehensive road map for addressing challenges within this sector. By considering all these elements, it becomes possible to craft effective strategies for maximising efficiency within this sector.

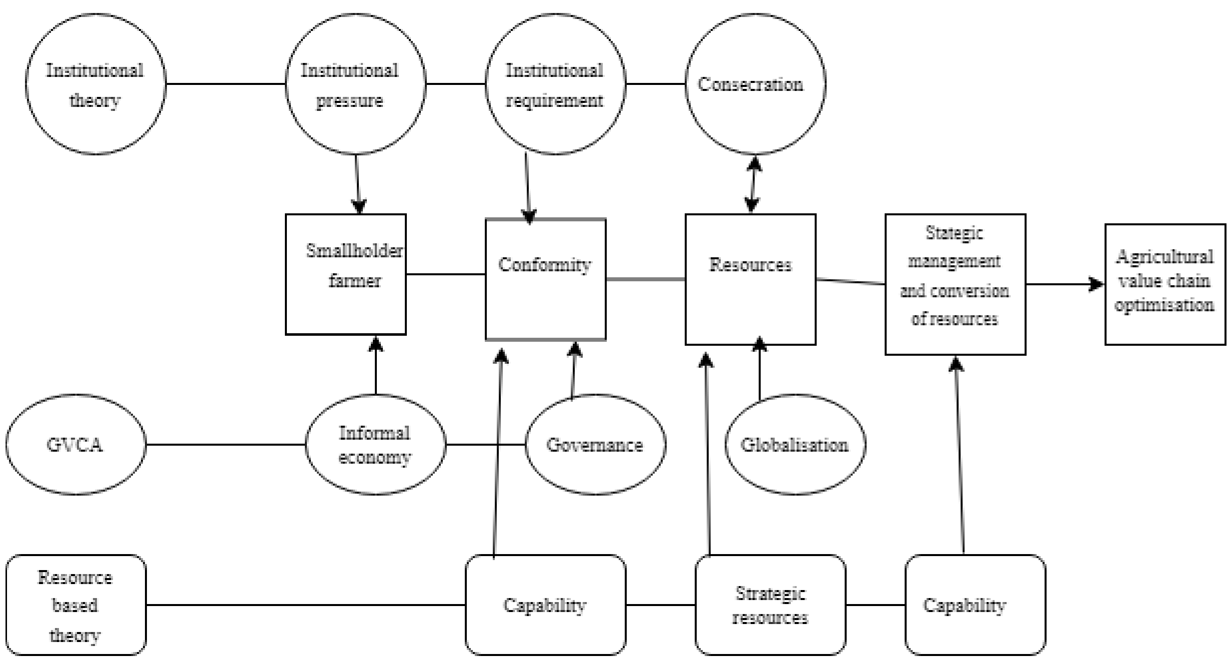

Figure 2.4: Empirical framework (Adapted from Tokaranyaset (2013)

2.11 Gaps in Literature

The literature review on agricultural value chain optimisation in a turbulent economy has identified several key gaps. These gaps include:

1. Limited research on value chain optimization in the context of economic instability: While there is a significant body of literature on value chain optimisation in the agricultural sector, there are still some gaps in the literature that need to be addressed. One of the major gaps is the lack of attention given to the impact of economic instability on the agricultural value chain. Although some studies have examined the effects of economic turbulence on the AVC sector (Iyoboyi and Musa-Pedro, 2020), there is a need for more research in this area. The impact of economic instability on the agricultural value chain is indeed a significant area that requires more attention. Economic upheavals can cause setbacks in value optimisation due to increasing costs of processing and packaging materials (Truelove *et al*., 2023). The volatility of the global economy can create uncertainty in Africa's agricultural sector.
2. Insufficient understanding of the challenges faced by smallholder farmers in a turbulent economy: The literature review reveals a lack of comprehensive understanding regarding how economic turbulence affects the smallholder farmers within the agricultural value chain. While some studies have examined the strategies used to overcome these challenges, there is still a need for more research that specifically addresses the unique challenges faced by smallholder farmers. Smallholder farmers face a range of challenges related to production and marketing, including lack of access to inputs like seed, fertilizers, and stock feed, as well as limited access to markets and marketing information (Kondowe, 2013).
3. Limited knowledge on strategies to overcome challenges faced by smallholder farmers in a turbulent economy: The literature review indicates a dearth of empirical studies scrutinising the efficacy of strategies employed to surmount challenges encountered by smallholder farmers in unstable economies. The bulk of existing research (Birthal *et al*., 2021; Atube *et al*., 2021) offers theoretical frameworks and models without substantiating their effectiveness with empirical evidence. Hence, there is a call for more empirical studies that shed light on the practical implications of these strategies.
4. Incomplete understanding of the role and dynamics of value chain actors: The review highlights a need for deeper insights into the roles, relationships, and dynamics among different actors in the agricultural value chain. This includes both direct actors, such as farmers, traders, processors, and retailers, as well as indirect actors providing financial

and non-financial services. Understanding these dynamics is crucial for enhancing collaboration and cooperation within the value chain.

Addressing these key gaps in the literature will contribute to a better understanding of value chain optimisation in a turbulent economy and provide insights into strategies that can enhance the resilience and competitiveness of smallholder farmers in Nigeria.

CHAPTER 3: EMPIRICAL CONTEXT

3.1 Introduction

According to World Bank (2021), more than one-third of Nigerians reside in rural areas, and many of these individuals are engaged in agricultural activities (Marris, 2018). Rural residents, who are primarily smallholder farmers, play a crucial role in farming in Nigeria. Additionally, a notable amount of their agricultural output is transported from rural areas to cities

3.2 Agricultural landscape in Nigeria

Fugile and Rada suggested in 2013 that the increase in crop yield per hectare and the expansion of land used for farming are the main drivers of agricultural growth. This growth can happen through improved farm inputs and the use of advanced technologies. However, over the past 40 years, the potential yield of certain crops, such as wheat, cassava, beans, and cocoa has decreased as a result of factors such as poor seed quality, soil infertility, and a lack of technology adoption in Nigeria (ICCO, 2019; Oluyole *et al*., 2019, Shittu *et al*., 2016). In contrast, as more people have become involved in farming, the amount of land used for certain crops, including cassava, cocoa beans, rice paddy, and wheat, has increased. Over the past four decades, Nigeria has seen a low share of global production for major crops such as oil palm, cocoa, and groundnut, due to a lack of efficient production processes. This has led to production being at subsistence level, causing poverty to persist in many communities and an increase in rural-urban migration. In 2014, the yields for crops in Nigeria were below the average yield for all countries that produce these crops. This indicates that other countries have implemented better methods and technologies to increase their production (Onyeneke *et al*., 2022; Chiaka *et al*., 2022). According to Emediegwu and Okeke (2017), Nigeria was principally an agrarian economy, producing cocoa, groundnuts, palm kernel, palm oil, amongst other cash crops for exports. In the late 1960s, the agricultural sector contributed on the average 55.18% to the nation's GDP and 55% of her foreign exchange earnings. However, the economy has undergone fundamental structural changes since independence, and the implementation of the medium-term development has led to the dominance of the oil sector over the agricultural sector (Emediegwu and Okeke, 2017)

Nigeria has the highest share of global food consumption among African countries, averaging 3.4% in the last five years (FAO Statistics). However, with a projected populace of 350 million, According to UNPFA, Nigeria is projected to become the third most populous country globally by the year 2050. Therefore, it is crucial to increase crop production in order to meet the people's food demand and achieve self-reliance. Currently, the rate of consumption for major crops in the country exceeds the production rate, and this gap is largely filled by imports. From 2011 to 2015 (NBS), Nigeria spent over ₦1.4 trillion on imports. As a result, Nigeria is very vulnerable to fluctuations in the global market; which can significantly impact inflation and revenue generation.

In the last four years, agro-processed exports have dropped by 41%, and these exports make up about 20% of Nigeria's non-oil export. The FAO estimates that Nigeria lost an annual $10 billion in exportation of agricultural commodities due to the production decline. According to the Nigerian Export Promotion Council (NEPC), this decline in exports is due to non-compliance with regulations and documentation required for food imports into Europe. From the report of the World Bank, $6.9 billion was lost by developing countries to rejection of food exports in 2015.

3.3 The International Cashew and Sesame Industry

The cashew tree, which is native to Brazil, was discovered by the Portuguese in the 16th century and subsequently introduced to other countries. As at today, the cashew industry's trade is primarily focused on raw nuts and kernels, although the cashew apple and shell also present other business opportunities. The global market for raw cashew nuts, which forms the basis of the industry, is currently worth over $500 million, and the market for processed cashew kernels worth more than $1 billion (IMARC, 2022).

The international cashew industry involves the production, processing, and trade of cashews globally. Cashews are a widely consumed nut that is grown in tropical regions, primarily in West Africa, South-east Asia, and South America. Cashew production has seen significant growth in recent years, driven by increasing demand for the nut as a snack and ingredient in a variety of food products. In 2020, the global cashew market was valued at over US$ 10 billion and is expected to grow further in the coming years (Market Research Future, 2021). However, the international cashew industry faces several challenges, including issues related to production and processing. In many producing countries, the majority of cashew production is done by small-scale farmers, who often lack the necessary resources and technical knowledge to produce high-quality cashews. This can result in a lower quality product, which can limit the potential for exports and reduce the competitiveness of the industry. Additionally, the cashew processing industry is concentrated in a few countries, primarily India, Vietnam, and Brazil, which can lead to challenges related to market power and price negotiation for producers in other countries (UNCTAD, 2021).

Despite these challenges, the international cashew industry offers significant opportunities for growth and development, particularly for small-scale farmers in producing countries. Efforts to improve the quality of cashew production and processing, as well as the development of new markets for the nut, can help to enhance the competitiveness of the industry and increase the benefits for producers.

Sesame is an ancient oilseed crop that originated in India (Bedigian, 2015). The international sesame seed industry is a significant global agribusiness, with sesame seeds being one of the oldest oilseeds known to humankind. Sesame seeds are grown in many countries around the world, including Africa, Asia, and Latin America, and are used for a variety of purposes, including as a source of oil for cooking and industrial applications, and as a food ingredient in a range of products, such as bakery goods, confectionery, and condiments. According to the Food and Agriculture Organisation of the United Nations (FAO, 2021), India, Myanmar, and Ethiopia are the leading producers of sesame seeds, with other countries such as Sudan, Nigeria, and Mexico also having substantial production. Sesame seeds are traded worldwide, with the majority of exports going to Asia, Europe, and North America (FAO, 2021). In Nigeria, the major sesame producing states are Kano, Katsina, Nasarawa, Jigawa, Benue, Yobe, Kogi, Gombe, and Plateau (NEPC, 2014). The FAO (2019) reports that global sesame production reached 5.5 million tonnes in 2017, with 57% grown in Africa. Mordor Intelligence (2019) and Cision (2019) estimated the global sesame market value to be $6.5 billion in 2018 and predict it will reach $17.77 billion by 2025.

One of the key challenges facing the international sesame seed industry is the lack of standardisation and regulation of quality and food safety, which can affect the competitiveness of sesame seeds in global markets (International Trade Centre, 2019). In addition, the industry is facing increasing pressure to adopt sustainable and environmentally friendly practices, such as reducing the use of pesticides and improving water management (International Trade Centre, 2019). To address these challenges, the international sesame seed industry is increasingly focused on the development of value-added products, such as organic and non-GMO sesame seeds, and the implementation of sustainable farming practices (International Trade Centre, 2019). By developing these new products and practices, the industry is positioning itself to meet the evolving demands of consumers and maintain its competitiveness in the global marketplace.

3.3.1 Global Consumer Demand

In West Africa, cashew is the second most valuable export crop after cocoa (Nitidae, 2019), making the region a significant player in the global cashew market with a 45% share since 2015 (Monteiro *et al*., 2017). The global growth rate for cashew nuts is currently 7-10% annually (GIZ, 2010), and demand is projected to exceed 4,500,000 metric tons by 2034. According to a report by Research and Markets, the main consuming countries of cashew nuts are India, the United States, European countries, China, and the Middle East (Research and Markets, 2022). This growth is due to factors such as increasing consumption patterns and economic growth in developed countries, which have resulted in cashew nuts being currently well-priced compared to other tree nuts (Global Cashew Council, 2021). Furthermore, there is an expected increase in the demand for cashew nut, which provides attractive investment opportunities for investors. According to a report by Mordor Intelligence, the global cashew nut market is expected to grow at a CAGR of 5.2% during the period 2021-2026 (Mordor Intelligence, 2021).

The demand for cashews has been driven by the growing health and wellness trend, as cashews are a rich source of protein, healthy fats, and various minerals, including iron, magnesium, and zinc (Food and Agriculture Organisation of the United Nations, 2021). In addition, the increasing popularity of plant-based diets has also contributed to the growing demand for cashews, as they can be used as a substitute for dairy products in a range of vegan and vegetarian products (Food and Agriculture Organisation of the United Nations, 2021).

Data from the International Trade Centre (2021) shows that the value of global cashew exports increased from $6.2 billion in 2016 to $7.5 billion in 2019, with the largest destinations for exports being the United States, the Netherlands, and the United Kingdom. In addition, the demand for organic and fair-trade cashews has been growing, as consumers are increasingly interested in sustainable and ethical food products (International Trade Centre, 2021).

To meet the growing demand for cashews, the global cashew industry is focused on improving productivity and efficiency in production, as well as developing new and innovative products, such as cashew-based dairy alternatives and snacks (International Trade Centre, 2021). By doing so, the industry is poised to continue to meet the evolving needs of consumers and sustain its growth in the global marketplace.

The growth in the nut market is being driven by improved planting materials, higher yields, good farming practices, and expanded cultivation areas. To meet consumers demand, new flavours e.g., honey-coated nuts, sesame-coated nuts are being introduced. Additionally, many traditional foods e.g., salads, bread, etc. are introducing this nut. While sales of some basic nut have remained stable, the premium nut market, which includes cashew, is performing well. This is largely because of its low-fat which can help lower cholesterol. Cashew production is limited to tropical regions, so demand for cashew kernels in temperate markets must be met through import

Global consumption of sesame seeds reached $6,559 million in 2018, and it is projected to exceed $7,244 million by 2024, with a compound annual growth rate of 1.7% (Mordor Intelligence, 2019). The consumption of sesame seeds is increasing globally, driven by changes in consumer behaviour and an increased awareness of the high nutritional value of sesame seeds. 70% of the world's sesame seeds are used to produce oil and meal, with oil consumption accounting for 65% and food consumption accounting for 35% (Morris, 2002). According to a report published by Myint *et al*. in the year 2020, it was discovered that seven nations, namely Tanzania, China, Sudan, Myanmar, India, Ethiopia, and Nigeria, are the leading consumers of sesame seeds and collectively account for approximately 70% of the total consumption of sesame seeds globally.

3.3.2 Production

In 2012, global cashew production was estimated at 4.2 million metric tonnes, with West Africa playing a dominant role in both current and emerging markets (Adeigbe *et al*., 2015). Annually, approximately 900,000 tons of raw cashew nuts enter the international market, and Nigeria's Export Promotion Council (NEPC) estimates the country's production at 40,000 tonnes in 2021. In 2008, Nigeria was proudly positioned as the second largest producer of raw cashew nuts globally, with a staggering production of 675,266 tons (FAO, 2009; UNCTAD, 2019). However, unfortunately, there has been a noticeable decrease in the production of raw cashew nuts in Nigeria since 2010. Despite the fact that the world production of raw cashew nuts has increased, according to Adesanya *et al*. (2021), Nigeria's production in 2019 was only 100,000 tons, leading to a significant drop in its world ranking of raw cashew nut producers, from second to 14th.

The recent trend in the production of raw cashew nuts has shown an impressive annual growth rate globally, with a range of 7-10% (GIZ, 2010). Specifically, Africa has been identified as the sole contributor to a staggering 55% of the total world production of cashew nuts. The future outlook for raw cashew nut production looks promising; with forecasts projecting that production will reach 730,000 metric tons. In addition, the extrapolated demand for raw cashew nuts is estimated to be a staggering 4.5 million metric tons, as stated by Adesanya *et al*. (2021). India is recognized as the leading consumer of raw cashew nuts globally, with the United States of America following closely behind. Other significant consumers of raw cashew nuts include the countries that make up the European Union, China, and the Middle Eastern nations. The high demand and value placed on raw cashew nuts can be attributed to a number of factors, such as the growing consumption patterns and the improvement in the economy of developed nations. These factors collectively contribute to the elevated positioning of raw cashew nuts in terms of price.

The consumption of cashew kernels is expected to experience a significant increase in the future, presenting exciting opportunities for investors in the cashew processing industry (GIZ, 2010). The latest production trend in the raw cashew nut sector, as reported by GIZ in 2019, can be attributed to a number of factors, including the utilisation of advanced propagules, an increase in yield, and better compensation for farmers, the adoption of good agricultural practices (GAP), and an expansion in the area dedicated to cashew cultivation. These developments have all contributed to the growth of the raw cashew nut sector.

The cultivation of sesame has been estimated to cover a vast area of approximately 11.7 million hectares (117,000 km2), distributed across many regions of the world, as reported by FAOSTAT in 2018 and further substantiated by Dossa *et al*. in 2023. In terms of production, sesame seeds are ranked as the seventh largest oilseed globally, just behind soybean, groundnut, cotton seed, sunflower, linseed, and rapeseed, as stated by Myint *et al*. in 2020. The global production of sesame seeds is estimated to be around 5.5 million metric tons. Out of the 22 countries that are considered to be major producers of sesame seeds globally, a significant number of them, 13 to be exact, are located in Africa, with Nigeria being among the top producers, as reported by Dossa *et al*. in 2017 and FAOSTAT in 2020, and confirmed by Myint *et al*. in 2020. According to the reports by the United Nations Statistics Division (UNSD) in 2017 and FAOSTAT in 2022, a substantial portion of the global sesame production, around 92%, comes from the leading sesame-producing nations. The yield rate of sesame production in Nigeria was 729 kg/ha, with a production rate of 573,000 metric tons/ha in 2018.

As documented by Dossa *et al*. in 2023, Africa has experienced a significant increase in its sesame seed production by 25%, and as a result, it has emerged as the second largest producer of sesame seeds globally. Furthermore, seven of the sesame seed producing nations in Africa are also among the largest group of sesame seed marketers in the world, reflecting the growth and importance of the sesame seed industry in the region. According to the data available, Nigeria has experienced a remarkable increase in its sesame seed production, which has correspondingly impacted the export market. As reported by the Financial Derivatives Company in 2018, the increasing demand for sesame seeds and its significant contribution to Nigeria's export market has put immense pressure on production, highlighting the growing significance of the sesame seed industry in the country. Despite this, Nigeria has the greatest untapped potential for sesame export majorly because production is dominated by smallholder farms (NEPC, 2018).

3.3.3 Current status of the Nigerian Cashew and Sesame Industry

Current status of the Nigerian Cashew Industry

In Nigeria, there is a single production season for cashew. The trees flower between November and December, and fruiting happens in February (CII, 2002). Typically, harvest starts in late February until early June. The trees begin bearing fruit after 2-4 years, and productivity increases from the fifth year, reaching peak production after 10 years of planting. The cashew tree can continue to produce for 25-30 years, but the yield decreases substantially after 30 years. Due to the long period of time before the trees start producing, cashew production is considered a long-term investment (CII, 2002). In 2015, Nigeria earned N50 billion from exporting cashew nuts, an improvement from the N24 billion the sector contributed in 2013 and 2014, according to Sotonye of the National Cashew Association of Nigeria (NCAN). The country exported 220,000 tonnes of raw cashew nuts in 2017, earning USD 374 million, and had an average 48 kernel output ratio (KOR) or out-turn rate, which measures the weight of usable kernels per bag of cashew nuts, according to the NEPC, 2018.

Nigeria produced over 500,000 tonnes of cashew nuts in 2020, making it one of the largest producers of cashew nuts in Africa (FAO, 2021). Despite this large production volume, Nigeria's cashew industry faces significant challenges in terms of processing and value addition, with only a small percentage of cashew nuts being processed domestically (All Africa, 2021). However, the industry has faced numerous challenges in recent years, including limited investment in processing and infrastructure, as well as a shortage of skilled labour (All Africa, 2021)

In Nigeria, the majority of the cashew nuts produced are exported in their raw form due to limited involvement in processing and adding value by only a few individuals (Lawal *et al*., 2013). A major challenge in growing Nigeria's cashew value chain industry is the limited export of processed kernels (value-added products) compared to raw nuts, causing low foreign exchange revenue and a lack of job opportunities (USAID, 2002). At present, Nigeria receives the minimum international premium for raw cashew nuts due to factors such as small nut size, inadequate peelability, and inadequate post-harvest handling, as noted by USAID-Nigeria. Eze *et al*. (2022) reported that a significant amount of cashew fruits and nuts go to waste on farms due to farmers' inadequate processing skills, hindering the production of cashew nuts suitable for local and international markets.

It has been noted that a significant portion of the value-addition process for cashews, such as roasting, packaging, and labelling, takes place in foreign countries, which results in local producers capturing only a small fraction of the final product's value. According to reports by Adeniji, (2018) and AfriCashew splits, (2020), Nigerian farmers are among the lowest paid for raw cashew nuts. This low price has led Nigeria to call for fair pricing for its raw cashews, in line with other West African countries, due to the improved quality of its product. This call was made during the 4th edition of the World Cashew Convention in Macau, 2018.

The current state of the sesame industry in Nigeria

Sesame seed, also known as beniseed, has the potential to generate significant revenue for Nigeria because it is a high-valued non-oil export crop that is in high demand in the global market. In Nigeria, there are two primary types of sesame that are grown, the brown and white varieties, which are largely cultivated by small-scale farmers (Tiamiyu *et al*., 2013). Sesame, once locally processed, finds extensive usage in the regions where it is cultivated, as reported by Galadima and Isa (2020). Furthermore, according to a study by Ikwuakam *et al*. (2016), sesame has a value-addition margin of more than 15% compared to other cash crops such as oil palm and sheanut, indicating the potential of the sesame industry in Nigeria.

Nigeria has high-quality sesame seed oil and 90% of the production is exported. The production of sesame seeds in Nigeria has been continuously improving due to the favourable prices, as reported by Tahir *et al*. (2021). The prices of sesame seeds are subject to variations based on various factors such as colour, quality as per oil content grades, origin, moisture content and purity, as explained by Rahman *et al*. (2019). On average, a metric ton of white and brown sesame seeds are sold internationally for $1,600-$1,800 and $700-$1,000 respectively. Within Nigeria, the prices for a ton of white and brown sesame seed vary, but typically sell for ₦410,000 and ₦370,000 respectively (Rahman *et al*., 2020). According to Rahman *et al*. (2019), black sesame commands a premium price over white sesame in the international market, with a difference ranging from 40% to 45%. This is due to the fact that white sesame is widely considered as a bulk commodity and utilised primarily for food seasoning, whereas black sesame, which is less abundant, is utilised in higher-value markets for its oil, as a component in medicine and in the production of value-added food products. The authors also report that hulled sesame seeds are considered to be of greater value than unshelled seeds, with the price difference between the two ranging from 10% to 15%.

3.4 Cashew Value Chain Analysis

The cashew value chain connects growers to brokers, processors, multinational buyers, suppliers of inputs, transportation providers, and other service providers (Fitzpatrick, 2011). Analysing this chain can benefit policy development, resource allocation, and the creation of research programs (Rota and Sperandini, 2010). It also has the potential to enhance product quality, prioritise investment in technology, increase profits, and reduce poverty in Nigeria by capitalizing on the growing demand for cashew in local domestic and international markets. The cashew value chain in Nigeria involves various actors and stages, from production and harvesting to processing, packaging, and marketing of the final product. Understanding the different components of the value chain is important for improving the competitiveness of the cashew industry in Nigeria and increasing its contribution to the country's economy. The majority of cashew nuts are produced by smallholder farmers, who typically sell their harvest to intermediaries or processors (All Africa, 2021).

The next stage of the value chain after production in Nigeria is processing, which involves removing the outer shell of the cashew nut and grading the kernels for sale (All Africa, 2021). Despite being a major producer of cashew nuts, Nigeria currently has limited processing capacity, with only a small percentage of cashew nuts being processed domestically (All Africa, 2021). Packaged cashew kernels are sold to traders and exporters, who are responsible for marketing and selling the product to international buyers. In recent years, the Nigerian cashew industry has faced challenges in terms of competitiveness and market access, with a reliance on imports of processed cashew nuts and limited investment in processing and marketing infrastructure. To address these challenges and improve the competitiveness of the cashew industry in Nigeria, various initiatives have been undertaken, including investments in processing infrastructure, capacity building for farmers and processors, and market linkages for smallholder farmers. These efforts aim to increase the value added in the domestic cashew industry and improve its contribution to the Nigerian economy.

3.4.1 Cashew nut products and by-products

Cashew nut and its by-products that can be exploited by adding value as listed by Bianca and Stefano (2014) include:

Cashew nut kernel: This is the production target, and it is majorly consumed as snack when roasted. Also, in the food industry, this nut acts as a substitute for other nuts (Judge and Azam-Ali, 2001).

Cashew Seedlings: Harvesting cashew seedlings for sale involves moving seedlings from nurseries, but it has been reported to have a potential negative effect due to the delicate root system of cashew seedlings (Judge and Azam-Ali, 2001). However, Abdulsalam and Peter (2010) believe that seedlings with strong tap and lateral roots have better survival rates during transplant shock and drought when propagated through transplantation.

CNSL: Due to its unique chemical properties, CNSL is the primary by-product obtained from cashew nut processing (Quirino *et al*., 2014). Around 30-35% of the raw nut shell is CNSL, primarily used in the polymer sector as a raw material for making brake linings, varnishes, and surface coatings (Das *et al*., 2004).

Cashew Skin Extract: This is the reddish-brown testa that covers the kernel. It is a source of hydrolysable tannins, polyphenols such as cardol, anacardic acid, and cardanol.

Cashew Shell Cake**:** This material is obtained following the removal of the nut shell liquid, and it is utilised as fuel in cashew processing factories and shell liquid extraction (per Nair, 2010), and according to Mohod *et al*., 2008, its energy content exceeds that of sawdust.

Other secondary products include cashew kernel oil, cashew kernel powder, cashew kernel butter and cashew kernel milk (Nair, 2010).

3.4.2 Processing Evolution of the national output and perspectives

In Nigeria, there are three types of cashew processing methods: Small Cottage Processing: This type of manual processing is done by small cottage industries, using low-quality nuts and employing basic roasting methods to remove toxic elements. The shells are manually cracked and the kernels are heated to remove the skin. This method produces nuts of low quality, leading to significant size variations and inconsistent roasting.

Processing for export: This form of processing developed mainly after the economy was deregulated. It is performed by plants such as Premier Cashew Processing Industry in Enugu and a cashew processing factory in Ibadan, which process roughly 10% of the local output and also offer processing services for nut merchants.

Processing for the local market: The Nigerian nuts are given a delicious boost in flavour with this method. To boost sales, the kernels are roasted, seasoned, and packaged in eye-catching containers. These branded items can be found in retail stores, sold at a rate of $2 to $3 per 200g pack. The nuts are of a consistent high quality, produced under strict hygiene guidelines, and conform to regulatory standards (a list of processors can be found in the annex).

Types of processed products commercialised**:** In Nigeria, three forms of cashew products are available: (1) Cottage product, primarily for local consumption; (2) Factory-processed product, for export (such as W450, W-240, W-320, etc.), frequently packaged in jute bags and tins; (3) Branded product, flavoured/salted nuts for middle and high-income consumers, mostly whole nut, whites, and sold in retail stores.

3.4.3 Factors influencing the national processing performance

A low-quality cashew nut can result from immaturity, improper drying, contamination, genetic characteristics, etc. Cashew processing requires activities that can be performed either mechanically or manually, but small-scale processors often lack this capability (Mutayoba and Kusiluka, 2018). The national processing efficiency of this nut is evaluated based on: availability of raw material, processing technique, etc. Improvement efforts have been made, particularly in India, which was the first to enter the global cashew trade. From 1959 to 2008, India saw an increase in the number of cashew processing firms from 170 to over 3500, and has implemented energy-efficient methods such as solar power and biomass gasification. This industry provides jobs for half a million persons, especially women.

In Africa, efforts have been made to enhance the capacity of small-scale processors through upgrading processing equipment and raising the farm-gate price. This led to a rise in the domestic processing rate of raw cashews from 5% in 2012 to 8% in 2016 (Nicholson *et al*., 2019). Small, medium, and large-scale processors handle cashew nut processing in Nigeria, with manual small-scale processors making up the majority. Typically, they process less than one ton per day using materials obtained from their own farms. A study by Fitzpatrick (2011) evaluated the challenges faced by small-medium processors in five African countries; these include limited knowledge, unavailability of appropriate equipment, lack of working capital, etc.

3.4.4 Processing Constraints

The raw cashew nut processing industry in Nigeria faces a number of constraints, which limit its competitiveness and impact its contribution to the Nigerian economy. Some of the key constraints include:

Lack of processing infrastructure**:** Nigeria has a limited ability to process cashew nuts, with only a small fraction of them being processed locally. The absence of processing infrastructure is a significant challenge for the industry, hindering the potential for value-addition and limiting the competitiveness of Nigeria's domestic cashew industry (All Africa, 2021).

Shortage of skilled labour**:** The cashew processing sector in Nigeria experiences a shortage of skilled workers, affecting the quality and efficiency of processing (Ojo, 2020). This shortage of skilled labour has been identified as a significant obstacle to the growth of the industry, limiting its potential for expansion and competitiveness in the global market (Venkataram, 2019).

Reliance on imports**:** The dependence on imported processed cashew nuts also constitutes a hindrance for the domestic cashew industry, diminishing its competitiveness, and limiting the potential for value-addition and job creation (Ojo, 2020).

Lack of Market Access**:** In Nigeria, small-scale farmers frequently encounter challenges in finding markets for their cashew nuts, hindering their ability to earn a fair price (Adeigbe *et al*., 2015). This lack of market access also constitutes an obstacle for the growth of the cashew industry in Nigeria, restricting its potential for expansion and competitiveness (Ameh *et al*., 2022).

3.4.5 Packaging

Nigerian cashews are packaged in 80kg jute bags, or polythene bags, with 13 bags equaling one ton. Processed nuts for exportation are often placed in tins or cartons, which are vacuum-sealed and filled with carbon dioxide to prevent contamination and deterioration during transit. Proper packaging like this is crucial for quality; in alignment with NSPRI's mission of increasing the country’s self-reliance through reduction in post-harvest loss (Babarinsa and Omodara, 2017). The cashew packaging industry in Nigeria is faced with several challenges, including:

Lack of Standardisation**:** The cashew packaging sector in Nigeria faces the issue of a lack of standardisation, hindering the competitiveness of the domestic cashew industry in the global market. This absence of standardisation can also have an impact on the quality of the cashew nuts, leading to inconsistent packaging and labelling (Babarinsa and Omodara, 2017).

Limited Packaging Material Availability: The cashew packaging industry in Nigeria faces the challenge of a shortage of packaging materials, hindering its potential for growth and competitiveness (Nwosu *et al*., 2016). This shortage can cause inefficiencies and increased costs in the packaging process.

High Cost of Packaging Materials: The high cost of packaging materials is a hindrance to the growth of the cashew packaging industry in Nigeria, as it affects the competitiveness of the domestic industry in the global market by raising production costs (Mordor Intelligence, 2023; Babarinsa and Omodara, 2017).

Inadequate Packaging Technology**:** Another challenge for the cashew packaging industry in Nigeria is the absence of advanced packaging technology, which hampers the potential for efficiency and cost-effectiveness in the packaging process (NEPC, 2021).

The Nigerian government and development organisations have been working to support the development of the cashew packaging industry, including investments in modern packaging technology and capacity building for packaging companies (All Africa, 2021). These efforts aim to improve the competitiveness of the domestic cashew industry in the global market and increase its contribution to the Nigerian economy.

3.4.6 The performance of the value chain

Evaluating supply chain performance involves assessing both logistical (e.g., facilities, inventory, etc.) and cross-functional factors (e.g., information, pricing, etc.) Chopra and Meindl (2013). Maintaining quality in the cashew industry requires coordination throughout the value chain, from selecting the best seed varieties to proper storing, packaging, etc. Also, along the value chain, cold storage should be considered to maintain freshness during transit (Srivastava *et al*., 2013). To determine the prices for nuts and kernels, buyers consider factors such as availability of raw material, cost of transaction, and available markets.

To grow an economy sustainably, there must be harmony and balance between consumer's preference and resource allocation (Bonney, 2009). This can be achieved through grading, using cashew nut shell residue to improve soil fertility, planting organic cashews, reducing post-harvest waste, providing support for extension services, etc. Also, support of the government is required through policies like investment in certification, developing industry standards, capacity building, etc. In many developing economies, the governments lack the resources to create agricultural development programs, so external support from international organisation may be required (Reardon and Gulati, 2008). This could involve creating access to facilities, information flow, participating in risk sharing. Also, researches geared towards developing drought-tolerant varieties could be funded (INCAJU, 2014; ADB, 2013).

At present, Nigeria's cashew industry concentrates on the nut, excluding other product derivatives. Brazil, the world's third-largest cashew processor, possesses expertise in processing both the cashew apple and CNSL comprehensively. The health benefits of the cashew apple associated with consumer's demand of new products can be an opportunity to drive more value into the chain, and this will improve the welfare of the rural farmers (Abate and Peterson, 2005).

3.4.7 Raw cashew nut marketing in Nigeria

In Nigeria, the production of RCNs depends majorly on the small-scale farmers, unfortunately, a large number of exploitative middlemen control the local buyers and pay farmers far less than deserving (Adejo *et al*., n.d.). Also, in the cashew value chain, there exists a twin issue of inefficient marketing and poor pricing (NEPC, 2021). Hence, it is imperative to create efficient marketing channels and working systems.

Based on field observation, RCNs are frequently sold by farmers to buyers through local sales agents, licensed and unlicensed buyers, and a small number of cashew companies. These outlets acquire cashew from the farm gate or farmers' homes, then export the commodity internationally (Adejo *et al*., n.d.).

Sadly, these farmers are typically unawareness of daily cashew prices in the international market; hence, their selling price is often lower than what could have been obtained. This ignorance contributes to the inadequate agricultural commodity marketing in Nigeria (Adejo *et al*., 2011). The cashew nut marketing system in Nigeria is disorganised due to the absence of specialised traders for RCNs. Instead, there are often middlemen exporters and traders who facilitate the exchange of information and negotiation of deals. As such, middlemen play key roles in marketing, thus reducing farmers' dividends. In essence, there needs to be a review of the liberalization policy of the Nigerian government in the marketing of commodity crops. Although this policy was aimed to boost competition and increase profits for all participants along in the value chain, so far, the intended benefits were short-lived because the buyers cheat the farmers at the farm gate.

3.5 Sesame seed production in Nigeria

Sesame, a crop grown primarily by smallholders, often receives minimal attention and is typically inter-cropped, making the extent of its cultivation not well documented. There is also limited information available on yield. Despite this, surplus sesame undergoes basic processing such as drying and cleaning before being bulked up for exportation (Haruna *et al*., 2015). The top producing areas in Nigeria include Nasarawa, Jigawa, and Benue States (Ukpe *et al*., 2023). The harvest season begins in December and lasts until July with only one season per producing area. In Nigeria, two varieties of sesame are grown. However, a limited number of companies are involved in the trade due to the crop's minimal attention (Haruna *et al*., 2015).

<u>White/raw:</u> The "White (Food Grade)" variety of sesame is grown in areas near Keffi, Lafia/Makurdi, Doma, and in states like Nasarawa, Taraba, and Benue. This variety is easier to sort and is consumed locally by the Fulani/Denin people. It is popular in the bakery industry due to its high grade (98-100% whiteness) seed.

<u>Brown/mixed:</u> The "Brown/Mixed" variety of sesame is predominantly cultivated in the northern regions of Nigeria, specifically in Kano and Jigawa states near Hadejia, and to a lesser extent in southern Katsina state. This type is primarily utilised for oil production.

The domestic production of sesame seeds in Nigeria holds great promise for both the local and international markets. Its economic benefits, such as being a source of raw materials for industries and a means of earning foreign exchange, make it important for the Nigerian government and non-governmental organisations to prioritise and develop plans to expand and enhance sesame seed production in order to meet the growing demand from both the local and foreign markets. The advancements in production and processing technology in Nigeria, including the development of high-yielding sesame seed varieties that are tolerant to biotic and abiotic stresses, as stated by Alegbejo *et al*. (2008), are a result of the focused and intentional investment made in research and development efforts towards the improvement of sesame seed production. This has placed Nigeria as the largest producer of sesame seeds in Africa and exports about 90% of its production. In Q1 2018, sesame was reported as the top non-oil commodity exported; accounting for 0.57% of total export value and 36.39% of agricultural exports (Proshare, 2018).

With an estimated untapped potential of $170 million (NEPC, 2018), Nigeria holds the highest potential for sesame exports in Africa.

3.5.1 Sesame seeds product and by-products

Sesame is a highly versatile crop that serves numerous purposes. According to Mshelia *et al*. (2012), a large portion of Nigeria's annual sesame production, approximately 65%, is processed into oil while the remaining 35% is utilised in various food forms such as ground sesame, washed sesame, roasted sesame, etc. Furthermore, Junaidu *et al*. (2022) have stated that the by-products and finished products of sesame seeds hold immense potential as raw materials for agro-allied industries in the production of livestock feeds and as sources of revenue for various actors in its value chain, as well as for the government. In addition to its uses in the food industry, sesame seeds are also utilised in the confectionery and baking sectors to create a wide range of baked goods such as biscuits, breads and other pastries. According to Mshelia *et al*. (2012), sesame seeds are even baked into crackers in the shape of sticks. Furthermore, the oil derived from sesame seeds has a variety of applications, including cooking, production of margarine, and various local purposes such as soap making, paint production, lubrication, and illumination. Additionally, sesame oil has been found to have medicinal properties, including the treatment of ulcers and burns (Junaidu *et al*., 2022).

There are a variety of ways in which sesame products are utilised and processed locally (Junaidu *et al*., 2022). Sesame biscuit, referred to as "Kantun-ridi" and Sesame pop, known as "Kunun-ridi," are just a few of the main locally processed products made from sesame seeds. Falusi (2018) also pointed out that sesame is often roasted and sprinkled on pancakes, chin-chin, and doughnuts and is frequently utilised as a soup thickener and condiment by local producers in Nigeria.

3.5.2 Nigeria sesame value chain analysis

The sesame seeds value chain holds tremendous potential for fostering the growth of agribusiness and creating numerous employment opportunities that will have a substantial impact on the rural sector in Nigeria. The sesame value chain includes individual farmers, farmer groups, clusters, cooperatives, and those participating in out-grower schemes. The transportation and sale of sesame seeds from rural areas to urban centers in Nigeria is mainly carried out by middlemen or buyers, as noted by Ali *et al*. (2015). The sesame seeds are usually transported in large quantities and sold to agents who work for major exporters, as reported by Chemonics

(2002). The National Sesame Seed Association of Nigeria (NSSAN) is the leading organisation for sesame farmers in Nigeria, however, many sesame farmers in the country are not registered members of this association. The North-East Commodity Association (NECAS) is a registered and active regional agro-commodity group in Nigeria. This group coordinates sesame production and value chain development in the North-East Nigeria. The Association has expanded its scope through initiatives such as the Federal Government/Central Bank of Nigeria Anchor Borrowers' Program, a drive for mechanisation, and partnerships with development agencies. Smallholder farmers are the main cultivators of sesame, and their commercialisation is managed by buyers, procurement companies, and middlemen who travel to the producing areas to purchase directly from the farmers. After purchase, these buyers transport the seeds to cities for storage or to sell to exporters' agents. Each producing state has storage facilities where aggregated seeds are temporarily held before being exported from the ports. These facilities, owned by the private individuals, come in varying sizes and can be rented or leased. For instance, NECAS has warehouses within farming communities, and in major cities; this simplifies aggregation and transportation.

3.5.3 Trade performance

With the high fluctuations in the price of sesame seeds globally in recent times, the prices of sesame seeds continue to rise despite the increase in supply (Rahman *et al*., 2019). According to Rahman *et al*. (2019), the average global price of sesame seeds in 2018, as reported by the International Trade Centre (ITC), reached $1,229 per ton, with notable variations in prices observed in different export destinations. Nigeria's sesame seed exports range from 140,000 to 180,000 tons per year, with the Middle East and Asia as the main destinations for these exports as shown in Figure 3.1.

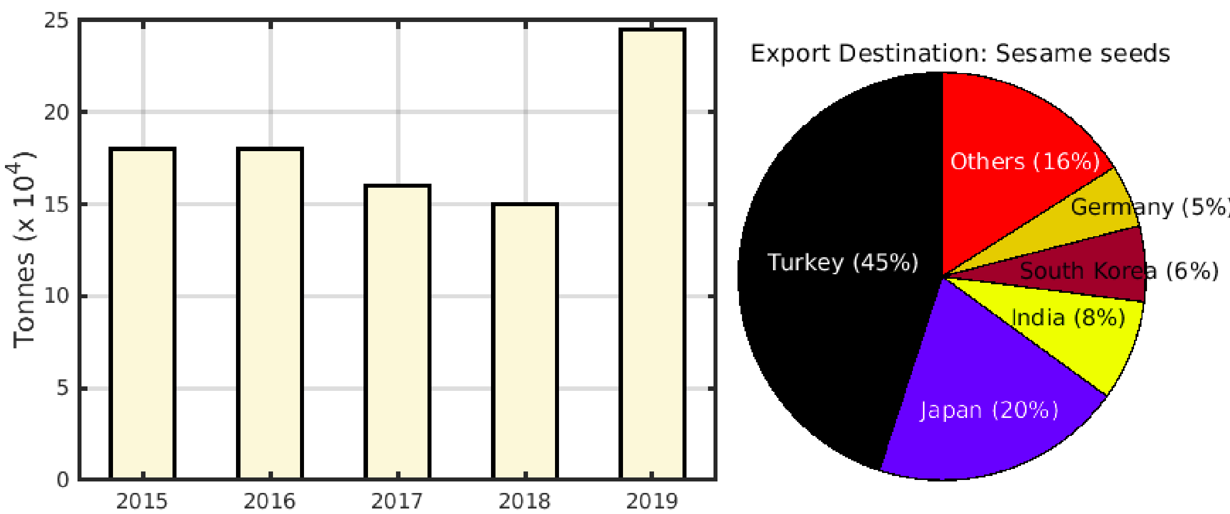

Figure 3.1: Nigeria total export in tonnes-sesame seeds (Source: NEPC, 2020)

In 2010, Nigeria exported 140,800 tons of sesame seeds worth $139 million, and earned ₦210 billion in the first half of 2012 from the exportation of sesame products. The total value of sesame exports in Q1 2018 was ₦26.6 billion, this position as the most highly exported non-oil commodity in Nigeria serves as a testament to its significance and prominence in the country's economy. This notable achievement showcases the impact and influence that the commodity has in terms of generating revenue through exports and contributing to the growth of Nigeria's overall economy. This marked an 83.1% rise from the previous quarter and a 104.1% growth from the same period in the previous year. According to a report by Toungos in 2020, the export of sesame seeds played a noteworthy role in both the overall export value and the agricultural exports in the beginning of 2018. Specifically, the export of sesame seeds contributed to approximately 0.57% of the total export value and was responsible for an impressive 36.39% of all agricultural exports in the first three months of 2018. In Q1 2020, sesame was the most traded agro-product in Nigeria, earning ₦49.1 billion in foreign exchange and accounting for 1.2% of total exports. Sesame is indeed a top non-oil export commodity, accounting for 0.57% of total exports and 36.39% of agricultural exports with Turkey and Japan as the top destinations (NEPC, 2020) (see Figure 3.1).

The growing demand for sesame presents Nigeria the chance to increase her production and expand its market to Asia, the Middle East, and Mediterranean, where sesame oil is highly sought after. In Nigeria, just 300,000 hectares of the 90 million hectares of arable land suitable for sesame cultivation are currently being utilised (Tunde-Akintunde, Oke and Akintunde 2012). By investing in sesame production, the country has the potential to increase its annual revenue from ₦21 billion to ₦86 billion. The findings of a study conducted by FAOSTAT in 2018 indicated that China, Japan, Turkey, the Republic of Korea, and Vietnam are among the leading importers of sesame seeds globally. According to the data obtained, China imported a staggering 828,211 tons of sesame seeds, followed by Japan with 157,170 tons, Turkey with 152,237 tons, the Republic of Korea with 72,063 tons, and Vietnam with 63,761 tons. These countries stand out as the largest consumers of sesame seeds in the world, providing insights into the growing demand for this highly valued crop.

3.5.4 Challenges to Sesame Value Chain in Nigeria

One of the significant challenges that hinder the production and utilisation of sesame seed-based value chain optimisation (VCO) in Nigeria is postharvest losses. These losses take place between the time of harvesting and consumption, affecting all aspects of the postharvest handling process, such as processing and packaging, transportation, storage, and marketing. This issue has been extensively studied and documented by Myint *et al*. in 2020, highlighting the need for efficient and effective measures to reduce postharvest losses and increase the availability of sesame seed-based VCO in Nigeria. As indicated by Gebretsadik *et al*. in their study published in 2019, there are several factors that contribute to postharvest losses of sesame seeds, including the size of the farmland, the total amount of sesame grains harvested, the prevailing climate conditions, the number of days the sesame grains are left in stacking piles, the distance from the farm to the market, and the mode of transportation. These factors, when not properly managed, can lead to significant losses in both the quantity and quality of the oilseeds. This is further compounded by the adoption of inadequate postharvest techniques, as noted by Myint *et al*. in their 2020 study. These unsuitable techniques result in damage, discoloration, shrinkage, and unpleasant odours in the product, which can significantly impact the marketability and profitability of the sesame seeds.

In addition to postharvest losses, another significant challenge that affects the production and utilisation of sesame seed-based value chain optimisation in Nigeria is the prevalent small-scale farming practices. There is a wide range of land holdings engaged in sesame seed production across Nigeria, with some wealthy investors cultivating large plots of farmland while small-holder farmers typically grow sesame on plots smaller than ten hectares. As pointed out by Abadi in 2018, this distinction creates several challenges for small-holder farmers, including higher production costs due to the need to manage multiple plots in different locations, as well as the potential for uneven and inadequate crop management. These factors can impact the yield and quality of the sesame seeds, and ultimately hinder the production and utilisation of sesame seed-based VCO in Nigeria. Small-scale farming practices, which are commonly associated with outdated production systems, pose a significant challenge to the production of sesame seeds in Africa. As noted by Abadi in 2018, this type of farming is often characterised by low productivity and inefficient practices, leading to reduced yields of sesame seeds. In Nigeria, small-holder farmers often struggle to achieve high yields, with less than one ton per hectare produced on average according to data from FAOSTAT in 2020. This is largely due to the reliance on traditional tillage practices, which do not take advantage of modern technologies and practices that could improve productivity and increase yields. As a result, small-scale farming practices in Nigeria continue to be a constraint to the production of sesame seeds and the development of the sesame industry.

The Central Bank of Nigeria reported in 2010 that one of the significant challenges facing the sesame seed value chain in Nigeria is poor marketing structure and market-related difficulties. Despite high levels of sesame seed production, low export quantities and values have been partly attributed to these market-related challenges, including the lack of adequate and reliable market information for farmers and sesame seed traders. This information gap enables middlemen to act as intermediaries, inhibiting the direct purchase of sesame seeds by major exporters. As noted by Munyua *et al*. in 2013, this dynamic contributes to inefficiencies and limitations in the sesame seed value chain, hindering the growth of the sesame industry in Nigeria. Small-scale farmers in Nigeria often face challenges related to fluctuating prices when selling their sesame seeds, resulting in low sales and revenues. The depreciation of the value of the Naira against the dollar has also negatively impacted the export of sesame seeds by increasing the expenses associated with exporting and reducing the overall value of foreign exchange earned. Furthermore, inadequate infrastructure, such as limited access to well-maintained roads, also contributes to difficulties in transporting and marketing sesame seeds. These challenges can result in low export quantities and decreased earnings for farmers and other stakeholders in the sesame seed value chain.

Another significant challenge faced by the sesame seed value chain in Nigeria is a lack of access to adequate funding and support systems. Most small-scale farmers and other participants in the value chain are unable to secure formal credit to finance their operations, which limits their ability to grow and expand their businesses. Additionally, the scarcity and rising costs of farm inputs and processing equipment make it difficult for many participants to participate in commercial agriculture activities. This is due in part to low levels of income and savings, as well as limited access to credit, which restricts the ability of value chain actors to invest in the necessary resources and technologies. The limited access to various concessionary financing and credit programs offered by CBN and the Nigeria Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL), including the Anchor Borrowers Program (ABP) and the Micro, Small, and Medium Enterprise Development Fund (MSMEDF), has been identified as an issue according to the 2018 Borno State commodity value chain assessment report. This hinders the ability of value chain actors to participate and effectively engage in the various financing opportunities available to them.

Challenges to Production Value Chain – The Farmers

1. Poor implementation of advanced, mechanised farming methods. Most farmers rely on traditional methods because they lack access to cutting-edge technologies.

2. Scarce supply of upgraded seed varieties for farmers.

3. Yield per hectare is low (0.5-1.0 tons) compared to China's 1.4-1.6 tons.

4. Farmers are ignorant about certain effective sesame production methods.

5. Lack of access to timely and high-quality farm inputs e.g., fertilizers, pesticides, etc

Challenges to Processing Value Chain – The Processors

1. Inadequate post-harvest technical proficiency.

2. Failure to meet international quality standards.

3. Lacking processing infrastructure like cleaners and de-stoners. The limited number of processing plants in Nigeria has resulted in a lower quality of sesame seed production, as most seeds are processed manually. This manual sorting and processing of these seeds are inefficient and have affected the pricing of the commodity both locally and internationally (Haruna *et al*., 2015). The brown sesame seed variant is also limited in its use for oil extraction and animal feed due to specific seed requirements such as colour and flavour, imposed by confectioneries and bakeries (Ukpe *et al*., 2023). The lack of proper processing facilities continues to hinder the competitiveness of the sesame seed value chain in Nigeria (Haruna *et al*., 2015).

4. High cost of processing facilities due to reliance on imported machines and difficulty obtaining spare parts, compounded by unfavourable exchange rate.

<u>Challenges to Marketing Value Chain – Marketers</u>

1. High transport cost for unprocessed seeds to ports for export. Nigeria mostly export seeds and lacks commercial oil extraction. Despite contract cleaning facilities, there's a lack of organised hauling.

2. Insufficient number of standard labs for seed tests and analysis before export.

3. Complicated procedures for farmers, aggregators, and exporters to access financial aid from financial institutions for production and export growth.

4. Inadequate export logistics support and limited access to export procedures.

5. Poor marketing infrastructure.

3.6 Smallholder farmers in Nigeria

Small-scale farms, typically under 5 hectares, play major roles in agricultural production and biodiversity preservation in sub-Saharan Africa, as per Eastwood *et al*. (2010). According to Röttger (2015), smallholder farmers have made a significant impact in reducing poverty and providing employment. Low yields impact the profitability and competitiveness of small-scale farmers. Additionally, many small-scale farmers are not equipped to handle the complicated demands of running an agricultural business, with over 80% operating at a subsistence level and lacking the necessary skills and resources to grow their production to a commercial level.

Smallholder farms often rely on family labour, but in some cases engage in labour exchange (Lambert *et al*., 2016; USAID, 2009). The extent of family involvement varies based on factors such as the gender of the household head, number of males and females in the household, and family size (Adamu, 2014). Generally, smallholder farmers are characterised as having limited access to resources, information, and technology, but the degree of these limitations varies greatly (Odoemenem and Obinne, 2010).

The type of agribusiness model that prevails in a country "depends on the level of economic development and the supportive conditions for agribusiness in that country" (Olomola and Mogues, 2018). They further note that in Nigeria, which is a developing nation, the agricultural sector is largely dominated by traditional farming practices, resulting in "low productivity, growing income disparities, and heavy reliance on processed agricultural products" (Olomola and Mogues, 2018, p. 2).

According to Gebremedhin and Jaleta (2012), commercialisation strengthens the connection between inputs and outputs in agricultural markets. To take advantage of the commercial agriculture initiative, smallholder farmers must not only be market-oriented but also demonstrate market participation skills and willingness. The fragmentation and dispersion of small farms, however, can make mechanisation challenging and is likely the reason for the low 46% utilisation of the country's arable land (World Bank, 2008).

3.6.1 Roles of smallholder farmers

Smallholder farmers are a significant contributor to global food production, producing 70% of Africa's food according to IFAD (2003), and accounting for 80% of the food consumed in Asia and sub-Saharan Africa (Dan-Azumi, 2011). In Latin America, they occupy nearly 35% of cultivated land (Altieri and Koohafkan, 2008). The fragmentation of landholdings and reduced investment in small farms is threatening the contribution of smallholders to agriculture, making them susceptible to poverty (Sabo *et al*., 2017). There are variations among smallholders, such as the proportion of crops for subsistence, local, or export markets, and their livelihood assets and strategies (Nagayets, 2005, Faber and Wenhold, 2007). Sabo *et al*. (2017) noted that not all studies connect agricultural development and poverty with smallholder farmers, but their significance as food producers and high representation among the world's poor suggests that their development plays a key role in reducing poverty and hunger

The capability of smallholders to continually contribute to the economy, strengthen food security, and reduce poverty depends on the functioning ecosystems that provide services like soil fertility improvement, water delivery, pest control, etc. However, it is noteworthy that certain activities of smallholders can stress the ecosystems through overuse of fresh water and nutrients, modification of the soil structure, heavy reliance on pesticides, etc. (Sabo *et al*., 2017)

3.6.2 Challenges of smallholder agriculture in Nigeria

Smallholders have limited access to modern technologies, and their circumstances may not always warrant substantial investments in capital, inputs and labour (Odoemenem and Obinne, 2010). These technologies could make farm chores less arduous. In addition, farmers require information on production techniques such as cultivation, weeding and pest control, which can be disseminated by extension workers, other farmers, research institutions, etc. (Ozowa, 1995).

Additionally, small-scale farmers rely on traditional equipment and mostly depend on rain for their farming operations. Sinyolo *et al*. (2014) found that irrigation access could boost productivity in drought-prone regions. According to the Nigeria Strategy Support Programme document by the International Food Policy Research Institute, the average smallholder farmer lacks enough fertilizer for one hectare, hindering yield improvement. This requires education through extension services and access to proper farming tools (Opara, 2011). Additionally, factors such as lack of business orientation, low productivity and income, limited investments, and lack of market and processing access, as noted by the International Fund for Agricultural Development (IFAD) (2009), further impede small scale farming productivity in Nigeria.

Smallholders face limitations in human capital, education and technology experience (Salami *et al*., 2010; DAFF, 2012) and have limited access to credit facilities (Odoemenem and Obinne 2010). According to EFInA (2008), only 23% of adults in Nigeria have access to formal financial institutions, while 24% have access to informal financial services. The remaining 53% of the population is financially excluded. Rural areas have a low ratio of formal financial institution branches (e.g., commercial, and agricultural banks) compared to informal financial associations (money lenders, thrift savings, and credit associations) as observed by Odoemenem and Obinne (2010). Okojie *et al* (2010) also found that many rural women in Edo state heavily rely on thrift savings. As stated by Ogundele and Ayinde (2020), the Nigerian Federal government has implemented programs such as the Agricultural Credit Guarantee Scheme (ACGS) and Agricultural Credit Support Scheme (ACSS) to improve financial inclusion in the agricultural sector. However, the authors note that the impact of these programs has been limited due to farmers' lack of awareness of available loan options (Ogundele and Ayinde, 2020).

Another major problem is the unavailability of land due to Nigeria's land tenure system is a major challenge for small-scale farmers (Nwalieji and Igbokwe, 2011). Local government councils have the responsibility of providing land to new farmers, but according to Nwalieji and Igbokwe (2011), they have not fulfilled this obligation effectively. Small-scale farmers lack the capital to acquire land for agriculture and some smallholder households have land holdings that are no longer viable. In 5 Sub-Saharan African countries, a review of national surveys found significant differences in farm size among smallholders, with those having larger holdings having higher income per capita and crop revenue (Jayne *et al*. 2010). Households with smaller landholdings earned lower crop revenue and relied more on off-farm income sources. Approximately 25% of households had effective landlessness, holding less than 0.11 hectares of land per capital, processing, and trading outlets also hinder smallholder farmers' productivity and growth.

A key challenge to small-holding farming in Nigeria is transportation. According to Akinbode *et al*. (2021), the challenges faced by smallholder farmers in rural Nigeria are linked to inadequate transport infrastructure. The authors note that the poor state of roads and lack of transportation options often prevent farmers from accessing markets and obtaining necessary inputs, resulting in reduced agricultural productivity and income (Akinbode *et al*., 2021). The transport challenges faced by smallholder farmers in rural Nigeria are particularly acute during the rainy season, when many rural roads become impassable. This prevents farmers from bringing their crops to market, leading to spoilage and waste. In addition, the lack of reliable transportation options means that farmers may be forced to rely on middlemen who charge exorbitant prices for their services, further reducing the farmers' profits (Akinbode *et al.*, 2021).

3.6.3 Transport in rural Nigeria

Rural areas inhabited by smallholder farmers are characterised by poor accessibility and a deficient transport system, according to Donnges (2003). Transportation is a critical issue for rural communities in Nigeria, as it affects access to markets, healthcare, education, and other important services. The rural transportation network in Nigeria is characterized by limited infrastructure, poor road quality, and a lack of public transportation options, which can make it difficult and expensive for rural residents to access basic services (Adesina and Fakorede, 2015). In sub-Saharan Africa, particularly Nigeria, most rural transport takes place on informal pathways linking villages, farms, and water sources (Airey, 2014). This lack of accessibility hinders access to markets and other essential services, curbing the productive potential (Porter, 2013).

Rural transportation in Nigeria lacks public transportation options. In rural areas, people often rely on private vehicles, motorcycles, or bicycles for transportation, but these options can be expensive (Adesina and Fakorede, 2015). The hazardous transport system greatly affects the livelihoods, health and education services, social interaction, and development of agriculture value chains in these regions.

Transportation infrastructure plays a crucial role in facilitating effective farming operations. However, in Nigeria, the main form of transportation is through roads which are in disrepair and lacks access to rail or air travel (Uduji *et al*., 2018b). The cost of food is impacted by transportation expenses, including fares and taxes imposed by informal checkpoints operated by transport unions (Uduji *et al*., 2018b). This inefficiency, due to lack of adequate funding has indeed slowed the pace of agricultural production in Nigeria (Kassali *et al*, 2012; Asongu *et al*, 2019a, 2019b).

3.6.4 Fuel hike and smallholders' transportation and productivity

The energy-intensive nature of agricultural production makes it susceptible to fluctuations in energy prices, such as those from shifts in the global oil market or policy changes like the elimination of oil subsidies and inflation. Because petroleum is the primary source of energy in Nigeria, its instability has a significant impact on productivity- transportation, input supply, production, distribution, marketing, and consumption. Research shows a negative relationship between the cost of petroleum products and agricultural output. Higher fuel prices reduce households' incomes, decreases consumer spending, increases transportation costs, double-digit inflation, and elevated prices for food and other essential services (Aina *et al*., 2015; Ocheni, 2015). It is important to note that fluctuations in oil prices due to low stocks and supply disruptions in the global oil market have affected rice production in Nigeria (Ocheni, 2015). The volatility of fuel price has led to a substantial rise over the past decade, with gasoline and diesel prices climbing from $0.19/litre and $0.17/litre in 1993 to $0.39/litre and $0.40/litre in 2022, with informal prices reaching $0.59/litre and $1.89/litre in February and March of 2022. (Sources: Oladimeji *et al*., 2018; Petroleum Product Marketing Company, 2022). Previous governments attempted but failed to reform the energy sector by removing oil subsidies and diversifying the economy to reduce dependence on crude oil exports (Akinyemi *et al*. 2017).

3.6.5 Smallholder farmers and agricultural market

Economic theories suggest that in an efficient market, market margins are distributed in proportion to the total utility generated by each intermediary. However, market inefficiencies can disrupt this distribution. Produce moves physically from farm to mark*et al*ong the supply chain, while money and information flow in the opposite direction. Asymmetrical access to information gives intermediaries more bargaining power, allowing them to capture a larger share of the marketing margin in the supply chain (FAO, 1997). Establishing links between farmers, traders, and processors is seen as a way to mitigate seasonal surpluses and resulting price drops, especially for perishable products (Das, 2008). However, the connection between producers and processors is weak due to factors such as (i) a shortage of appropriate raw materials for processing, (ii) conflicting tax policies, (iii) unpredictable demand for processed goods, and others. There have been ongoing efforts to connect farmers to markets and improve coordination among marketing channels and intermediaries. These efforts include: (i) establishing alternative marketing channels with improved pricing policies that lower margins, (ii) promoting contract farming for guaranteed purchase and prices, and (iii) developing efficient supply chains to add value to certain commodities (Dileep *et al*., 2002).

3.7 Smallholder Agricultural finance

It is important that smallholder farmers transcend from subsistence to mechanised farming, and this shift requires a consistent flow of funds. The financing of agricultural activities is a crucial aspect of agriculture because it influences the quality and quantity of farm inputs (Fadeyi, 2014; Miller and Jones, 2010). Agricultural finance encompasses the financial services for agriculture production, processing, and marketing (IFC, 2011) and can include formal and informal sources, short- to long-term loans, and leasing. Regrettably, the allocation of government funds towards agriculture in many African nations falls below the target established by the Comprehensive African Agriculture Development Program in 2003, which aimed for 10% of annual budgets to be devoted to agriculture (Ali *et al*., 2016). The Nigerian government's funding for the agriculture sector has been insufficient for its development (Evbuomwan, 2016). Despite receiving international support in the form of funding, including $185 million in 2001 and $15,870 million in 2015, and an average government funding of $48,621 million in 2001 and $41,245 million in 2015, the agriculture sector still lacks adequate funding. Similarly, despite commitments from banks to allocate a portion (1.4%) of their credit portfolio to agriculture, development in the sector remains limited. In general, smallholder farmers in Nigeria have access to two major sources of funding for their agricultural operations.

Smallholder agricultural finance is a critical component of agricultural value chain optimisation in Nigeria. According to Ogundele and Ayinde (2020), access to credit and other financial services is essential for smallholder farmers to invest in their farms, increase their productivity, and participate fully in agricultural value chains. The authors note that improving smallholder agricultural finance can lead to more efficient and profitable value chains, benefiting both farmers and other actors along the chain (Ogundele and Ayinde, 2020).

Smallholder agricultural finance and agricultural value chain optimisation are closely linked in the context of developing countries. Smallholder farmers are often the primary producers in agricultural value chains and face numerous challenges in accessing finance. Agricultural value chain optimisation seeks to improve the efficiency and effectiveness of the value chain to benefit all actors, including smallholder farmers (UNDP, 2013).

One of the major challenges facing smallholder farmers is a lack of access to affordable finance. Smallholder farmers often lack collateral and credit history, making it difficult to secure loans from traditional financial institutions (IFC, 2018). As a result, smallholder farmers often rely on informal financing sources with high interest rates and unfavorable repayment terms. This lack of access to finance limits smallholder farmers' ability to invest in their farms, improve productivity, and participate fully in the agricultural value chain (Ogunleye *et al*., 2017).

Agricultural value chain optimisation can help to address these challenges by improving access to finance for smallholder farmers. By improving the efficiency and effectiveness of the value chain, there are opportunities to reduce transaction costs and increase profits for all actors, including smallholder farmers (World Bank, 2017). This can increase the attractiveness of lending to smallholder farmers by formal financial institutions, as they can better assess the risk of lending to farmers within an optimised value chain.

Furthermore, agricultural value chain optimisation can help to create new financing opportunities for smallholder farmers. For example, through the creation of commodity exchange markets, smallholder farmers can access credit by using their crops as collateral. This can enable smallholder farmers to secure financing at lower interest rates, thereby increasing their profitability and ability to invest in their farms (IFC, 2018).

3.7.1 The informal sources of agricultural finance

The informal financial sector in Nigeria is comprised of:

Loans from cooperative societies known as "ajo" among the Yoruba, "esusu" among the Igbo, and "adashe" among the Hausa. These loans are often obtained from trusted sources such as friends, family members, or local moneylenders. However, the market is largely dominated by monopolistic moneylenders who impose excessively high interest rates and often demand collateral from farmers in exchange for their services.

The credit thrift society is a type of mutual financial collaboration among individuals who share similar goals and objectives. Members regularly contribute money in an effort to generate collective financial benefits for each member. Contributions can be made on a daily, weekly, or monthly basis and can be managed in one of two ways. The first is by rotating the pool of money among members at the conclusion of each time period, or second by lending money to members with an identified need at a pre-determined interest rate. This concept was first described by Afolabi in 2010.

Money lenders, often referred to as un-instituted local banks, play a significant role in providing quick financing options for rural communities. These lenders are known for their ability to provide funding with minimal notice, a feature that makes them popular among those who need immediate financial assistance. However, this convenience is accompanied by a significant drawback - exorbitant interest rates. According to Afolabi (2010), these rates can sometimes exceed 10% per month, making it challenging for borrowers to repay their loans and causing them to incur significant financial burden.

Informal sources of agricultural finance play an important role in optimising agricultural value chains for smallholder farmers in Nigeria. According to Akinwale *et al*. (2019), these informal sources of finance provide a critical lifeline for farmers who may not have access to formal financial institutions. These sources of finance can help farmers to purchase necessary inputs and equipment, improve their farming practices, and ultimately increase their productivity and profitability (Akinwale *et al*., 2019). Despite the various challenges associated with these sources of finance, such as lack of collateral and regulatory oversight, they continue to be an important means of financing agricultural production and ensuring food security in the country (Asongu, 2017). However, these informal financial services are not considered ideal due to the high interest charged on loans, which can eat into a farmer's profits.

3.7.2 The formal sources of Agricultural finance

Formal sources of agricultural finance, such as commercial banks and micro-finance institutions, can play a crucial role in optimising the agricultural value chain for smallholder farmers in Nigeria. Odey *et al*. (2021) noted that access to formal finance can enable smallholder farmers to invest in their farms, adopt improved technologies, and access higher-value markets, leading to increased productivity and profitability along the value chain. The formal finance can also improve the resilience of smallholder farmers to external shocks, such as climate change and economic downturns (Odey *et al*., 2021). In Nigeria, the agricultural sector is supported by these three forms of formal agricultural finance, which play a significant role in its growth and development:

<u>Government funding</u>**:** The funding of the agricultural sector by the Nigerian government has been inconsistent since the 1980s, with allocation ranging from as low as 0.90% in 2015 to a high of

1.38% in 2018. This is still below the recommended 10% allocation set by the Comprehensive Africa Agriculture Development Program in 2015. (Sources: Budget Office, 2018; World Bank, 2018; Ofoegbu, 2015.

Bank's funding**:** Despite the ability of banks to provide loans to the agriculture sector, their allocation of loans to this sector is low compared to other sectors. According to Ofoegbu (2015), banks' credit portfolio for agriculture was only 1.4% in 2008 and 2009, but increased to 1.7% in 2010.

International donor funding**:** The Nigerian government often receives financial assistance and grants from foreign governments and international organisations, with a focus on boosting agricultural productivity, particularly for smallholder farmers. These funds are gathered and disbursed through a structured process without interest repayment to smallholder farmers. (Source: OECD, 2018). However, according to Akinola (2013) and Eluhaiwe (2014), the distribution of these funds lacks integrity as administrators often prioritise requests from beneficiaries they will personally benefit from. It is also alleged that many recipients of these funds, aware that they do not need to repay, misuse the funds instead of investing in farming.

3.7.3 Growth enhancement support scheme in Nigeria: current condition

Agriculture is a crucial component of the economy for rural households, offering employment opportunities and contributing 40% to the country's GDP. It also provides raw materials for agro-based industries and generates substantial foreign exchange revenue (World Bank, 2014; FGN, 2017). The agricultural sector in Nigeria has experienced slow growth despite its vast potential; partly due to limited cultivation of arable land and outdated farming methods. To enhance food security and rural development, the government has taken steps such as liberalizing input distribution and launching the Growth Enhancement Support Scheme (GESS) in 2012. GESS supports financially-handicapped farmers, unlike the previous programs. Under GESS, farmers receive a 50% subsidy for their agricultural inputs through electronic wallets, as opposed to paper vouchers. Afterwards, farmers receive unique codes on their mobile devices to retrieve inputs from accredited dealers. The federal and state governments each contribute 25% of the input costs, while farmer registration is handled by state and local governments (Akinboro, 2014; Grossman and Tarazi, 2014).

Farmers manually complete a machine-readable form, and the data is entered into a national database, resulting in the issuance of a unique GESS ID number (IFDC, 2013). Farmers with mobile phones have their phone number captured during registration, and they would receive periodic messages confirming their registration status and indicating when and where to claim their subsidy allocation (where they would pay 50% of the allocation cost). Farmers without phones will automatically be apprised when collection starts in the community. This initiative seeks to empower farmers by giving them control over the cash component of a product value; which indeed has proved more efficient and transparent than previous schemes (Uduji and Okolo-Obasi, 2018; Akinboro, 2014; Olomola, 2015). Nonetheless, GESS has received criticism over its effectiveness and practicality, as many detractors consider it a new burden added to the already existing schemes (Fadairo *et al*., 2015; Tiri *et al*., 2014).

3.8 Strategies for optimising agricultural value chain in Nigeria

1. Input supply**:** The lack of required farm inputs and the cumbersome process of securing land have hindered agricultural production in Nigeria. In 2013, Agriculture Transformation Agenda (ATA) was launched by the government to tackle some of these challenges. Between 2011 and 2014, this scheme created policies that resulted in the supply of subsidized seedlings and fertilizers to 18% of rural farmers. The Edo state government reduced costs for acquiring land by subsidizing the costs and simplifying the process to obtain a Certificate of Occupancy (PwC, 2017). In the same vein, the Anambra state government is fostering community relationships to avoid disputes during land acquisition, and has enacted laws to facilitate land transfers (PwC, 2017).

2. Production**:** The declines in fresh water resource, water pollution, and insufficient irrigation systems have affected the quality and availability of fresh water for agriculture (World Bank Group, 2021). Efforts have been made to address this issue through the implementation of various irrigation projects, such as the Zauro irrigation project in Kebbi, which includes a 50 million m3 water reservoir and is expected to support the annual production of 42,000 tons of rice, maize, and other major crops. Similarly, the middle-Ogun irrigation project aims to bring about 12,000 hectares of land under irrigation.

3. Mechanisation**:** Mechanisation in Nigeria is underutilised, leading to a decrease in the quality of agricultural goods. The slow adoption is due to limited access to agricultural equipment and the scarcity of skilled workers.

4. Storage**:** To combat post-harvest losses, and poor food quality, the government and Africa Exchange (AFEX) launched the e-WRS in 2014 (World Bank Group, 2021; AGRA, 2019). This

enables farmers and distributors to safely store their produce in certified storage facilities and use the receipts from these facilities as security for securing bank loans. As at 2016, the program had benefited 60,000 farmers in 8 states, with plans to expand through the use of mobile warehouses (Ordu *et al*., 2021).

5. Processing: The government introduced the Staple Crops Processing Zone (SCPZ) Program in 2011 to reduce post-harvest losses, foster commercial agriculture, enhance value addition, and decrease dependence on imports. These losses are estimated at 35-50% for fruits and vegetables and 15-25% for grains (Agrojiva, 2021). The first 12 SCPZ sites, as stated by FMARD, have the potential to increase farming output by 12.7 million metric tonnes annually, raise processing output by 6.2 million metric tonnes, and create up to 550,000 jobs.

6. Marketing and Trade**:** The high cost of transportation, poor road conditions, and distances as found by Tunde *et al*. in 2012 in Kwara State, negatively impact the marketing of agricultural products. Additionally, a lack of knowledge of major export markets such as the US, UK, and EU and sub-par product quality impede international trade (Thomas and Eforuoku, 2020). As an example, in 2012, the USAID-funded NEXTT project aimed to enhance trade efficiency along the Lagos-Kano-Jibiya route. By 2015, this initiative led to a 25% decrease in import time, 5% decrease in export time, a 35% decrease in import cost, and a 21% decrease in export cost for goods moving through this corridor.

7. Research**:** Local and international research institutes have made significant contributions to enhance agricultural production. Between 2002 and 2010, the International Institute of Tropical Agriculture and its partners boosted the cassava industry by advocating for the cultivation of different cassava varieties. The National Animal Production Research Institute also utilised cross-breeding to enhance local cattle breeds, leading to an increase in milk production (Agricultural Research Council of Nigeria, 2013).

CHAPTER 4: METHODOLOGY

4.1 Introduction

This chapter will provide an overview of the study's hypotheses, the data gathering methods and analysing techniques, and study location.

4.2 Research question

Many authors have looked into how macroeconomic variables affect the optimisation of the agricultural value chain (Beugelsdijk, Nell, and Ambos, 2017). It was observed that factors such as inflation, interest rates, and exchange rates, influenced of climate change and social-economic factors, are major sources of economic instability that hinder the agricultural value chain. Additionally, given that many developing countries rely on subsistence and small-scale farming, some studies (Minten *et al*., 2009; Maertens *et al*., 2012) have examined the involvement of small-scale farmers in the agricultural sector. These studies suggest that smallholder farmers can play a significant role in a nation's food sustainability and export earnings. However, so far, very few studies have examined how the agricultural value chain can be optimised in a turbulent economy for smallholder farmers. In the light of this gap, this research employs a combination of qualitative and quantitative techniques to address the following inquiries:

1. How are economic turbulence and the agricultural value chain optimisation related?
2. What is the costs efficiency of resources deployed along the agricultural value chain?
3. What are the institutional barriers to value chain optimisation?

The study aimed to address the previously mentioned questions by identifying the following specific objectives:

i. To investigate the impacts of economic turbulence on value chain optimisation of cashew and sesame smallholder farmers in rural communities.
ii. To examine the effects of economic turbulence factors on the value chain optimisation.
iii. To ascertain the effects of resources costs along the value chain for cashew and sesame farmers.
iv. To identify the institutional constraints to the optimisation of value chain by smallholder farmers.
v. To analyse the strategies required to overcome the institutional challenges of economic turbulence.

4.3 Research Design

A descriptive survey design allows for the collection of new data from a representative sample to characterise the population under examination, which may be impractical to observe directly (Siedlecki, 2020). This design has three phases: the pre-data phase, in which the research is introduced including the problem statement, objectives, and hypothesis; the data phase; and the post-data collection phase. The final phase includes details on the method of analysis, research design, population and sample size, sampling technique and procedure, data sources, research instruments, and the validity and reliability of the instruments used (Siedlecki, 2020). This survey design accurately captures the characteristics and processes of the study group and provides a comprehensive understanding of the population from which the sample will be selected. These methods were chosen in order to have a robust analysis, and also to objectively test the study hypotheses which are presented in the subsequent section.
Owing to the dynamic nature of this study, two research methods were combined-.

1. <u>Cross-sectional survey</u>**:** This was used to collect data over the study area. Then, it also used exploratory method to acquire relevant and in-depth information on agricultural value chain from the selected small holder farmers in the locations (Mendelsohn, 2004). The primary method of this study is the descriptive survey design with the hope that the study will gather quantitative data to examine the effects of macroeconomic turbulent factors on the value chain of smallholder farmers. The data and findings from the quantitative method were further probed with exploratory method using interviews. The data and findings from the two methods can then be integrated to guarantee triangulation and complementarity of both methods.

2. <u>Exploratory interviews</u>**:** This method helps to gather information about the distinctive challenges and opportunities associated with the unskilled small-holder's engagement in the value chain. The exploration will be done with in-depth interview (structured and unstructured) so as to unmask the complex factors in the operation, thus providing reliable and adequate information on the research problems.

A descriptive survey design allows for the collection of new data from a representative sample to characterise the population under examination, which may be impractical to observe directly. This design has three phases: the pre-data phase, in which the research is introduced including the problem statement, objectives, and hypothesis; the data phase; and the post-data collection phase. The final phase includes details on the method of analysis, research design, population

and sample size, sampling technique and procedure, data sources, research instruments, and the validity and reliability of the instruments used. This survey design accurately captures the characteristics and processes of the study group and provides a comprehensive understanding of the population from which the sample will be selected. These methods were chosen in order to have a robust analysis, and also to objectively test the study hypotheses which are presented in the subsequent section.

4.4 Definition of Variables

This section provides an overview of the variables that were examined in this study, including the independent, dependent, and control variables that were used to assess the impact of different factors on the optimisation of agricultural value chains and the total cost of production along the value chain.

4.4.1 Dependent variables

Value chain optimisation: The value chain optimisation variable, which is represented in dollars ($), was operationalised by computing all the costs incurred along the value chain and subtracting it from the revenue generated by smallholder farmers cultivating cashew and sesame crops over a specified survey period. This information is crucial in helping to understand the financial viability of these farming practices and can assist in identifying areas for improvement and optimisation.

Total production cost: This is a continuous dependent variable that is measured by aggregating the variable and fixed costs incurred by individual farmers from the production stages of cashew and sesame to the processing and packaging stages during the survey year. The cumulation of the total variable and fixed costs for all the stages thus gives the total production cost. This important metric, which is crucial in determining the optimisation of the farming operations, is expressed in dollars ($), and it takes into account all the costs expended along the value chain.

4.4.2 Independent Variables

To determine the factors that impact value chain optimisation and cost of production in a turbulent economy, hypotheses were formulated based on economic theories and previous research findings, involving both continuous and discrete variables. To examine the factors influencing market supply and choice of market outlet, the following variables were created. The following variables that are expected to influence the dependent variable(s) (see Table 4.1):

1. Quality of life: The quality of life of the households is an important aspect that is closely tied to the economic well-being of smallholder farmers who cultivate cashew and sesame. The household profit, which is measured in dollars ($) during the survey year, is a continuous dependent variable that can be impacted by various economic factors. It is widely recognized that an improvement in the quality of life can have a positive impact on the value chain optimisation of these farmers. This can be achieved through increased access to resources such as capital, technology, and markets, as well as through improved social and economic conditions such as education and health services. By improving the quality of life of smallholder farmers, they are better equipped to make informed decisions, improve their production processes, and increase their income, ultimately leading to a more sustainable and profitable farming operation.

2. Farming Experience**:** This is a continuous variable quantified in terms of the number of years the farmer has spent growing cashew and sesame crops. This accumulation of time is believed to play a significant role in determining the success of the farming operation, as it is widely accepted that farmers with a greater number of years of experience are more likely to produce a higher yield and earn a higher profit from their efforts. This is due to their accumulated knowledge and expertise in the area, allowing them to make more informed decisions and effectively navigate any challenges that may arise.

3. Land Size Allocated: This variable expressed in hectares is thought to have a positive correlation with various dependent variables. Specifically, cash crops such as cashew and sesame have a direct relationship with profitability, meaning that an increase in the cultivation area of these crops can directly enhance value chain optimisation. Therefore, it is expected that the size of farmland will have a positive impact on the value chain optimisation of smallholder farmers. This was supported by a study conducted by Kindie in 2007, which found that the allocation of land for sesame cultivation had a positive effect on the market supply of this particular crop. In other words, the more land allocated for sesame cultivation, the greater the marketable supply of sesame, resulting in increased profits for smallholder farmers.

4. Yield**:** The term "yield" refers to a crucial economic factor that has the potential to greatly affect the profitability of households, and is typically expressed in Naira currency for the given survey year. High yields are seen as a positive influence on value chain optimisation, as it leads to a higher profit margin for farmers. According to a study conducted by Bosena in 2008, there is a direct correlation between the increase in cotton yield and the increase in the marketable supply of cotton. In other words, as the yield of cotton goes up, so does the amount of cotton that is available for market distribution, resulting in increased profits for farmers.

5. Age of plantation**:** The age of a plantation is a critical factor in determining the profitability of smallholder farmers, as it can have a significant impact on the production output of the farm. As a continuous variable measured in years, the age of a plantation is considered to have a direct correlation with the productivity of the farm. It is widely believed that older plantations tend to produce less compared to younger plantations that are within a specific age bracket. As such, the age of the plantation can have either a positive or negative effect on the optimisation of the farm, depending on whether it is considered to be young or old. If the plantation is not considered old, then the age of the plantation will positively impact the optimisation. However, if it is considered old, then the age of the plantation will negatively impact the optimisation.

6. Economic turbulence: The concept of economic turbulence refers to a specific type of economic factor that has the potential to impact the profit margins of smallholders. This variable is measured through a 5-point Likert scale survey conducted during the designated survey year, with results indicating that economic turbulence tends to have a detrimental effect on the optimisation of the value chain for cashew and sesame, as well as contributing to an increase in the overall cost of production along the entire supply chain. This measurement scale adopted is in consonance with the constructs measured in the studies of Skenderi and Dreshaj (2018); Asamoah *et al*. (2019) and Pooja (2018)

7. Costs of input: The costs of inputs play a crucial role in determining the production cost throughout the entire value chain of cashew and sesame production. These costs are a persistent variable that can significantly impact the overall cost of production. The costs of inputs encompass a wide range of factors, including the cost of high-quality seeds, farm equipment, fertilizers, labour, land, and agricultural chemicals. It is believed that these costs will result in a corresponding increase in the overall cost of production along the value chain of cashew and sesame. In order to accurately assess the impact of costs of inputs on production, it is important to take into account all of the various components that contribute to the total cost of production as it is being measured by Oladimeji *et al*. (2020) and Ja'afar-Furo *et al*. (2020).

8. Logistics: The cost associated with the transportation of both incoming and outgoing goods, commonly referred to as logistics, is considered a continuous economic variable. This cost is comprised of the expenses incurred in bringing inputs to the farm and also in transporting the produced goods away from the farm. It is hypothesised that this cost will have a positive impact on the overall production cost. This is in accordance with the studies of Oladimeji *et al*. (2020) and Ja'afar-Furo *et al*. (2020).

9. <u>Inflation</u>: Inflation is the rate at which the general level of prices for goods and services is rising and, subsequently, purchasing power is falling. This variable is measured using a 5-point Likert scale survey conducted during the survey year. Most of the constructs in this method were adopted from CBN, (2017) that conducted an inflation attitudes survey report on the influence of inflation on the prices of agricultural commodities in Nigeria. Also, Efendi *et al*. (2023) tested the influence of inflation monetary variables on the income of corn farmers using a perceptual scales. Results indicate that inflation tends to have a negative effect on the optimisation of the value chain for cashew and sesame, as well as contributing to an increase in the overall cost of production along the value supply chain.

10. <u>Exchange rate</u>: Exchange rate is a variable that represents the value of one currency in relation to another. It can affect agricultural value chain optimisation by influencing the costs of imported inputs and exported products either positively or negatively. It is categorical variable operationalised by employing a five-point likert scale. Most of the construct measured were adopted from Singh and Sahin, (2019) who operationalised exchange rate using likert scale to measure agricultural supply chain efficiency of green agricultural growers with exchange rate as a variable and Efendi *et al*. (2023) who also employed same in their method.

11. <u>Interest rate</u>: Interest rate is a variable that refers to the cost of borrowing or the return on investment. It can influence farmers' decisions regarding investments in agricultural value chain activities. It is a categorical variable measured with a five-point likert scale. This scale has been previously tested Obianefo *et al*. (2019) on the perception of smallholder farmers on single digit interest rate in Nigeria and most of the constructs were adopted.

12. <u>Taxation</u>: This variable encompasses the taxes imposed on agricultural activities, such as income tax, sales tax, or property tax. It can affect the profitability and competitiveness of agricultural value chain participants. It is a categorical variable measured on a five-point likert scale from 1=strongly disagree to 5=strongly agreed. This scale has been tested and validated by Fufa (2017) and Fochmann *et al*. (2010).

13. Consumers' price index: This variable measures changes in the average prices of goods and services consumed by households. It reflects consumer purchasing power and can impact demand for agricultural products. The variable was measured at the ordinal level of measurement using a rating scale ranging from 1=strongly disagree to 5=strongly agreed.

14. Producers' price index: This variable tracks changes in the average prices received by producers for their output. It reflects producer profitability and can impact supply decisions within the agricultural value chain. The variable was measured at the ordinal level of measurement using a rating scale ranging from 1=strongly disagree to 5=strongly agreed.

15. Institutional constraints: Institutional constraints refer to the limitations or barriers that affect the ability of farmers to adopt new technologies or practices. The variable is measured using a 3-point ordinal scale, where respondents are asked to rate the level of institutional constraints they face in order to optimise value chain of cashew and sesame on a scale of 1 to 3. This rating scale are in accordance with the scales employed by Olumba *et al.* (2021), Mgbenka and Mbah (2016) and Kehinde and Aboaba (2016).

16. Strategies to overcome Institutional Constraints: These refer to the actions the smallholder farmers expected to be taken by the government in order for them to overcome the limitations or barriers they face in optimising value chain via profit maximisation and cost reduction. The variable is measured using a 5-point ordinal scale, where respondents were asked to rate the level of agreement on the strategies, they perceived to be effective in overcoming institutional constraints on a scale of 1 to 5. This scale adopted has been previously tested by Olumba *et al.* (2021).

4.4.3 Control variables

Key socio-economic variables are included as control in the models because of their importance as predictors in the agricultural value chain optimisation of small-holder farmers. These variables are relevant predictors in agricultural value chain because they have significant impact on the efficiency and profitability of agricultural systems.

1. Age: The age of the respondents is a crucial variable that is measured in terms of the number of years. This factor plays a significant role in determining the value chain optimisation and total cost of production of cashew and sesame among smallholder farmers. The age of the farmers can influence their decision-making processes, their level of experience, and their ability to adopt new technologies and techniques, all of which can ultimately impact the cost and efficiency of the production process. Additionally, older farmers may have established networks and relationships that can facilitate access to markets, inputs, and other resources, which can positively impact their production outcomes.

2. Household Size: The Household Size, which refers to the number of members residing in the household, plays a crucial role in determining the value chain optimisation of cashew and sesame smallholder farmers. In this work, it is assumed that any member of the household may choose to be involved in the production process. This means that the availability of labour, which is an essential factor in production, is expected to have a positive relationship with value chain optimisation (VCO). However, the size of the family can have a complex impact on the value chain optimisation and the total production cost. On one hand, a larger family size could provide a larger pool of labour, leading to an increase in production and a positive impact on VCO. On the other hand, a large family may consume more resources, reducing the volume of produce available for sale and leading to a negative impact on VCO and the total production cost. As a result, the impact of household size on value chain optimisation and the total production cost is unclear and may depend on the specific circumstances of each household.

3. Education Level of the Household Head: The Education Level of the Household Head (EduHH) is a critical factor that plays a role in determining the value chain optimisation of cashew and sesame smallholder farmers. This variable is assigned a value of "1" when the household head is uneducated and values between 2 and 5 if the head has a formal education. It is widely accepted that the level of education of a farmer has a significant impact on their ability to adopt new technologies and practices. Farmers who have a higher level of education are more likely to be able to quickly adopt new technologies, initiatives, and marketing strategies. This is because they have the necessary knowledge and skills to understand and effectively utilise these new tools and techniques. As a result, it is hypothesised that higher levels of education (as reflected in the EduHH variable) will have a positive impact on the value chain optimisation. This is because an educated farmer is more likely to use available resources in an effective manner, enabling them to improve their production processes and increase their competitiveness in the market. Therefore, it is believed that the Education Level of the Household Head will play a significant role in determining the value chain optimisation of cashew and sesame smallholder farmers

4. Monthly Income: This is a continuous variable, is recorded in Naira (₦) and pertains to the total amount of money earned by a household through their farming activities. In this study, it is believed that the monthly income can have both a positive and negative impact on the value chain optimisation and overall production cost.

Table 4.1: Variables included in model estimate and expected outcome

DESCRIPTION	TYPE	MEASUREMENT	EFFECT	SOURCES
Dependent variables				
VCO	Continuous	Dollars		
Total cost	Continuous	Dollars		
Independent Variables				
Inflation	Ordinal	5-point scale	-ve	CBN, (2017); Efendi *et al*. (2023)
Exchange rate	Ordinal	5-point scale	-ve/+ve	Singh and Sahin, (2019); Efendi *et al*. (2023)
Interest rate	Ordinal	5-point scale	-ve	Obianefo *et al*. (2019)
Taxation	Ordinal	5-point scale	-ve	Fufa (2017) and Fochmann *et al*. (2010)
Consumer price index	Ordinal	5-point scale	-ve/+ve	CBN, (2017); Efendi *et al*. (2023)
Producer price index	Ordinal	5-point scale	-ve/+ve	CBN, (2017); Efendi *et al*. (2023)
Economic turbulence variables	Ordinal	5-point scale	-ve	CBN, (2017); Efendi *et al*. (2023)
Institutional constraints (IC)	Ordinal	3-point scale	-ve	Olumba *et al*. (2021), Mgbenka and Mbah (2016) Kehinde and Aboaba (2016).

Strategies to overcome ICs	Ordinal	5-point scale	+ve	Olumba *et al*. (2021)
Age of plantation	Continuous	Years	-ve	Coulibaly *et al*. (2019)
Yield	Continuous	Tons	+ve	
Years of experience	Continuous	Years	+ve	
Land area allocated for cultivation	Continuous	Hectare	+ve	
Quality of life	Continuous	Dollars	+ve	
Inbound logistics	Continuous	Dollars	+ve	Joseph *et al*. (2019)
Outbound logistics	Continuous	Dollars	+ve	Joseph *et al*. (2019)
Cost of improved seed	Continuous	Dollars	+ve	Ojimba *et al*. (2017)
Cost of farm implement	Continuous	Dollars	+ve	Ojimba *et al*. (2017)
Cost of fertilizer	Continuous	Dollars	+ve	Ojimba *et al*. (2017)
Cost of farm labour	Continuous	Dollars	+ve	Ojimba *et al*. (2017)
Cost of land	Continuous	Dollars	+ve	Ojimba *et al*. (2017)
Cost of agrochemicals	Continuous	Dollars	+ve	Ojimba *et al*. (2017)
Control variables				
Age	Continuous	Years	+ve	
Household size	Continuous	--	-ve/+ve	
Monthly income	Continuous	Dollars	+ve	
Level of education	Categorical	Edu-scale	+ve	

5-point scale-: 5: Strongly agreed, 4: Agreed, 3: Undecided, 2: Disagreed, 1: Strongly disagreed

3-point scale-: 3: Severe, 2: Mild, 1: Not severe. Scores will be ranked as high and low constraints.

Edu-scale-: 5: Tertiary, 4: Secondary, 3: Primary, 2: Adult literacy, 1: No formal education.

4.5 Survey Locations

For this study, three geopolitical zones were selected in Nigeria; South-west, Northwest and North central, and the pilot study was conducted in the rural towns of Ibadan and Kano, located in south-west and Northwest Nigeria (see Figure 4.1). Nigeria is a West African country occupying a land mass totalling 923,768 sq. km. The Sahara desert's edge is found at the country's northernmost borderland. The north-east trade wind blowing from this desert during the harmattan season is typically hot, dry, and dust-filled. Conversely, the south-west wind typically blows from the Atlantic Ocean towards the hinterland between the April and September. The country's average temperature lies between 25oC and 30oC, while annual mean rainfall is between 600 mm and 2650 mm. Due to its diverse climatic conditions, Nigeria possesses substantial potential for agricultural production.

Nigeria comprises of 36 states, 6 geopolitical zones, 400 ethnic groups and 450 languages, thus highlighting the importance of uniting similar groups for efficient resource distribution. This research selected three geopolitical zones (North-central, North-west, and South-west) for examination as they are heavily engaged in agricultural activities with many residents being farmers. Additionally, the farm settlements in these zones support the agricultural value chain. The aim is to gather data on smallholder farmers in rural areas with a large amount of arable land where many people are involved in farming.

1. ***North Central Zone***

The North Central zone also called the Middle Belt is located between latitude 8^{o}N and 10^{o} N and Longitude 3^{o}E and 10^{o}E. This zone constitutes states like Benue, Plateau, Niger, Kogi, Nasarawa, Kwara, and the Federal Capital Territory. The region has a total land area of approximately 166,000 square kilometres and a population of over 21 million people (NPC and ICF, 2014). North Central Nigeria is bordered by North West Nigeria to the north, South West Nigeria to the south-west, South South Nigeria to the south-east, and North East Nigeria to the north-east. The region is home to several ethnic groups, including the Gure, Gwandara, Kado, and Bassa ethnic nationalities, among others. Each of these ethnics has its own unique culture, language, and traditions. This region is characterised by tropical continental climate with wide variation of temperature (24^{o}C to 37^{o}C) and limited rainfall 100 and 200 cm^3 (Iloeje, 2007). Also, this region features the rainy season between April and October, and the dry season between December and March. The climate favours the production of big tubers, cereals and sweet potato.

2. ***North West Zone***

The North-West region of Nigeria is a study area for an agricultural value chain thesis. The region has a total land area of approximately 64,809 square kilometres and a population of over 14 million people (Census 2006). The coordinates of the region are Latitude 10° to 14°N and Longitude 6° to 12°E. The region consists of Kano, Jigawa, Sokoto, Zamfara, Kaduna, Katsina, and Kebbi. The climate of the region is influenced controlled by the dry and dusty air mass from the Sahara Desert, and the warm, tropical air mass coming from the Atlantic Ocean. The North-West region is known for its diverse ethnic groups, including the Hausa, Fulani, Kanuri, and Beriberi. The region is bordered by the North-East region to the north-east, the Federal Capital Territory to the south-east, and the North-Central region to the south. To the west, it borders the Republic of Niger, while the Republic of Chad lies to the north.

In terms of agriculture, the North-West region is known for its production of crops such as sorghum, maize, millet, rice, cow-pea, groundnut, and vegetables. The region also has a significant livestock sector, with cattle, sheep, and goats being the most common animals reared.

3. South-west Zone

The South-west zone is a region in Nigeria that comprised of six states: Ekiti, Ondo, Osun, Ogun, Oyo, and Lagos. The region has a total land area of approximately 41,011 square kilometres and a population of approximately 31 million people. The geographic coordinates of South-west Nigeria are approximately 6°15'N and 5°10'E. The South-west region of Nigeria is known for its diverse ethnic groups and cultures, with the Yoruba being the largest ethnic group in the region. Other ethnics that can be found in the region include the Igbo, Edo, and Efik. The region is bordered by the Atlantic Ocean to the south and by the regions of South-South and South-East Nigeria to the east and south-east, respectively. In 2014, it had the third-largest economy among African regions, and as at 2007, its population exceeded 27 million. This zone has two seasons: a rainy season between April and October, caused by the South-west monsoon wind from the Atlantic Ocean, and a dry season between November and March, caused by the north-east trade wind from the Sahara Desert. The temperature ranges between 21^{o}C and 28^{o}C. The primary occupation of the inhabitants in this region is agriculture. Additionally, many individuals are engaged in trading, and other skilled trades. Currently, the region's agricultural growth is hindered by the ongoing conflicts between farmers and herders, as well as a shortage of skilled labour in the sector.

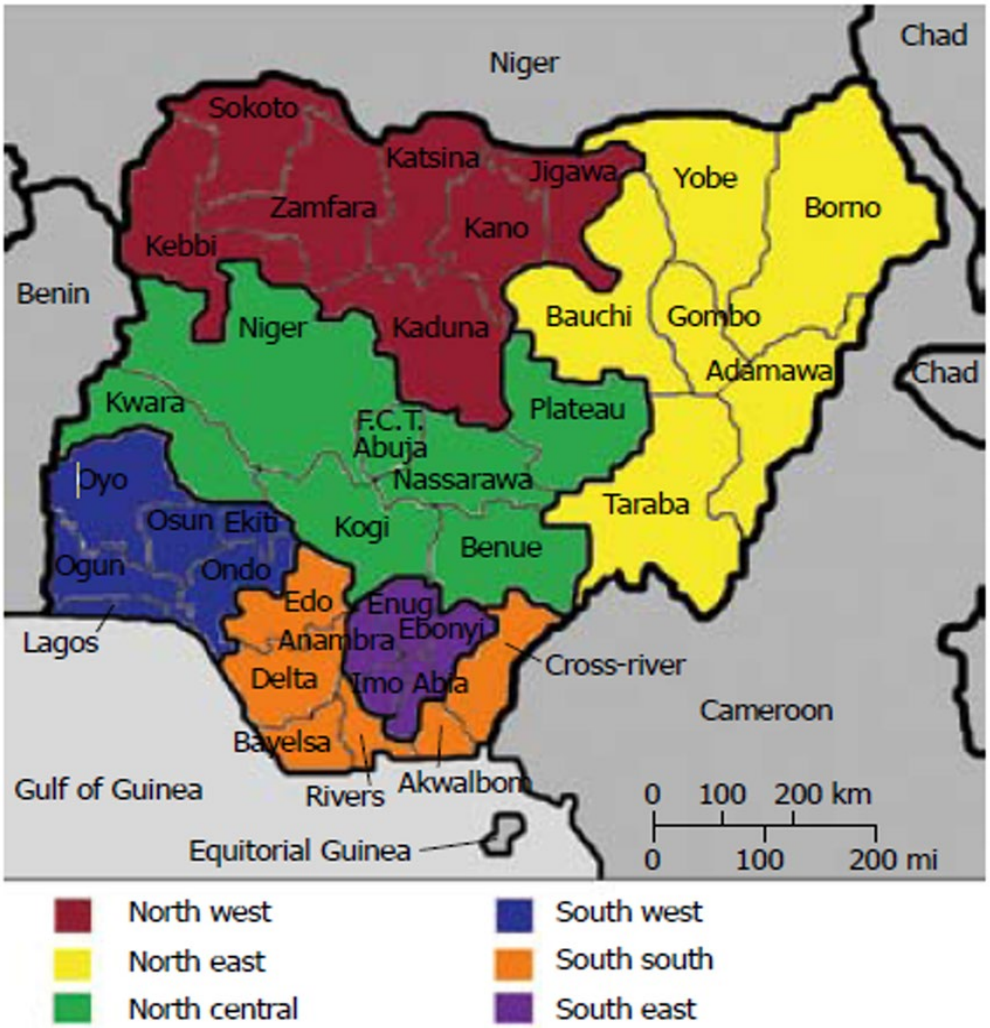

Figure 4.1: Map showing different geo-political zones of the areas surveyed (Source: Adapted from Akinlua *et al.*, 2015)

4.6 Data Collection

4.6.1 Sampling Method

This research used a four-stage multistage sampling method. The first stage involved the convenient sampling of the three zones under study. The second stage was a purposive sampling of one state from each selected region; the states were Oyo, kogi and Kano. The third stage was a purposive sampling of 3 towns per state based on commercial production of cashew and sesame. The last stage consists of snowballing sampling of 50 cashew farmers per town in Oyo and Kogi states and 60 sesame farmers per town in Kano state; thus, giving a total sample size of 480 farmers.

The study selected smallholder farmers who are involved in growing and processing cashew and sesame using similar criteria across the regions sampled. This approach was taken to ensure that the respondents were homogeneous in terms of their characteristics, local environment and the impact of environmental factors on their farming practices. Instead of using simple random sampling, a multistage sampling procedure was employed to ensure that important features that met the sampling criteria were not overlooked. The main criteria used to select the sampled respondents were the location of the farm, the amount of arable land available to the farmer, and whether farming was the main source of income or if they were involved in other part of the agricultural value chain.

The farmers surveyed were identified as follows: The researcher initially made contact with the chairpersons of local farmers' associations in each state. These chairpersons provided information on the dates of meetings and the contact information for the local government branches of the state farmers' associations. The local government farmers' associations then supplied lists of farmers to be visited for the study. The researcher and the research assistant then took turns visiting these farmers in each state.

4.6.2 Interviewers Training

For each geopolitical zone, three interviewers were employed by the researcher for data collection, with one interviewer covering a particular state. The selection of interviewers was based on criteria such as educational qualification, gender, fluency in the local language, and location. The interviewers were chosen from both undergraduate and graduate students. Additionally, the study prioritised male candidates due to the time and energy required for data collection, and only individuals who were native to the regions were selected to ensure they were familiar with the area.

The interviewers were trained on various aspects of the survey, including the communication of research objectives and goals, the survey methods, and the sampling process. They were also trained on how to avoid biases during the interview process. The interviews were designed to supplement the structured questionnaire by providing additional clarity and context for the questions. Both structured and exploratory interviews were used to gather both quantitative and qualitative data. The interviewers were trained to avoid biases such as poor rapport management, poor management of uncooperative respondents, poor impression management, rephrasing attitude questions, asking questions out of context, and modifying factual questions. Additionally, the interviewers were instructed to ask questions as they were structured and to record answers exactly as they were given by the respondents.

4.6.3 Pilot Study

This section describes a pilot study that was conducted in December, 2021 to evaluate the effectiveness and reliability of the research instruments. The goal of the pilot study was to gather additional information to improve the instruments. The pilot study confirmed the validity and reliability of the research instruments, although some modifications were made after the pilot study. The study produced accurate data through the use of the questionnaire and interview. The pre-test of the questionnaire was conducted on 54 farmers in Ibadan, Oyo State and Kano state in the south-western and North-western regions, which are part of the study area. The pilot study helped to determine the readiness of the respondents, evaluate the wording and structure of the questions, and provided insight into the potential reactions of the respondents.

4.6.4 Data sources

In this study, both primary and secondary data were utilised. The primary data was collected using a structured questionnaire consisting of nine sections.

1. Section one: This covered socio-economic characteristics of the respondents in terms of geopolitical zone, age, gender, marital status, level of education, household size, monthly income, yield, age of plantation, years of experience, total land area, area of land allocated for cultivation of cashew and sesame, do you process and package?, if yes what quantity, and the achievement of value chain objectives.

2. Section two: This contains questions on the production characteristics of small-scale farmers in the study area.

3. Section three: These covered questions relating to the processing and packaging habits of the farmers.

4. Section four: Contains questions on the quality of life of farmers.

5. Section five: consists of questions on the economic turbulence affecting farmers’ output

6. Section six: consists of questions on the access to institutional and support services

7. Section seven: consists of questions on the benefit-cost analysis

8. Section eight: consists of questions on the strategies to overcome the challenges of economic turbulence

9. Other information: This last section contains questions on the institutional constraints to the optimisation of value chain.

4.6.5 Structured and Unstructured Interviews

The researcher and trained assistants conducted both structured and unstructured interviews to gather relevant information from the farmers. Primary data sources were used to elicit information from smallholder farmers in three specific geo-political regions, which were purposively selected. The primary data was gathered through formal surveys and key informant interviews. The structured questionnaire used for the formal survey was pre-tested, and the researcher conducted interviews with selected farmers using a snowballing technique. In addition to the formal survey, 18 key informants were interviewed from various organizations and institutions located in the selected geo-political zones.

The unstructured interview was discussion-based. These main questions were presented to the interviewees: (i) what are the challenges to the agricultural value chain optimisation and (ii) what are the significant factors or methods of optimising the agricultural value chain? All respondents were allowed to express their opinions freely, and the researcher and the research assistants only probed further on the responses when further clarification is required.

4.7 Methods of Data Analysis

The gathered data was organised and analysed using coding, descriptive statistics, frequency tables, percentages, and multiple regression analysis to test the hypotheses. The data was processed and evaluated using Stata, and the hypotheses were tested and accepted or rejected based on the results.

4.7.1 Descriptive Statistics

Data on the smallholder farmers' profile was analysed using frequency counts and simple percentages.

4.7.2 Regression Analyses

Two-staged least squares (2SLS) regression was used to analysed the determinants of the value chain optimisation of smallholder cashew and sesame farmers while ordinary least square regression was used to analyse their cost efficiency along the chain. This is because, the 2SLS method is particularly useful in the context of agricultural value chain optimisation. This is because it allows for the consideration of endogeneity, where independent variables are correlated with the error term (Mariano, 2011). In the context of agricultural value chain optimisation, certain variables such as quality of life of farmers, social class and productivity can influence each other. The 2SLS method allows for the calculation of a proxy for quality of life that is uncorrelated with the measurement errors in productivity and social class. This makes it a suitable method for analysing agricultural value chain optimisation, where such relationships are likely to exist. A study by Adelekan and Omotayo (2017) used 2SLS to analyze the effect of non-farm earnings on agricultural productivity. On the other hand, OLS is a suitable method for analysing cost efficiency along the value chain. One of the basic assumptions of OLS is that the values of the error terms are independent of the values of the predictors (Flynn, 2021). When this recursivity assumption holds true, OLS can provide unbiased real value estimates for your alpha and beta. In the context of cost efficiency analysis along the value chain, this assumption is likely to hold true, making OLS a suitable method. Furthermore, OLS is considered to be the most accurate method in segregating total costs into fixed and variable components, which is crucial in cost efficiency analysis.

Determinants of the value chain optimisation

This section of the analysis examines the relationship between the optimisation of the agricultural value chain and factors such as inflation, exchange rate, and interest rate. To analyse this, a two-stage least squares (2SLS) regression model was employed. A multiple linear regression model was considered the most suitable method for analysing the optimisation of the agricultural value chain as it takes into account factors such as inflation, exchange rate, and interest rate. Additionally, it is assumed that all of the sampled households that produce cashew and sesame also participate in the processing and packaging stages of the value chain. However, if the assumptions of the Classical Linear Regression (CLR) model are not met, the estimates from the model may not accurately represent the Best Linear Unbiased Estimator (BLUE). Therefore, it is important to assess the potential issues of multicollinearity and endogeneity before including significant variables in the regression models for analysis.

The problem of endogeneity occurs when one of the predictor variables in the regression model is correlated with the residual in the population data generation process. This can lead to bias and inconsistency in the estimated parameters of the model when using ordinary least squares estimation techniques. Endogeneity happens when one of the independent variables in a regression model is connected to the error term in the data-generating process. This can stem from various sources such as omitted variables, measurement errors, or simultaneous relationships (Maddala, 2001). To detect endogeneity, the Durbin-Wu-Hausman test was used. In this study, quality of life of cashew and sesame seed farmers, which is one of the independent variables, could lead to endogeneity bias in the ordinary least squares (OLS) method if it is correlated with the error term. Therefore, to identify the determinants of value chain optimisation of cashew and sesame seeds farmers, a 2SLS model was used. This model is an alternative to OLS except that it addresses issues of endogeneity by utilising a two-step process during the analysis phase (Wooldridge, 2010).

The representation of the optimisation function's econometric model specification is shown in matrix form:

$Y= \beta_0 + Xk'\beta_1 + \delta Y_1 + \varepsilon$___________ (1)

Where Y is a vector of value chain optimisation (net profit) of cashew and sesame, X' is exogenous variable that is assumed to affect value chain optimisation, Y_1 is a vector of endogenous variables which are quality of life of cashew and sesame seed farmers, β_0, β1 and δ are vectors of parameters to be estimated, and ε is a vector of the disturbance terms.

2SLS involves using OLS regression in two stages. In the initial stage of the analysis, the relationship between the dependent variable (quality of life of both crops' farmers) and all the independent variables in the system is examined by estimating a reduced form of the structural equations, with the endogenous variable being regressed on all the exogenous variables separately.

Reduced form: $Y_{1i} = \pi_0+ \pi_1 X_i+ \pi_2 Z_i+ v$ __________(2)

Where, Y_{1i} is endogenous variable (quality of life of cashew and sesame smallholder farmers, X_i is vector of exogenous variables (AGE, EDU, HSZE, INC, FARMSZ, PLTAGE, YLD,ETF,INFL,

EXCH, INT, TAX, CPI, PPI, STRT, CONSRT), Z_i is a vector of excluded instruments (productivity of smallholder farmers and social class); π are the coefficients to be estimated; and v is the errors terms, symmetrically distributed around zero. To ensure accurate results in this scenario, additional information is required. The instruments (Z) in this scenario must meet two criteria: they must be uncorrelated with the error term (ε), also known as being orthogonal to the error process (exogeneity condition, meaning Cov (Z, ε) =0), and they must be correlated with the endogenous variable (Y1) (relevance condition, meaning Cov (Y1, Z) ≠ 0). This is according to Wooldridge (2010). This means that Z affects the endogenous variable directly and has no direct connection to the dependent variable Y. By removing the residual from the regression equation (1) from the actual value of the quality of life variable (QoL cashew and QoL Sesame), a Y value for the quality of life variable is obtained that is not related to the error term.Itis important to conduct various tests prior to performing 2SLS estimations. In the second stage of the process, the variable for quality of life is replaced with the calculated value of yield in the structural equations. This results in the removal of all endogenous variables from the right-hand side of the equations. The explicit function of the two stage least square regression models were presented below. The data were normalized to bring them into common scale using natural log without distorting the differences in the range of values. Therefore, the models were in semi-log form.

For Cashew

(a) Stage one

$$lnQoL = \propto + \beta 1lnAGE + \beta 2lnEDU + \beta 3lnHSIZE + \beta 4lnMINC + \beta 5lnPROD + \beta 6lnSOCST + v$$

Stage two

$$lnOPT = \propto + \beta 1lnQoL + \beta 2lnAGE + \beta 3lnEDU + \beta 4lnHSIZE + \beta 5lnMINC + \varepsilon$$

(b) Stage one

$$lnQoL = \propto + \beta 1lnAGE + \beta 2lnEDU + \beta 3lnHSIZE + \beta 4lnMINC + \beta 5lnPLTAGE + \beta 6lnYLD + \beta 7lnFRMSZ + \beta 8lnPROD + \beta 9lnSOCST + v$$

Stage two

$$lnOPT = \propto + \beta 1lnQoL + \beta 2lnAGE + \beta 3lnEDU + \beta 4lnHSIZE + \beta 5lnMINC + \beta 6lnPLTAGE + \beta 7lnYLD + \beta 8lnFRMSZ + \varepsilon$$

(c) Stage one

$$\ln QoL = \propto + \beta 1\ln AGE + \beta 2\ln EDU + \beta 3\ln HSIZE + \beta 4\ln MINC + \beta 5\ln PLTAGE + \beta 6\ln YLD + \beta 7\ln FRMSZ + \beta 8\ln ETF + \beta 9\ln INFL + \beta 10\ln EXCH + \beta 11\ln INT + \beta 12\ln TAX + \beta 13\ln CPI + \beta 14\ln PPI + \beta 15\ln PROD + \beta 16\ln SOCST + v$$

Stage two

$$\ln OPT = \propto + \beta 1\ln QoL + \beta 2\ln AGE + \beta 3\ln EDU + \beta 4\ln HSIZE + \beta 5\ln MINC + \beta 6\ln PLTAGE + \beta 7\ln YLD + \beta 8\ln FRMSZ + \beta 9\ln ETF + \beta 10\ln INFL + \beta 11\ln EXCH + \beta 12\ln INT + \beta 13\ln TAX + \beta 14\ln CPI + \beta 15\ln PPI + \varepsilon$$

(d) Stage one

$$\ln QoL = \propto + \beta 1\ln AGE + \beta 2\ln EDU + \beta 3\ln HSIZE + \beta 4\ln MINC + \beta 5\ln PLTAGE + \beta 6\ln YLD + \beta 7\ln FRMSZ + \beta 8\ln ETF + \beta 9\ln INFL + \beta 10\ln EXCH + \beta 11\ln INT + \beta 12\ln TAX + \beta 13\ln CPI + \beta 14\ln PPI + \beta 15\ln STRG + \beta 16\ln CONSRT + \beta 17\ln PROD + \beta 18\ln SOCST + v$$

Stage two

$$\ln OPT = \propto + \beta 1\ln QoL + \beta 2\ln AGE + \beta 3\ln EDU + \beta 4\ln HSIZE + \beta 5\ln MINC + \beta 6\ln PLTAGE + \beta 7\ln YLD + \beta 8\ln FRMSZ + \beta 9\ln ETF + \beta 10\ln INFL + \beta 11\ln EXCH + \beta 12\ln INT + \beta 13\ln TAX + \beta 14\ln CPI + \beta 15\ln PPI + \beta 16\ln STRG + \beta 17\ln CONSRT + \varepsilon$$

For Sesame

(a) Stage one

$$\ln QoL = \propto + \beta 1\ln AGE + \beta 2\ln EDU + \beta 3\ln HSIZE + \beta 4\ln MINC + \beta 5\ln EXP + \beta 6\ln PROD + \beta 7\ln SOCST + v$$

Stage two

$$\ln OPT = \propto + \beta 1\ln QoL + \beta 2\ln AGE + \beta 3\ln EDU + \beta 4\ln HSIZE + \beta 5\ln MINC + \beta 6\ln EXP + \varepsilon$$

(b) Stage one

$$\ln QoL = \propto + \beta 1\ln AGE + \beta 2\ln EDU + \beta 3\ln HSIZE + \beta 4\ln MINC + \beta 5\ln EXP + \beta 6\ln YLD + \beta 7\ln FARMSZE + \beta 8\ln PROD + \beta 9\ln SOCST + v$$

Stage two

$$lnOPT = \propto + \beta 1 lnQoL + \beta 2 lnAGE + \beta 3 lnEDU + \beta 4 lnHSIZE + \beta 5 lnMINC + \beta 6 lnEXP + \beta 7 lnYLD + \beta 8 lnFARMSZE + \varepsilon$$

(c) Stage one

$$lnQoL = \propto + \beta 1 lnAGE + \beta 2 lnEDU + \beta 3 lnHSIZE + \beta 4 lnMINC + \beta 5 lnEXP + \beta 6 lnYLD + \beta 7 lnFARMSZE + \beta 8 lnETF + \beta 9 lnINFL + \beta 10 lnEXCH + \beta 11 lnINT + \beta 12 lnTAX + \beta 13 lnCPI + \beta 14 lnPPI + \beta 15 lnPROD + \beta 16 lnSOCST + v$$

Stage two

$$lnOPT = \propto + \beta 1 lnQoL + \beta 2 lnAGE + \beta 3 lnEDU + \beta 4 lnHSIZE + \beta 5 lnMINC + \beta 6 lnEXP + \beta 7 lnYLD + \beta 8 lnFARMSZE + \beta 9 lnETF + \beta 10 lnINFL + \beta 11 lnEXCH + \beta 12 lnINT + \beta 13 lnTAX + \beta 14 lnCPI + \beta 15 lnPPI + \varepsilon$$

(d) Stage one

$$lnQoL = \propto + \beta 1 lnAGE + \beta 2 lnEDU + \beta 3 lnHSIZE + \beta 4 lnMINC + \beta 5 lnEXP + \beta 6 lnYLD + \beta 7 lnFARMSZE + \beta 8 lnETF + \beta 9 lnINFL + \beta 10 lnEXCH + \beta 11 lnINT + \beta 12 lnTAX + \beta 13 lnCPI + \beta 14 lnPPI + \beta 15 lnSTRG + \beta 16 lnCONSRT + \beta 17 lnPROD + \beta 18 lnSOCST + v$$

Stage two

$$lnOPT = \propto + \beta 1 lnQoL + \beta 2 lnAGE + \beta 3 lnEDU + \beta 4 lnHSIZE + \beta 5 lnMINC + \beta 6 lnEXP + \beta 7 lnYLD + \beta 8 lnFARMSZE + \beta 9 lnETF + \beta 10 lnINFL + \beta 11 lnEXCH + \beta 12 lnINT + \beta 13 lnTAX + \beta 14 lnCPI + \beta 15 lnPPI + \beta 16 lnSTRG + \beta 17 lnCONSRT + \varepsilon$$

__Determinants of total cost of production__

The determinants of the total cost of production of cashew and sesame along the entire value chain were analysed using multiple linear regression model (OLS). Implicitly the models are stated as:

$$Y_t = \beta_0 + \beta X_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where:

Y_t= Total production cost along the value chain of cashew and sesame seeds

X_t= Vector of explanatory variable representing factors influencing total cost of cashew and sesame production along the value chain

β_0 = An intercept

β = Coefficient of explanatory variable

ε_t = Stochastic error term.

The explicit forms of the models are stated thus as:

$$InCOST = \propto + \beta 1InAGE + \beta 2InEDU + \beta 3InHSIZE + \beta 4InMINC + \beta 5InEXP + \varepsilon$$

$$InCOST = \propto + \beta 1InAGE + \beta 2InEDU + \beta 3InHSIZE + \beta 4InMINC + \beta 5InEXP + \beta 6InIMPSEED + \beta 7InFARMIMPL + \beta 8InFERT + \beta 9InLBOR + \beta 10InLAND + \beta 11InAGCHEM + \varepsilon$$

$$InCOST = \propto + \beta 1InAGE + \beta 2InEDU + \beta 3InHSIZE + \beta 4InMINC + \beta 5InEXP + \beta 6InIMPSEED + \beta 7InFARMIMPL + \beta 8InFERT + \beta 9InLBOR + \beta 10InLAND + \beta 11InAGCHEM + \beta 12InINBOUND + \beta 13InOUTBOUND + \varepsilon$$

$$InCOST = \propto + \beta 1InAGE + \beta 2InEDU + \beta 3InHSIZE + \beta 4InMINC + \beta 5InEXP + \beta 6InIMPSEED + \beta 7InFARMIMPL + \beta 8InFERT + \beta 9InLBOR + \beta 10InLAND + \beta 11InAGCHEM + \beta 12InINBOUND + \beta 13InOUTBOUND + \beta 14InETF + \varepsilon$$

4.7.3 Qualitative Data Analysis

The thematic analysis method, which involved organizing, categorizing, and identifying patterns or themes within the data to draw insight and conclusion was utilised to evaluate the data collected for this study. The following steps were used in arriving at the themes for the qualitative research:

1. Data collected through survey on agricultural value chain optimisation in a turbulent economy were thematically analysed through data familiarisation, coding, theme development and reviewing. Data familiarisation was conducted by reviewing of transcripts of interviews with various actors along the cashew and sesame value chain in the study areas. Relevant texts were highlighted and notes made on potential themes that emerged from the data. Relevant literatures on agricultural value chain optimisation were also reviewed.

2. Systematic review of data was then carried out with key phrases identified and initial codes assigned to relevant sections of text that are related to the themes of interest, including agricultural inputs used along the value chain of cashew and sesame, impact of economic turbulence on the the agricultural value chain of cashew and sesame, and challenges of cashew and sesame sub-sectors.

3. Overarching themes were identified through the iterative process of reviewing and comparing codes. Focus was made on the themes that emerged frequently and had a significant impact on agricultural value chain optimisation.

4. Reviewing and refining of the themes to ensure that they accurately reflected the data and provided a comprehensive understanding of agricultural value chain optimisation. This involved reviewing the transcripts and codes to ensure that each theme captured the relevant data and that there was enough data to support each theme. Themes were then refined by clarifying their meaning and ensuring they were distinct from one another. Each theme was then named based on its central concept.

Based on the analysis, the following themes emerged:

1. Agricultural inputs used along the cashew and sesame value chain
2. Impact of economic turbulence along the value chain of cashew and sesame
3. Challenges of cashew and sesame sub-sectors

4.8 Ethical Considerations

The significance of ethical considerations is that they provide guidance to the participants, the research organisation, and the researcher. To ensure ethical conduct in this study, a number of measures were taken such as: (i) Providing participants with an introduction letter outlining the purpose of the survey i.e academic research. (ii) Obtaining voluntary consents before proceeding to the questions (iii) Giving participants the option to opt-out should they become uncomfortable midway. (iv) Not obligating them to answer any question. (v) Avoiding suggestive questions that could lead to a pre-planned direction. (vi) Allowing rescheduling for those unwilling to participate on the scheduled date. (vii) Ensuring confidentiality of personal information. (viii) and utilising locally-approved methods for effective understanding for participants with low literacy level.

CHAPTER 5: VALUE CHAIN OPTIMISATION AND ECONOMIC TURBULENCE

5.1 Introduction

This chapter analyses the quantitative data drawn from value optimisation of cashew and sesame seeds in Nigeria. It presents and discusses the socio-economic characteristics of the respondents, as well as the descriptive statistics and correlation matrix of the variables under consideration.

5.2 Profile of the Respondents

The characteristics of the surveyed households, such as the gender, literacy level, marital status, age, income, and household size of the respondents, play a significant role in their involvement in the production, processing, and marketing of cashew and sesame seeds. Also, a household's composition can impact the decisions made regarding value chain activities. This section analyses the demographic information of the sampled households in relation to their participation in the cashew and sesame seed value chain, as gathered from the survey administered using Kobo toolbox.

Table 5.1: The profile of the respondents of this study

Variable	**Indicators**	**Cashew**		**Indicators**	**Sesame seeds**	
		N	%		N	%
Age	≤ 30	44	15.5	30-39	61	36.3
	31- 40	78	27.6	40-49	48	28.6
	41- 50	86	30.4	≥50	59	35.1
	51- 60	52	18.4			
	> 60	23	8.1			
Gender	Male	238	84.1	Male	165	98.2
	Female	45	15.9	Female	3	1.8
Educational level	No formal Education	40	14.1	No formal education	23	13.7
	Adult education	26	9.2	Adult education	4	2.4
	Primary	24	8.5	Primary	2	1.2
	Secondary	78	27.6	Secondary	17	10.1

	Tertiary	115	40.6	Tertiary	122	72.6
Marital Status	Single	32	11.3	Single	-	-
	Married	232	82.0	Married	167	99.4
	Divorced	4	1.4	Divorced	1	0.6
	Separated	3	1.1	Separated	-	-
	Widowed	12	4.2	Widowed	-	-
Household size	≤5	110	38.9	≤5	75	44.6
	6-15	163	57.6	6-15	87	51.8
	16-25	10	3.5	16-25	6	3.6
Monthly income	≤349	196	69.3	≤460	108	64.3
	350-849	69	24.4	461-960	34	20.2
	850-1349	8	2.8	961-1460	14	8.3
	≥1350	10	3.5	>1460	11	7.1
Years of experience	≤10	78	27.6	≤10	78	46.4
	11-20	112	39.6	11-20	63	37.5
	21-30	64	22.6	21-30	16	9.5
	>30	29	10.2	>30	11	6.6
Age of plantation	≤10	106	37.5			
	11-30	162	57.2			
	31-50	15	5.3			
Intercrop pattern*						
	Maize	157	55.5	Maize	65	38.7
	Cassava	133	47.0	Cassava	3	1.8
	Yam	130	45.9	Yam	2	1.2
	Vegetables	45	15.9	Vegetables	2	1.2
	Cocoa	19	6.7	Rice	61	36.3
	Potatoes	2	0.7	Pepper/Tomatoes	2	1.2
	Pepper/Tomatos	67	23.7	Banana/plantation	1	0.6
	Fibre crops	1	0.4			
	Banana/plantation	57	20.1			
	Oil palm	38	13.4			

N is the number of people under a category.

5.2.1 Age, gender, and education

The age of a household's head plays a significant role in agriculture as it impacts their level of experience in farming and, to an extent, reveals where the household is in its life cycle. The results, shown in Table 5.1 reveals that the average age of smallholder farmers who participated in this study and produced cashew and sesame seeds was 44 years. Additionally, a majority of the participants in this group were in their productive age, with 73.5% of cashew farmers and 64.9% of sesame farmers being 50 years or younger. This implies that the respondents are predominantly economically productive agile youth. This finding concurs with previous research (such as Yakubu, 2002; Oladimeji *et al*., 2014; Adamu and Bakari, 2015) which revealed that the age group between 21 and 60 years is the most active in agriculture and is more willing and able to take risks in pursuit of profit compared to older farmers.

Additionally, the majority of cashew farmers surveyed were headed by men (84.1%), while only 15.9% were headed by women. In contrast, sesame seed production was heavily skewed towards men, with 98.2% of the sampled farmers being male and only 1.8% being female. This large imbalance could be attributed to the fact in this region, although women are allowed to cultivate arable crops on their husband’s plots, permanent access is only granted to men. The implication of this finding is that cashew production is heavily dependent on men, as is consistent with previous research. Studies by Akor*et al*. (2014), Oladimeji *et al*. (2014), and Adamu and Bakari (2015) also found that sesame farming is primarily carried out by males rather than females.

Furthermore, education and literacy are key factors in increasing crop productivity because it can improve a household's ability to accept new ideas, manage resources, and use market information appropriately. Ultimately, this would increase sales volume and reduce marketing cost. The majority of the sampled cashew farmers (85.9%) and sesame seed farmers (86.3%) had received some form of education, including adult education and higher education; this indicates that most of the respondents were literate. The findings indicate that there is a possibility of higher profits in cashew and sesame farming through education, as it would allow farmers to gain access to information on innovative agricultural practices. Indeed, education is a critical factor that determines a farmer’s ability to access, understand, and apply technological knowledge (Zbinden and Lee, 2005).

5.2.2 Marital status, household size and income

The research found that a majority of the smallholder cashew (82%) and sesame seeds farmers (99.4%) surveyed were married, indicating that the availability of family labour for these types of farming in the study areas is likely. This aligns with previous findings by Tijani *et al*. (2010) that 60% of farming households are married. In fact, the size of a household can have an impact on the availability of family labour for farming activities. This study found that the average household of sampled cashew and sesame seed farmers consisted of 7 people living together, with most of the cashew (61.1%) and more than half of sesame seed (55.4%) household having a family size of 6 to 25 persons. This suggests that cashew and sesame farming can be a viable source of income for families, unfortunately, it also means that these households would have higher expenses; this would reduce their overall income from the enterprise. This observation is corroborated by the report of Solomon (2008), Banmeke (2003), and Makama *et al*. (2011) who reported that the higher the household size, the higher the availability of family labour for farming operations.

This study found that the average monthly income for smallholder cashew farmers was $326, and 69.3% of these farmers earn below $349 monthly. Similarly, the average monthly income for smallholder sesame seed farmers was $603, and 66% of this study's respondents earn less than $460 per month. The low monthly income earned by smallholder cashew and sesame seed farmers, combined with their large households, means that they are living below poverty line ($1 per day) if they depend solely on farm income. This is due to factors such as high costs of farming inputs, poor transportation infrastructure, and limited access to improved seed varieties (Samuel *et al*., 2020).

5.2.3 Years of experience, age of plantation and inter-cropping pattern

The study discovered that the largest group of farmers in the sample had been engaged in farming for 18 to 20 years. 67.2% of the cashew farmers have 20 years or less of experience, while the majority of the sampled sesame farmers (83.9%) have up to 20 years of experience in sesame seed production. This suggests that the farmers are familiar with the details and intricacies of the farming enterprise. The study implies that farmers in the area have a significant amount of experience in growing which could lead to higher profits. This is consistent with previous research that found farmers in Nasarawa (Abu *et al*., 2011) and Benue State (Adole, 2016) had an average of 12.8 and 15 years of experience respectively. Also, research has shown that farmers who have been farming for longer are more likely to be aware of new and efficient production methods (Amaza and Olayemi, 2002).

It was also found that the majority of cashew plantations in the study area were relatively mature, with an average age of 15 years. The vast majority of respondents (94.7%) reported owning plantations that were 30 years old or younger, while only a minority (5.3%) had plantations older than 30 years. This suggests that the plantations are likely to be fruiting at optimal levels. This aligns with the previous findings of Lawal *et al*., 2011 who recorded an average cashew plantation age of 26 years in Kogi State, and Coulibaly *et al*. (2019) who recorded an average of 27 years for cashew plantations in Ivory Coast.

The results showed that the most commonly grown crops alongside cashew by the surveyed farmers were maize, cassava, and yam. These crops were found to be the most cost-effective options for intercropping with cashew, as noted in previous studies by Lawal and Uwagboe (2017) and Ardiani *et al*. (2020). In Ghana, yam and maize were recommended as crops that generate higher returns to farmers when inter-cropped with cashew (Opoku-Ameyaw *et al*., 2011). The study conducted by Aremu-Dele *et al*. (2021) found that inter-cropping cashew with cassava and maize did not negatively impact the growth of the cashew seedlings, and the young cashew trees did not inhibit the growth of the other crops. Additionally, this study found that maize and rice were the most commonly inter-cropped with sesame by farmers. Other studies, such as those conducted by Teklu*et al*. (2021) in Ethiopia and Mkamilo (2004) in Tanzania, have also found that inter-cropping maize and sesame can complement each other.

5.3 Preliminary tests

5.3.1 Exploratory Factor Analysis (EFA)

A principal component analysis was conducted on the variables included in the regression analysis with the goal of reducing the number of variables or constructs that are interrelated. This provided the basis to extract and determine the specific constructs underlying a particular measure, thereby resulting in a unified and concise number of variables/factors measuring a similar construct. The analysis helped to determine the number of latent constructs underlying a set of items (variables) and which of these items have a greater impact or define the construct of measurement more (Hair *et al*. 2006). As shown in Table 5.2, the KMO index of 0.54 to 0.88 for cashew and 0.56 to 0.75 for cashew and sesame, along with the Bartlett's Sphericity of p-value

0.000 and 0.000, indicate a satisfactory factorability, and supports the suitability of the data for analysis.

The study also assessed the dependability of the variables, both independent and dependent, through a reliability test following the principal component analysis. The Cronbach's alpha test was used to assess the consistency of the scale used for each individual factor. Reliability is concerned with the consistency of the research instrument over time. The result of the reliability test revealed a Cronbach's Alpha value ranging from 0.530 to 0.986 and 0.580 to 0.924 for both cashew and sesame respectively. This indicates that the instrument is reliable and the implication of this is that the instrument is consistent across items internally. Shahin, (2011) reported that whilst measuring the internal consistency, a level of 0.6–0.7 was regarded satisfactory.

The results of the Durbin-Wu-Hausman test revealed that the quality of life variable for cashew and sesame smallholder farmers was endogenous, meaning it was correlated with the error term, thereby violating the assumptions of Ordinary Least Squares (OLS) and leading to biased estimates. The outcomes of the Durbin Wu-Hausman test indicate that the assumption that the quality of life of cashew and sesame farmers are not influenced by other factors was rejected at a significance level of 1% ($\chi 2 = 15.7288$ and P-value = 0.0001) and ($\chi 2 = 14.3607$ and P-value =0.0002), respectively using estat endogenous STATA command following the ivregress analysis. To address the endogeneity issue, the study employed the Two-Stage Least Squares (2SLS) technique. If the instruments used for estimation and hypothesis testing are unreliable and the model contains too many independent variables, using the Two-stage least squares method may not produce accurate results. To address the problem of endogeneity, the two-stage least squares method relies on the use of valid instrumental variables. Therefore, to determine the relevance of excluded variables in this study, F statistic was calculated from the first stage regression using the STATA command "estat” first stage. The F test result for quality of life of cashew farmers was 154.1 and for quality of life of sesame seed farmers was 156.1 (a general guideline states that if the F-test value is less than 10, it raises doubts about the validity of the hypothesis. In this study, the F-test statistic greatly exceeded the critical value, which suggests that the null hypothesis of weak instruments is rejected (refer to Appendix Tables). The validity of the over-identifying restrictions was also tested using Hansen-Sargan and Basmann tests using the "estatoverid" command. The results of the Sargan and Basmann tests for both cashew and sesame showed a P-value of 0.0000, indicating that the model was correctly specified and the instruments used were valid.

Table 5.2: Item factorability, principal components factoring and construct reliability

Variables	Bartlett's test of sphericity		KMO		Eigen value		Cronbach's alpha	
	Cashew	Sesame	Cashew	Sesame	Cashew	Sesame	Cashew	Sesame
Optimisation							0.673	0.924
Economic turbulence	1820.581	216.401	0.78	0.56	3.98	2.14	0.643	0.624
Inflation	228.534	140.865	0.54	0.59	2.06	2.01	0.530	0.580
Exchange rate	297.761	103.486	0.73	0.70	2.43	2.10	0.709	0.650
Interest rate	966.181	120.694	0.69	0.56	2.98	1.79	0.748	0.703
Taxation	539.863	196.441	0.69	0.70	2.24	2.39	0.644	0.671
CPI	557.107	264.108	0.62	0.75	2.60	2.73	0.715	0.745
PPI	281.723	117.354	0.59	0.61	2.19	1.99	0.547	0.598
Strategy	4885.416	700.851	0.88	0.67	7.30	2.96	0.986	0.672
Constraints	1585.897	1051.100	0.85	0.84	4.91	4.92	0.906	0.909

5.3.2 Confirmatory Factor Analysis (CFA)

Common Method Bias

To address the possibility of method bias affecting the measurement model outcomes, a common method bias test was conducted. As suggested by Podsakoff, Shen, and Podsakoff (2006), an "unmeasured latent factor" was used for studies that do not explicitly measure a common factor. Aiken and West (1991) compared standard regression weights before and after adding the Common Latent Factor (CLF) and found that the model was indeed affected by the CLF, with some of the deltas of the independent variables being more than 0.200. As a result, the subsequent model was adjusted to include the common method factor.

Validity and Reliability

To ensure that latent factors are well explained by their observed variables, it is important to avoid convergent validity issues. According to Hair, Black, and Babin (2010), certain thresholds must be met to achieve validity and reliability with parameters such as Composite Reliability (CR), Average Variance Expected (AVE), Maximum Shared Variance (MSV), and Average Shared Variance (ASV). To achieve reliability, CR should be greater than 0.70. For Convergent reliability to be achieved, CR should be greater than AVE and AVE should be greater than 0.50. For Discriminant validity, MSV should be less than AVE and ASV should be less than AVE. To achieve convergent validity, AVE was calculated, and all the retained items had AVE greater than 0.50. Therefore, all the factors achieved convergent validity. Discriminant validity was achieved by comparing the square roots of AVE on the diagonal in the matrix below to all inter-factor correlation. All factors showed adequate discriminant validity because diagonal values are greater than the correlations. All the retained factors achieved discriminant validity. Composite reliability was achieved for each factor. From the analysis, all the parameters were above the minimum threshold of 0.70, indicating that the variables retained during model modification achieved the validity and reliability. All the indicators are shown in Table 5.3 below. These findings are consistent with previous studies such as those by Hensele and Sarstedt (2013) and Sekaran and Bougie (2010).

Table 5.3a: Composite Reliability, Convergent and Discriminant Validity results of the CFA model (Cashew)

	CR	AVE	MSV	MaxR(H)	ETF	INFL	EXCH	INT	TAX	CPI	PPI
ETF	0.920	0.528	0.248	0.919	**0.727**						
INFL	0.885	0.642	0.066	0.810	-0.032	**0.941**					
EXCH	0.510	0.510	0.016	0.968	-0.008	0.027	**0.714**				
INT	0.734	0.631	0.205	0.755	0.134	0.198*	-0.093	**0.857**			
TAX	0.716	0.937	0.099	0.754	0.302***	0.088	-0.095	0.315***	**0.846**		
CPI	0.721	0.741	0.205	0.864	-0.079	0.199*	-0.125	0.453***	0.216**	**0.849**	
PPI	0.704	0.577	0.248	0.965	0.498	-0.256**	0.120	-0.100	0.006	-0.203**	**0.839**

Table 5.3b: Composite Reliability, Convergent and Discriminant Validity results of the CFA model (Sesame)

	CR	AVE	MSV	MaxR(H)	ETF	INFL	EXCH	INT	TAX	CPI	PPI
ETF	0.908	0.82	0.264	1.001	**0.906**						
INFL	0.712	0.858	0.073	0.86	-0.048	**0.926**					
EXCH	0.821	0.916	0.012	0.74	-0.029	0.058	**0.957**				
INT	0.961	0.867	0.246	0.736	0.118	0.158**	-0.084	**0.931**			
TAX	0.768	0.927	0.083	0.792	0.406***	0.038	-0.05	0.251	**0.963**		
CPI	0.977	0.893	0.205	0.882	-0.05	0.186*	-0.114	0.355**	0.230**	**0.945**	
PPI	0.875	0.79	0.279	0.993	0.372	-0.35	0.116	-0.11	0.014	0.472**	**0.888**

Model Fit Evaluation

Table 5.4 shows the results of a confirmatory factor analysis, which tests the fit between a theoretical model and observed data. The CMIN/DF ratio of 4.789 is within the acceptable range of 1 to 3, indicating that the model fits well. The CFI values of 0.986 and 0.951 is greater than the recommended value of 0.95, indicating an excellent fit. The SRMR values of 0.072 and 0.033 is less than the recommended value of 0.08, indicating an excellent fit. The RMSEA values of 0.056 and 0.036 is less than the recommended value of 0.06, indicating an excellent fit. Finally, the PClose values of 1.010 and 1.000 is greater than the recommended value of 0.05, indicating an excellent fit. Overall, these results suggest that the theoretical model fits well with the observed data, and there is a good level of agreement between them.

Table 5.4: Model Fit results of the Confirmatory Factor Analysis

Measure	**Observed value**	**Observed value**	**Recommended value**
	Cashew	**Sesame**	
CMIN/DF	2.731	2.607	Between 1 and 3
CFI	0.986	0.951	>0.95
SRMR	0.072	0.033	<0.08
RMSEA	0.056	0.036	<0.06
PClose	1.010	1.000	>0.05

5.4 Correlation matrix of independent variables

Table 5.5 highlights the correlation between the independent variables that impact the optimisation of the value chain for small-scale cashew farmers, as well as the descriptive statistics of these variables. From the table, it is observed that the mean of the socio-economic variables age, education, household size and monthly income are 43.6, 3.7, 6.9 and $326, respectively.

The agronomic variables of age of plantation, farm size allocated for cashew and yield have means of 14.9, 3.6 and 4.4, respectively. The economic turbulence has a mean 24.7 while the economic turbulence factors variables of inflation, exchange rate, interest rate, taxation, consumer price index and producer price index have the mean of 21.4, 22.2, 22.5, 20.3, 20.5 and 18.7 respectively.

Correlation matrix in Table 5.5 revealed that economic turbulence has negative and significant correlation with exchange rate and the agronomic variable yield. Also, economic turbulence shows a positive and significant correlation with income and household size of small-holder cashew farmers. Constraints to value chain optimisation and strategies to overcome the challenges of economic turbulence have positive and significant relationship with economic turbulence.

The variance inflation factors in Table 5.5 indicated that the VIF values ranges from 1.148 to 2.380. This implies that the data pass the test of multi-collinearity. Table 5.5 also shows that the predictive factors do not have any influence on each other.

Table 5.5: Descriptive statistics and correlation matrix

	Mean	SD	MIN	MAX	VIF	AGE	EDU	HSZE	PLTAGE	YLD	ETF	INFL	EXCH	INT	TAX	CPI	PPI	STRT	CONSRT	FRMSZE	INC
AGE	43.6	12.3	20	80	2.38	1															
EDU	3.7	1.4	1	5	1.71	-.447**	1														
HSZE	6.9	4.0	1	25	1.78	.553**	-.307**	1													
PLTAGE	14.9	8.4	3	50	1.28	.356**	-.260**	.197**	1												
YLD	4.4	2.5	1	15	1.67	-.168**	.153**	-.093	-.065	1											
ETF	24.7	5.5	6	30	1.25	.086	.048	.165**	.007	-.129*	1										
INFL	21.4	2.9	7	25	1.65	-.116	.140*	-.068	-.258**	-.046	-.009	1									
EXCH	22.2	2.5	7	25	1.43	.020	.079	-.021	-.013	.029	-.127*	.197**	1								
INT	22.5	5.1	9	30	1.57	-.113	.099	-.105	-.200**	.007	-.050	.322**	.276**	1							
TAX	20.3	4.7	9	30	1.86	-.060	.099	-.047	-.175**	-.054	.040	.571**	-.018	.445**	1						
CPI	20.5	4.3	6	30	1.15	.016	.048	.039	-.094	.020	-.012	.164**	.301**	.289**	.235**	1					
PPI	18.7	2.7	12	25	1.23	-.074	.060	.029	-.087	.051	.112	.328**	-.040	.097	.282**	-.029	1				
STRT	26.2	12.9	6	40	1.17	-.098	.206**	-.028	-.036	-.096	.335**	.144*	.027	-.047	.078	.083	.044	1			
CONSRT	21.4	4.1	8	24	1.29	-.064	.054	.102	-.039	-.012	.199**	-.012	-.030	-.007	-.102	-.006	-.031	.106	1		
FRMSZE	3.62	2.7	0.5	15	1.30	-.094	-.079	-.058	-.074	.087	-.070	-.051	-.008	.017	-.088	-.072	-.004	-.177**	-.007	1	
INC	326.07	325.18	45.95	1952.81	1.26	.069	.212**	.058	.042	.075	.127*	-.035	.090	.051	-.108	.024	-.015	.213**	.117*	-.010	1

5.5 Econometric analysis results of the determinants of value chain optimisation of cashew

Table 5.6 presents a summary of the 2SLS regression analysis. The presented models in the study are the initial and subsequent stages of the structural equations' regressions. The report includes the coefficients and their level of statistical significance.

1. Model 1 explores the effects of the socio-economic variables and the unobserved variables (productivity of the farmers and social status) on the quality of life in the first stage regression while the second stage of the two staged least square estimation explores the impact of endogenous variable (quality of life) and socio-economic (control variables) on value chain optimisation of cashew.

Stage one

$$lnQoL = \propto + \beta 1lnAGE + \beta 2lnEDU + \beta 3lnHSIZE + \beta 4lnMINC + \beta 5lnPROD + \beta 6lnSOCST + v$$

Stage two

$$lnOPT = \propto + \beta 1lnQoL + \beta 2lnAGE + \beta 3lnEDU + \beta 4lnHSIZE + \beta 5lnMINC + \varepsilon$$

2. In Model 2, the agronomic factors (age of plantation, yield and farm size) were analysed in addition to the endogenous and control variables.

Stage one

$$lnQoL = \propto + \beta 1lnAGE + \beta 2lnEDU + \beta 3lnHSIZE + \beta 4lnMINC + \beta 5lnPLTAGE + \beta 6lnYLD + \beta 7lnFRMSZ + \beta 8lnPROD + \beta 9lnSOCST + v$$

Stage two

$$lnOPT = \propto + \beta 1lnQoL + \beta 2lnAGE + \beta 3lnEDU + \beta 4lnHSIZE + \beta 5lnMINC + \beta 6lnPLTAGE + \beta 7lnYLD + \beta 8lnFRMSZ + \varepsilon$$

3. Model 3 presents the addition of economic turbulent and economic turbulent factors in addition to all variables in model 2.

Stage one

$$lnQoL = \propto + \beta1lnAGE + \beta2lnEDU + \beta3lnHSIZE + \beta4lnMINC + \beta5lnPLTAGE + \beta6lnYLD + \beta7lnFRMSZ + \beta8lnETF + \beta9lnINFL + \beta10lnEXCH + \beta11lnINT + \beta12lnTAX + \beta13lnCPI + \beta14lnPPI + \beta15lnPROD + \beta16lnSOCST + v$$

Stage two

$$lnOPT = \propto + \beta1lnQoL + \beta2lnAGE + \beta3lnEDU + \beta4lnHSIZE + \beta5lnMINC + \beta6lnPLTAGE + \beta7lnYLD + \beta8lnFRMSZ + \beta9lnETF + \beta10lnINFL + \beta11lnEXCH + \beta12lnINT + \beta13lnTAX + \beta14lnCPI + \beta15lnPPI + \varepsilon$$

4. Finally, model 4 presents the inclusion of strategies to overcome the challenges of economic turbulence and institutional constraints to the optimisation of value chain in addition to all factors presented in model 3.

Stage one

$$lnQoL = \propto + \beta1lnAGE + \beta2lnEDU + \beta3lnHSIZE + \beta4lnMINC + \beta5lnPLTAGE + \beta6lnYLD + \beta7lnFRMSZ + \beta8lnETF + \beta9lnINFL + \beta10lnEXCH + \beta11lnINT + \beta12lnTAX + \beta13lnCPI + \beta14lnPPI + \beta15lnSTRG + \beta16lnCONSRT + \beta17lnPROD + \beta18lnSOCST + v$$

Stage two

$$lnOPT = \propto + \beta1lnQoL + \beta2lnAGE + \beta3lnEDU + \beta4lnHSIZE + \beta5lnMINC + \beta6lnPLTAGE + \beta7lnYLD + \beta8lnFRMSZ + \beta9lnETF + \beta10lnINFL + \beta11lnEXCH + \beta12lnINT + \beta13lnTAX + \beta14lnCPI + \beta15lnPPI + \beta16lnSTRG + \beta17lnCONSRT + \varepsilon$$

Table 5.6: Value chain optimisation of smallholder cashew farmers

Variables	Model I	Model II	Model III	Model IV
QoL	-0.5458716**	-0.5975363***	-0.6530192***	-0.6287597***
AGE	-2.083771***	-1.372325**	-1.372325***	-1.22605*
EDU	-0.5607625*	-0.349805	-0.2886595	-0.3155411
HSIZE	0.2730944	0.224689	0.2894482	0.2430857
MINC	0.1640899	-0.0399133	-0.0317614	-0.0489141
PLTAGE		0.1235127	0.1505174	0.1529119
YLD		0.8965806***	0.8714513***	0.8919669***
FRMSZ		1.155647***	1.110054***	1.116776***
ETF			-1.176193**	-1.312023**
INFL			-0.4842094	-0.6132088
EXCH			0.875625	0.9133473
INT			0.8281573	0.8238144
TAX			-0.1883942	-0.0989116
CPI			0.0405368	0.0365227
PPI			-0.1054578	-0.034528
STRAT				0.0762888
CONSRT				0.7618068
Constant	7.841166***	3.549468***	4.020898*	2.730363
R^2	0.0144	0.1948	0.2180	0.2270
Adjusted R^2	-0.0034	0.1713	0.1741	0.1774
Sig level	0.0047***	0.0000***	0.0000**	0.0000***
N	283	283	283	283

Note: ***, ** and * are Significant at 1%, 5% and 10% significant levels, respectively.

Table 5.6 presents the determinants of value chain optimisation of cashew smallholder farmers. The statistical significance of Model 1 ($P < 0.01$) suggests that the model effectively explains the relationships between the hypothesised variables. The coefficient of determination (R^2) was used to assess the goodness of fit of the regression model, and it revealed that 1.4% of the variation in the value chain optimisation of cashew was explained by the socio-economic characteristics of the respondents. Also, quality of life, age and level of education have negative but significant influence on the value chain optimisation of cashew. Model 2 presents the addition of agronomic factors. The model was jointly significant ($P < 0.01$), and the addition of agronomic factors increases the variation explained to 19.48% as depicted by R^2 of 0.1948. All the variables in model 2 did not have significant influence on the value chain optimisation of cashew smallholder farmers except quality of life, age, yield and farm size allocated to cashew. This does not support the assumption of hypothesis 5 that agronomic practices have no significant effects on value chain optimisation.

Model 3 presents the inclusion of economic turbulence and economic turbulence factors. The model was statistically significant ($P < 0.01$). R^2 of 0.2180 implies that all the explanatory variables included in the model were able to explain 22% of the variation in value chain optimisation of cashew. The model highlights economic turbulence to be significance ($P \leq 0.05$), although negative. These finding rejects hypothesis 1. Also, the economic turbulence factors are not significant ($P > 0.1$) determinants of the value chain optimisation of cashew which accept the assumption of hypothesis 2.

Finally, model 4 incorporates strategies to address the challenges posed by economic fluctuations and institutional limitations in optimising the cashew value chain, in addition to the variables included in model 3. The model was statistically significant ($P < 0.01$) with R^2 of 0.2270 indicating that the inclusion of strategies to overcome the challenges of economic turbulence and institutional constraints to the value chain optimisation of cashew explained 23% of the variation in the model. The results of the study showed that the efforts to tackle economic volatility and institutional barriers have no notable impact on optimising the cashew value chain, which confirms hypotheses 6 and 7.

All the four models highlight significant and negative influence of quality of life and age on value chain optimisation of cashew which means that as the quality of life and age changes, the value chain optimisation decreases. Models 3 and 4 revealed that economic turbulence has negative and significant influence on the value chain optimisation of cashew. This implies that as the economic turbulence increases, optimisation decreases.

5.6 Discussion

Quality of life: This study revealed that the quality of life was negative and significantly related to value chain optimisation of cashew. The negative and significant connections between these two variables reveal that the standard of living of a household is a crucial factor impacting the optimisation decision made by the head of the household. An increase in the quality of life of the cashew smallholder farmers' households was found to negatively impact their value chain optimisation by $0.55 to $0.65, according to the coefficient results, when controlling for other factors.

This result suggests that as smallholder farmers' quality of life improves, they may be less inclined to prioritise their cashew farming activities; instead, they would diversify into other business ventures such as transportation and trading. This shift in focus can ultimately lead to a reduction in the optimisation and profitability of their cashew farming enterprise. This observation is in contradiction to the report of Edeoghon and Anozie, 2015. They reported that there is a positive but insignificant association between the profitability of vegetable farmers and their standard of living in Lagos state. Also, Hudu *et al*. (2018) reported that Irish potato farmers in Plateau state of Nigeria with high profitability/optimisation have low livelihood status/quality of life.

Age: The age of respondents was negative and statistically significant on cashew value chain optimisation. This means that as the age of the respondents' increases, there will be decrease in the optimisation of the cashew value chain by $1.22 to $2.08. The findings of the study by Abebe (2009) suggest that active aged group households are believed to have a greater level of wisdom and are more adept at gaining skills in agriculture and marketing. However, the study by Magabe (2016) found that age has a positive impact on farming, as it is seen as a proxy measure for the household's experience in farming. It can be inferred from this that though age comes with experience, knowledge and established relationships, older farmers often have resistant to new ways of doing things, which can hinder optimisation efforts. Also, older farmers may have limited access to information and resources that could help optimise the value chain such as new market data, funding opportunities, or training programs.

Educational status: Results showed that a lack of education has a negative impact on the optimisation of the cashew value chain, which contradicts the initial assumption. The findings indicate that a decrease in the educational level of cashew smallholder farmers leads to a decrease in value chain optimisation by $0.56, while keeping other factors constant. This may be because many farmers in the study area do not possess the minimum educational qualifications necessary to become producer-focused, which could grant them access to skills and information required to increase productivity. This is in tandem with previous studies e.g., Astewel (2010) and Ayelech (2011), who found that if farmers who produce paddy and avocado receive education, the supply of paddy and avocado to the market will increase respectively. Amare (2013) discovered that a higher education level among farmers has a significant positive effect on the amount of pepper surplus that is sold in the market. This suggests that providing farmers with training in production practices can improve value chain optimisation through improved management skills, enhanced technological knowledge and increased knowledge on market trends.

Farm size: The hypothesis 5 suggests that the agronomic characteristics of smallholders have no effect on their value chain optimisation. However, this study revealed that farm size has a significant and positive impact on the optimisation of the cashew value chain. This implies that farms with large area have an increased optimisation of $1.11 to $1.16, thereby suggesting that households with large farm size are more likely to have increased yield which translate to high optimisation. This implies that the agronomic characteristic of 'farm size' does affect value chain optimisation, contradicting the hypothesis H_05. Wubshet (2010), Alemnew (2011), and Toyiba *et al*. (2014) found that the size of the land devoted to coffee, red pepper, and papaya production had a significant and positive impact on the amount of each commodity sold in the market at the farm level. This suggests that larger farms have economies of scale and have the potential to produce cashew nuts at a lower cost per unit. Economic turbulence can have a profound impact on the farm size and value chain optimisation of smallholder farmers. During periods of economic instability, smallholder farmers often face a myriad of challenges that can affect their ability to maintain or expand their farm size, and consequently, their value chain optimisation. Economic turbulence can trap smallholder farmers in a cycle of low-intensity farming and low yields. This is often due to limited access to markets and insufficient profits, which prevent beneficial investments (Combary, 2022). This situation is further exacerbated in developing countries where most of the world's farmers are smallholders with farms less than two hectares in size (Hannah and Max, 2022). The size and low labor productivity on these farms can make it difficult for smallholders to increase their incomes, and escape poverty (Hannah and Max, 2022).

Yield: Findings from this study suggest a link between yield and value chain optimisation for cashew farmers, contradicting the null hypothesis 5 that the agronomic characteristics of smallholders have no effect on their value chain optimisation. Yield contributed positively and significantly to the value chain optimisation of cashew farmers; that is optimisation increases by about $0.88. The explanation here is that farmers with better plantation maintenance, improved varieties and younger trees will have better yield which translates to better optimisation. An elevated cashew yield increases the chances of farmers selling it in the market and earning higher profits, likely due to low household consumption of cashew nuts making a larger volume available for sale. This correlation aligns with prior studies like those by Muhammed (2011) and Amare (2013), which discovered that household production of teff and pepper had a significant and positive impact on marketable supply. Similarly, the research by Mahlet *et al*. (2015) showed that a rise in potato production positively impacts market supply significantly. Moreover, social capital networks can also have a positive impact on smallholder farmers' adoption of climate change adaptation strategies, as found in a study by Ogunleye et al. (2021). Social networks can help farmers access more resources, better understand the markets, and enable them to pursue opportunities by developing innovations (Etriya et al., 2019). The use of smart, digital, and precision technologies can also help address information asymmetries and deficiencies facing farmers, particularly smallholders, which can improve their productivity and generate the rural transformation needed for achieving the SDGs by 2030 (UN, 2021) Therefore, the agronomic characteristic of yield plays a significant role in the value chain optimisation of smallholder cashew farmers, rejecting hypothesis 5.

Economic turbulence: Hypothesis 1 states that economic turbulence has no influence on the value chain optimisation of smallholders. However, findings from this study presents compelling evidence that contradicts this hypothesis. The perception of smallholder farmers on the effects of economic turbulence on the optimisation of the value chain of cashew and sesame farming was found to be negative and significant. This means that as the farmers' perception of economic turbulence increases, the optimisation of the value chain decreases by $1.18 to $1.31. This could be due to the fact that the farmers' perception can lead to a change in attitude towards production, and a negative perception of economic turbulence can lead to a negative attitude towards increasing the profitability of cashew farming. Economic turbulence can have a profound influence on smallholders' value chain optimisation. Their perception of economic conditions can shape their decision-making process, affecting their level of commitment and willingness to invest in optimising the value chain. Economic turbulence appears to have a significant influence on value chain optimisation for smallholders, providing evidence against the stated hypothesis. This highlights the importance of stable economic conditions for smallholder farmers in order to maximise their value chain optimisation and profitability.

Economic turbulence can have a significant impact on agricultural value chain optimisation by smallholder farmers. The COVID-19 pandemic, for example, has disrupted the supply chain, leading to a shortage of labor and affecting the value chain (PMC, 2022). The impact of economic turbulence on agricultural value chains can be both positive and negative, depending on various factors such as participation in global value chains, commodity prices, and climate change. Smallholder farmers who participate in global value chains can benefit from improved productivity by diffusing improved technologies and knowledge. However, some smallholder farmers who lack the required skills and assets could be excluded from these modern markets. Economic turbulence can affect the competitiveness of value chains, and value chain actors need to be able to adapt to changing economic conditions (FAO, 2021). Commodity price changes can also affect the production and supply of agricultural commodities, which can affect the value chain. Sustained periods of low commodity prices can reduce farm revenues and cause farmers to increasingly rely on credit, making them vulnerable to higher interest rates and other changes to economic conditions. Sustained periods of high commodity prices, on the other hand, can contribute to increases in farm revenues and farm operator resilience to changes in economic conditions

Climate change is another factor that can affect agricultural value chains. Climate variability can deteriorate the sustainability of diverse sectors worldwide, including agriculture. Crop productivity can be affected dramatically due to variations in integral abiotic factors such as temperature, solar radiation, precipitation, and CO_2. The adverse effects of climate change on the overall productivity factor of the agricultural sector are significant for understanding the creation of local adaptation policies and the composition of productive climate policy contracts (FAO, 2021). In Nigeria, economic turbulence has affected the agricultural sector, with the sector experiencing a decline in growth due to factors such as insecurity, climate change, and poor infrastructure (Abbass *et al*., 2022). However, the sector has also shown resilience, with some farmers adopting new technologies and practices to improve their productivity and profitability (Abbass *et al*., 2022).

5.7 Correlation matrix of independent variables used in econometric analysis

Table 5.5 presents the correlation matrix and the descriptive statistics of the independent variables that are determinants of the value chain optimisation of sesame smallholder farmers.

As depicted in the table, the mean of socio-economic variables: age, education, household size, years of farming experience and monthly income is 44.3, 4.3, 6.9, 13.9 and $603 respectively. The agronomic variables of yield and farm size under sesame cultivation have means of 1.0 and 6.1 respectively. The economic turbulence has the mean of 26.9 while the economic turbulence factors variables of inflation, exchange rate, interest rate, taxation, consumer price index and producer price index have the mean of 23.4, 22.6, 26.5, 25.0, 19.9 and 20.4 respectively.

Correlation matrix in Table 5.5 revealed that economic turbulence has negative and significant correlation with the agronomic variable farm size. Also, economic turbulence relationship with socio-economic characteristics shows a negative and significant correlation with years of experience while positive and significant correlation with educational status and monthly income. The variance inflation factors in Table 5.6 indicated that the VIF values ranges from 1.221 to 3.059 which are less than 5.0. This implies that the data pass the test of multicollinearity. Table 5.5 also shows that the predictive factors do not have any influence on one another.

Table 5.7: Descriptive statistics and correlation matrix

Variable	Mean	SD	MIN	MAX	VIF	AGE	EDU	HSZE	YLD	ETF	INFL	EXCH	INT	TAX	CPI	PPI	STRT	CONSRT	MINC	EXP	FARMSZE
AGE	44.3	9.1	30	65	3.06	1															
EDU	4.3	1.4	1	5	1.46	-.037	1														
HSZE	6.9	3.7	3	25	2.64	.638**	-.267**	1													
YLD	1.0	0.1	1	1.5	2.18	.123	-.185	.050	1												
ETF	26.9	2.5	18	30	1.45	.136	.160*	.054	.020	1											
INFL	23.4	1.5	16	25	1.74	.065	-.181*	-.010	.021	-.007	1										
EXCH	22.6	1.7	17	25	1.41	.018	.075	.070	-.087	.110	-.243**	1									
INT	26.5	2.0	21	30	1.79	.042	.075	-.019	-.250*	-.070	.128	.056	1								
TAX	25.0	2.9	16	30	1.62	.140	-.025	.075	-.169	.113	.401**	-.093	.060	1							
CPI	19.9	3.9	8	30	1.55	.062	-.063	.059	-.117	-.058	.259**	.036	.265**	.208**	1						
PPI	20.4	2.8	12	25	1.22	.091	.111	.053	-.226	.073	.192*	-.029	.037	.213**	.012	1					
STRT	34.8	4.6	18	40	1.81	.297**	.149	.157*	.181	.677**	-.029	.027	-.024	.057	-.102	.022	1				
CONSRT	18.3	4.7	8	24	2.89	.007	-.124	.182*	-.446**	.433**	-.010	-.028	-.192*	.007	.029	-.086	.406**	1			
MINC	603.4	610.3	68.9	4594.9	1.45	.200**	.013	.352**	-.101	.174*	.090	.191*	-.079	.026	.145	.003	.109	.232**	1		
EXP	13.9	10.4	2.0	50	1.30	-.095	-.060	.032	-.116	-.167*	-.092	.119	.176*	-.036	.010	-.111	-.036	.042	-.008	1	
FARMSZE	6.1	3.2	1	20	1.80	-.048	-.422**	.058	-.003	-.349**	.121	-.184*	.048	-.109	.091	-.171*	-.392**	.119	-.044	.061	1

5.8 Econometric analysis results of the determinants of value chain optimisation of sesame

A summary of the two-stage least squares regression analysis is presented in Table 5.7, including the coefficients and statistical significance of the first and second stage of the structural equation models.

1. In Model 1, the first stage regression examines the relationship between socio-economic factors and unobserved variables (such as farmer productivity and social status) on the quality of life. Afterwards, the second stage of the 2SLS estimation then examines the impact of the endogenous variable (quality of life) and socio-economic factors (control variables) on the optimisation of the sesame value chain.

Stage one

$$\text{InQoL} = \propto + \beta1\text{InAGE} + \beta2\text{InEDU} + \beta3\text{InHSIZE} + \beta4\text{InMINC} + \beta5\text{InEXP} + \beta6\text{InPROD} + \beta7\text{InSOCST} + v$$

Stage two

$$\text{InOPT} = \propto + \beta1\text{InQoL} + \beta2\text{InAGE} + \beta3\text{InEDU} + \beta4\text{InHSIZE} + \beta5\text{InMINC} + \beta6\text{InEXP} + \varepsilon$$

2. In Model 2 the agronomic factors (yield and farm size) were analysed in addition to the endogenous and control variables.

Stage one

$$\text{InQoL} = \propto + \beta1\text{InAGE} + \beta2\text{InEDU} + \beta3\text{InHSIZE} + \beta4\text{InMINC} + \beta5\text{InEXP} + \beta6\text{InYLD} + \beta7\text{InFARMSZE} + \beta8\text{InPROD} + \beta9\text{InSOCST} + v$$

Stage two

$$\text{InOPT} = \propto + \beta1\text{InQoL} + \beta2\text{InAGE} + \beta3\text{InEDU} + \beta4\text{InHSIZE} + \beta5\text{InMINC} + \beta6\text{InEXP} + \beta7\text{InYLD} + \beta8\text{InFARMSZE} + \varepsilon$$

3. Model 3 presents the addition of economic turbulent and economic turbulent factors in addition to all variables in model 2.

Stage one

$$lnQoL = \propto + \beta1lnAGE + \beta2lnEDU + \beta3lnHSIZE + \beta4lnMINC + \beta5lnEXP + \beta6lnYLD + \beta7lnFARMSZE + \beta8lnETF + \beta9lnINFL + \beta10lnEXCH + \beta11lnINT + \beta12lnTAX + \beta13lnCPI + \beta14lnPPI + \beta15lnPROD + \beta16lnSOCST + v$$

Stage two

$$lnOPT = \propto + \beta1lnQoL + \beta2lnAGE + \beta3lnEDU + \beta4lnHSIZE + \beta5lnMINC + \beta6lnEXP + \beta7lnYLD + \beta8lnFARMSZE + \beta9lnETF + \beta10lnINFL + \beta11lnEXCH + \beta12lnINT + \beta13lnTAX + \beta14lnCPI + \beta15lnPPI + \varepsilon$$

4. Finally, in model 4, strategies to address institutional challenges and limitations are considered in addition to all factors previously examined in Model 3.

Stage one

$$lnQoL = \propto + \beta1lnAGE + \beta2lnEDU + \beta3lnHSIZE + \beta4lnMINC + \beta5lnEXP + \beta6lnYLD + \beta7lnFARMSZE + \beta8lnETF + \beta9lnINFL + \beta10lnEXCH + \beta11lnINT + \beta12lnTAX + \beta13lnCPI + \beta14lnPPI + \beta15lnSTRG + \beta16lnCONSRT + \beta17lnPROD + \beta18lnSOCST + v$$

Stage two

$$lnOPT = \propto + \beta1lnQoL + \beta2lnAGE + \beta3lnEDU + \beta4lnHSIZE + \beta5lnMINC + \beta6lnEXP + \beta7lnYLD + \beta8lnFARMSZE + \beta9lnETF + \beta10lnINFL + \beta11lnEXCH + \beta12lnINT + \beta13lnTAX + \beta14lnCPI + \beta15lnPPI + \beta16lnSTRG + \beta17lnCONSRT + \varepsilon$$

Table 5.8: Value chain optimisation of smallholder sesame farmers

Variables	Model I	Model II	Model III	Model IV
QoL	-0.1845091	-0.0918522	-0.0683825	-0.2024484
AGE	0.1972351	0.4399504	0.6360393	0.5566283
EDU	-0.4142104	-0.0515447	0.0695674	0.0602458
HSIZE	-1.091388**	-1.023652**	-0.9805094*	-0.9560703*
MINC	0.5254947*	0.3966593	0.2575945	0.2826062
EXP	0.6995108***	0.5037679**	0.5025815*	0.4592371*
YLD		-21.85202***	-24.1823***	-23.86192***
FARMSZE		22.62776***	24.92214***	24.48061***
ETF			0.2757632	-0.4759082
INFL			5.971595**	6.135018***
EXCH			2.285769	2.473366
INT			-0.914226	-0.2224048
TAX			-1.545167	-1.608915
CPI			-0.4394464	-0.5175922
PPI			-1.207384	-1.181885
STRAT				-0.3708953
CONSRT				0.9968048
Constant	3.057334**	2.432715*	-3.749541	-4.076603
R2	0.0544	0.2037	0.2305	0.2273
Adjusted R2	0.0192	0.1637	0.1546	0.1397
Sig level	0.0554*	0.000***	0.0002***	0.0005***
N	168	168	168	168

Note: ***, ** and * are Significant at 1%, 5% and 10% level of significance, respectively.

Table 5.7 showcases the elements that impact the enhancement of the smallholder farmer's sesame value chain. The first model shows that 5.4% of the variation in value chain optimisation can be explained by factors such as household size, monthly income, and years of farming experience. These factors were discovered to significantly affect value chain optimisation. The results from Model 2 indicate that agronomic factors, such as yield and farm size, have a significant impact on the value chain optimisation of sesame farming for smallholder farmers. This is evident by the increase in explained variation from 5.4% to 20.3% in the value chain optimisation of sesame. However, the direction of the influence of yield is not in line with the initial expectation that it would have a positive effect. This contradicts hypothesis 5.

Model 3 presents the inclusion of economic turbulence and economic turbulence factors. The model was statistically significant ($P < 0.01$). R^2 of 0.2305 implies that inclusion of economic turbulence and economic turbulence factors in the model were able to explain 23.1% of the variation in value chain optimisation of sesame. The economic turbulence factors were not significant determinants of the value chain optimisation of sesame except inflation as depicted in model 3. This is not in support of hypotheses 1 and 2. Finally model 4 is an inclusion of strategies to overcome the challenges of economic turbulence variables and institutional constraints to the value chain optimisation of sesame along with other variables in model 3. The model was statistically significant ($P < 0.01$) with R^2 of 0.2273 indicating that the strategies to overcome the institutional challenges of economic turbulence variables and institutional constraints to the value chain optimisation of sesame explained 22.7% of the variation in the model. Both strategies to overcome the challenges of economic turbulence variables and institutional constraints have no significant impact on the value chain optimisation of sesame which corroborates hypotheses 6 and 7. The model also accepts the assumptions of hypotheses 6 and 7.

Models 2, 3 and 4 revealed that yield has negative and significant influence on the value chain optimisation of sesame seeds. This implies that as the yield appreciates, optimisation depreciates. Also, model 3 revealed that inflation is a positive significant contributor to the value chain optimisation of sesame. This implies that as the inflation increases, value chain optimisation of sesame increases.

5.9 Discussion

Years of Farming Experience (EXP): The study found that the length of time a household has been growing sesame has a considerable effect on enhancing the sesame value chain. Specifically, as a farmer's experience increases by one year, their ability to optimise the value chain for sesame increases by \$0.70, \$0.50, and \$0.46, respectively. This is consistent with previous research (Ayelech, 2011; Ele *et al.*, 2013) that shows that farmers who have greater expertise in sesame cultivation and sales are able to generate more profit due to their increased knowledge and experience along the value chain. While experience is undoubtedly important in the sesame value chain, it is crucial to recognise that new farmers may bring innovative ideas and approaches to the value chain that will enhance optimisation.

Household size: The size of the household of the survey participants has negative and significant impact on the value chain optimisation of sesame at 5% and 10% significant levels. The negative sign implies that as the household size increases by 5, the value chain optimisation of sesame decreases by $1.09 to $1.02, while as the household increased by 10, the value chain optimisation decreased by $0.98 to $0.96 respectively, keeping all other factors constant. This is likely due to the fact that larger households consume more sesame, leaving less available for sale, and this definitely reduces the optimisation of sesame. This outcome supports the findings of Obasi *et al*. (2016) who discovered that the larger the household size, the more the consumption of sesame, which in turn reduces the amount available for sale. The result is in opposition to the conclusion reached by Musa *et al*. (2020), who determined that household size has a significant, positive effect on the profitability of sesame farming in the Dutsin-Ma Local Government area of Katsina State. These contrasting findings on the impact of household size on sesame farming and profitability depends on the context and specific conditions of the area being studied which include the local market conditions and the farming practices.

Monthly income: The income of the smallholder sesame farmers' households had a positive and statistically significant impact on their value chain optimisation at a 10% level of significance. As the income of the respondents increased by $10, their value chain optimisation of sesame farming also increased by $0.53. This is likely because farmers with more disposable income were able to purchase inputs such as improved seeds, fertilizers, and processing materials, which allowed them to add more value to their sesame products and make more profit. Adenegan *et al*. (2012) also noted that availability of income from other sources other than farming had a significant, positive impact on the amount of maize made available for sale in the market. They assert that farmers who have additional sources of income are likely to be inclined to take on more risk in order to produce more. This suggests that while monthly income can provide necessary financial resources to invest in better farming practices and reduce financial risks, it may also discourage innovation and limit the potential for the sesame value chain to generate higher incomes. Therefore, it is essential to strike a balance between stability and innovation to achieve optimal sesame value chain optimisation.

Yield: The regression coefficient of sesame yields negatively correlated with sesame value chain optimisation and significantly at 1% significant levels. The value of the coefficient for yield of sesame implies that a decrease in yield of sesame by one tonne results in a decrease in farm level optimisation by $24.18 to $21.85, keeping other factors constant. This may be due to the fact that a significant portion of the sesame produced is consumed by members of the household, leaving less available for sale in the market. This conclusion is at odds with the findings of Rehima (2006), Kindie (2007), and Bosena (2008), who reported the positively significant impact of quantity of sesame, red pepper and cotton produced by households on the sellable supply of each respective commodity. This suggests that yield is context specific and can be a function of factors such as location, land, managerial skills and practices. Therefore, optimisation of sesame value chain through yield can be achieved by the adoption of sustainable farming practices, efficient use of natural resources, and the adoption of value chain management strategies that optimise profitability for stakeholders.

Social networking among smallholder farmers can have a significant impact on their knowledge sharing and decision-making processes, which can ultimately affect their yield and profitability. Studies have shown that farmers who lack access to formal sources of agricultural information often rely on information within their informal social network (Pratiwi and Suzuki, 2017). Farmers' social networks can address the environmental problems of agriculture by expanding the number of farmers using beneficial land management practices through practices such as information sharing (Albizua et al., 2021). In addition, social networks can affect the probability of farmers' exposure/awareness about farmer-based seed producer cooperatives (FBSc) (Ofolsha et al., 2022). The effect of social networks on smallholder farmers' decision to join FBSc was studied in Hararghe, Oromia, Ethiopia, and it was found that ties to peer advice networks correspond to better learning outcomes (Pratiwi and Suzuki, 2017). Therefore, it is important to promote social networking among smallholder farmers to facilitate knowledge sharing and decision-making. This can be achieved through the adoption of sustainable farming practices, efficient use of natural resources, and the adoption of value chain management strategies that optimise value chain for smallholders.

In the context of Nigeria's economy, it has been noted that smallholder farmers play a crucial role in agricultural production and food security (Olagunju & Ajiboye, 2010). However, they often face challenges such as limited access to credit, low use of improved technologies, and poor access to markets (Adeyonu *et al*., 2016). These factors can significantly affect their yield and subsequently their value chain optimisation. Therefore, optimisation of sesame value chain through yield can be achieved by the adoption of sustainable farming practices, efficient use of natural resources, and the adoption of value chain management strategies that optimise profitability for stakeholders. This aligns with studies such as those by Olagunju & Ajiboye (2010) and Adeyonu *et al*. (2016), which highlight the importance of these factors in improving smallholder farmers' productivity and market participation in Nigeria. In essence, yield as an agronomic characteristic appears to have significant effects on value chain optimisation, providing evidence against the stated hypothesis that agronomic characteristics of smallholders have no effect on their value chain optimisation.

Farm size: The outcome demonstrates that the amount of land dedicated to growing sesame has a significant impact on optimising the sesame value chain at a 1% level of significance, with a positive correlation. This suggests that as the amount of land allocated for sesame production increases, so too does the quantity of sesame produce, which in turn increases the amount of sesame available for sale and the overall optimisation of the value chain. Therefore, the cost per unit produced will decrease due to the benefits of economies of scale. The optimisation of costs by $24.92 to $22.63 can be achieved by increasing the size of the sesame field, assuming all other variables remain constant. This indicates that a large farm size will give higher optimisation than farm size with smaller area. The findings here are supported by studies conducted by Wubshet (2010), Alemnew (2011), and Toyiba *et al*. (2014), who found that the size of the land dedicated to coffee, red pepper, and pawpaw production had a significant and positive impact on the market supply of these commodities at the farm level.

This is due to the economics of scale, where the per unit production cost decreases as the land size increases. Increasing the size of land allocated for sesame by one hectare leads to an increase in optimisation by $24.92 to $22.63, when other factors are held constant. This suggests that larger farms will lead to higher optimisation than smaller ones, as supported by findings from previous studies on coffee, red pepper, and papaya production (Wubshet, 2010; Alemnew, 2011; and Toyiba *et al*., 2014).

This finding in the context of institutional theory aligned with regulative pillar which refers to the rules and laws that organisations must follow (Osinubi, 2020). In this case, the "rules" are the agronomic practices and characteristics that smallholders follow to optimise their value chain. The positive impact of increasing farm size on value chain optimisation can be seen as a form of regulative pressure that encourages smallholders to increase their farm size. Thus, the evidence provided suggests a need to reject the null hypothesis H_05 in favour of an alternative hypothesis that agronomic characteristics do have a significant effect on value chain optimisation.

Inflation rate: The estimated coefficient of inflation rate was statistically significant at 1 and 5% significant levels and positively related to value chain optimisation of sesame smallholder farmers. By implication the increase in the inflation rate by 1% results in an increase in the value chain optimisation of sesame by $5.97; while increase in inflation rate by 5% shoots the optimisation of sesame value chain by $6.13, keeping other factors constant. Inflation has a negative impact on the ability to buy goods and services, and it is a measure of the instability in the economy as a whole. Inflation hinders the ability of actors in the value chain to make purchases due to high costs; this is in conflict with the findings of Iyoboyi and Musa-Pedro (2020) who discovered that inflation negatively and significantly impacts the optimisation of the agricultural value chain. This suggests that economic turbulence factors, such as inflation, do have an influence on the value chain optimisation of smallholders, contradicting hypothesis 2 which stated that economic turbulence factors have no influence on the value chain optimisation of smallholders. In Nigeria, the agricultural sector has been affected by economic turbulence factors such as inflation, exchange rate fluctuations, and insecurity. These factors have led to a decline in agricultural productivity and profitability, particularly for smallholder farmers who lack access to finance, technology, and markets (UNDP, 2014). The government has implemented various policies and programs to support smallholder farmers, such as the Anchor Borrowers' Program, which provides credit facilities to smallholder farmers at low-interest rates. However, more needs to be done to address the challenges faced by smallholder farmers and promote sustainable agricultural development in Nigeria. The estimated coefficient of inflation rate was positively related to value chain optimisation of sesame smallholder farmers, suggesting that economic turbulence factors do have an influence on the value chain optimisation of smallholders. In Nigeria, smallholder farmers face various challenges that affect their productivity and profitability, and more needs to be done to support their development and promote sustainable agriculture.

5.10 Conclusion

This chapter concludes that the production of cashew and sesame is primarily carried out by men who are young, married, and has some form of educational qualification. These farmers often have large families who assist with labour. On average, cashew farmers earn less than $500 per month while sesame farmers earn slightly higher. This financial inadequacy is compounded by the fact that they have large families. Most of these farmers have a significant amount of experience in the industry and often inter-crop cashew and sesame.

In addition, it was found that economic instability significantly impacts the optimisation of the cashew value chain, but not for the sesame value chain. Specifically, the factor of inflation rate has a significant impact on optimising the sesame value chain for smallholder farmers. Furthermore, the study revealed that the socio-economic characteristics of the household, such as age, education, household size, and monthly income, play a significant role in the value chain optimisation of both cashew and sesame. Specifically, the age and education of respondents have a significant impact on the value chain optimisation of cashew, while household size and monthly income have a significant impact on the optimisation of sesame. Additionally, the agronomic characteristics of the farmers, such as yield and farm area allocated to cashew and sesame, also have a significant influence on value chain optimisation.

The research offers deeper understanding of the impact of techniques aimed at addressing the challenges and limitations posed by macroeconomic factors on the optimisation of the cashew and sesame value chains. The findings indicate that neither the strategies for addressing these macroeconomic challenges nor the limitations they present have a significant impact on the optimisation of cashew and sesame by small-scale farmers.

CHAPTER 6: COST EFFICIENCY AND ECONOMIC TURBULENCE

6.1 Introduction

This chapter analyses the factors influencing value optimisation in the cashew and sesame value chain. An evaluation of the factors that impact the total cost of producing cashew and sesame at the farm level was performed to identify any limitations in production costs. Before conducting multiple linear regression analysis, preliminary correlational analysis was undertaken to check if the explanatory variables meet the threshold for multicollinearity.

6.2 Correlation matrix of independent variables

Table 6.1 presents the correlation matrix and the descriptive statistics of the independent variables that are determinants of the cost efficiency of cashew smallholders. As presented in the table, the mean of socio-economic variables of age, education, household size, years of farming experience, and monthly income are 43.6, 3.7, 6.9, 17.9 and $326, respectively. The cost of tangible resources; improved seeds, farm implements, fertilizer, labour, land and agrochemicals have mean values of 192.86, 76.44, 168.48, 881.70, 1883.15 and 83.1, respectively. The means for inbound and outbound logistics are 177.9 and 636.3 respectively. The mean for economic turbulence is 24.7. The correlation matrix in Table 6.1 indicates that economic turbulence only has a positive and significant relationship with household size and monthly income. The variance inflation factors, as shown in Table 6.1, range from 1.124 to 3.639, which are below 5.0, indicating that the data pass the test for multicollinearity. Furthermore, Table 6.1 also illustrates that the factors used for prediction do not affect each other.

Table 6.1: Descriptive statistics and correlation matrix

Variable	Mean	SD	MIN	MAX	VIF	AGE	EDU	HSZE	MINC	EXP	SEED	IMPL	FERT	LBOR	LND	AGRC	INBND	OUTBND	ETF
AGE	43.6	12.3	20	80	3.64	1													
EDU	3.7	1.4	1	5	1.56	-.447**	1												
HSZE	6.9	4	1	25	1.52	.553**	-.307**	1											
MINC	326.1	325.2	45.95	1952.8	1.15	.069	.212**	.058	1										
EXP	17.9	10.2	3	59	3.3	.813**	-.468**	.489**	-.012	1									
SEED	192.9	171.4	57.4	781.1	1.32	.015	.362*	.025	-.314	.062	1								
IMPL	76.4	38.3	19.8	218.8	2.55	.133	.032	.215*	-.105	.110	.432**	1							
FERT	168.5	150.8	11.5	689.2	1.38	.079	.434**	.123	.065	-.162	.446	-.014	1						
LBOR	881.7	379.6	13.8	1723.1	2.16	.020	-.016	-.067	.074	.023	.338	.139	.024	1					
LAND	1883.2	1681.9	413.5	11487.1	1.88	-.174	.004	-.028	.014	-.141	.285	.331**	.085	-.009	1				
AGRCHEM	83.1	42.1	20.2	220.6	2.52	.115	-.088	.139	-.134	.055	.538*	.301**	.430*	.175	.122	1			
INBOUND	177.9	420.1	0.46	1688.6	1.2	.248	.057	.615*	-.364	-.026	.c	-.212	.c	.576	-.390	.576	1		
OUTBOUND	636.3	643.2	20.7	4480	1.19	.127	.101	.050	.117	.054	-.231	-.193	.298	-.188	-.228	.468*	.651	1	
ETF	24.7	2.9	7	25	1.12	.086	.048	.165**	.127*	.068	.002	.164	-.120	-.023	.033	-.052	-.435	.047	1

6.3 Regression analysis of the determinants of the costs of production of cashew along the value chain

Table 6.2 provides a summary of the regression analysis. The table outlines the coefficients and statistical significance.

1. Model 1 explores the effects of socio-economic (control variables) on total cost of production of cashew nut and kernel along the value chain.

$$lnCOST = \propto + \beta 1lnAGE + \beta 2lnEDU + \beta 3lnHSIZE + \beta 4lnMINC + \beta 5lnEXP + \varepsilon$$

2. In Model 2 the tangible resources costs (improved seeds, farm implements, fertilizer, farm labour, land and agrochemicals) were analysed in addition to the control variables.

$$lnCOST = \propto + \beta 1lnAGE + \beta 2lnEDU + \beta 3lnHSIZE + \beta 4lnMINC + \beta 5lnEXP + \beta 6lnIMPSEED + \beta 7lnFARMIMPL + \beta 8lnFERT + \beta 9lnLBOR + \beta 10lnLAND + \beta 11lnAGCHEM + \varepsilon$$

3. Model 3 presents the addition of intangible resources costs (inbound and outbound logistics) in addition to the input costs and control variables.

$$lnCOST = = \propto + \beta 1lnAGE + \beta 2lnEDU + \beta 3lnHSIZE + \beta 4lnMINC + \beta 5lnEXP + \beta 6lnIMPSEED + \beta 7lnFARMIMPL + \beta 8lnFERT + \beta 9lnLBOR + \beta 10lnLAND + \beta 11lnAGCHEM + \beta 12lnINBOUND + \beta 13lnOUTBOUND + \varepsilon$$

4. Finally, model 4 presents the inclusion of economic turbulence along with all factors presented in model 3.

$$lnCOST = \propto + \beta 1lnAGE + \beta 2lnEDU + \beta 3lnHSIZE + \beta 4lnMINC + \beta 5lnEXP + \beta 6lnIMPSEED + \beta 7lnFARMIMPL + \beta 8lnFERT + \beta 9lnLBOR + \beta 10lnLAND + \beta 11lnAGCHEM + \beta 12lnINBOUND + \beta 13lnOUTBOUND + \beta 14lnETF + \varepsilon$$

Table 6.2: Cost efficiency of cashew smallholder farmers along the value chain

Variables	Model I	Model II	Model III	Model IV
AGE	0 .0777025	0. 8920314*	0. 4896017	0. 4733148
EDU	1.02089***	0. 7290343***	0. 4707887***	0. 4630909***
HSIZE	0. 2542702	0. 2183894	0. 0033139	0. 0015395
MINC	0. 3457169***	0. 2041166*	0. 1149332	0. 1099002
EXP	-0.0327342	-0.3052235	0.0682192	0.0682059
IMPSEED		0. 2274607***	0. 1295907***	0. 1277744***
FARMIMPL		-0. 3352103***	-0. 1751012	-0. 1770495
FERT		-0. 0763603	-0. 1210226***	-0. 1164432**
LBOR		0. 0210744	0. 0292571	0. 0217474
LAND		-0. 1546961*	-0. 0735658	-0. 0672477
AGCHEM		0. 1426264**	0. 0179809	0. 0171561
INBOUND			0. 4285918***	0.4343347***
OUTBOUND			0. 2663614***	0. 2614728***
ETF				0. 2690563
Constant	1.261227	1.119876*	1.335702**	1.012793
R2	0.1566	0.4286	0.6024	0.6038
Adjusted R2	0.1414	0.4054	0.5831	0.5831
Sig level	0.000***	0.000***	0.000***	0.000***
N	283	283	283	283

Note: ***, ** and * are Significant at 1%, 5% and 10% levels of significance, respectively.

Model 1 shows that socio-economic factors explain 15.6% of the effect on total cost of production of cashew. Age, household size and years of farming experience are not statistically significant; however, the model presents a positive significant impact of education (1.02, $P < 0.01$) and monthly income (0.35, $P < 0.05$).

Model 2 presents the result of adding tangible resources costs. The addition of these six variables explains 42.9% of the variation in the total production cost of cashew. Costs of improved seeds (0.23, $P < 0.01$) and agrochemicals (0.14, $P < 0.1$) are shown to have a positive association with the total cost while costs of farm implements and agricultural lands have negative and significant effect on the total cost. Thus, hypotheses 4 are not supported.

Model 3 presents the assessment of the impact of costs of intangible resources (inbound and outbound logistics) on the total cost of cashew production along the value chain. Both inbound and outbound logistics ($P < 0.01$) were found to exert positive and significant influence on the total cost. This negates hypothesis 4.

Model 4 explains 60.38% of total cost with little distinction to that of model 3 which explains 60.24% of total cost in terms of model explanatory power. Economic turbulence as believed by the farmers is not a significant determinant of the total cost of cashew along the value chain of production. This supports hypothesis 3.

6.4 Discussion

6.4.1 Socio-economic characteristics of respondents and total cost of production

The results of the efficiency cost models indicate that all of the explanatory variables related to socio-economic have a consistent direction of impact, except for gender. Out of the five socio-economic factors analysed, three were found to have a significant impact on cost efficiency in cashew production, specifically age, education and monthly income.

Age: The coefficient for age is positive and statistically significant at the 10% level, indicating that as age increases, cost efficiency decreases. This means that as farmers get older, cost efficiency decreases by 89%. This finding suggests that younger farmers tend to have more energy and better managerial skills, which older farmers lose over time. This is consistent with the findings of Joseph *et al*. (2019) who found that age is significantly and positively related to cost efficiency under maize production in Adamawa state, Nigeria.

Educational level: The coefficient of education is found to have a positive and statistically significant impact on cost efficiency at a 1% level, meaning that farmers with higher levels of education tend to be more efficient in terms of cost than those without education. This suggests that as the level of education of a farmer increases, their cost efficiency improves by 46% to 102%. Educated farmers have an advantage in adopting new technologies more easily, which supports the findings of Joseph *et al*. (2019), but contradicts the findings of Maurice *et al*. (2014) who found that education had no significant impact on production cost.

Monthly income: The coefficient of monthly income indicates that as the farmers' income increases on a monthly basis, their cost efficiency also increases by 20.4% to 34.6%. This suggests that farmers who have more financial resources tend to invest more in the production of cashew, which in turn increases their costs. This aligns with the research of Joseph *et al*. (2019) who found that socio-economic characteristics influences production cost.

6.4.2 Costs of agricultural inputs

The costs of improved seeds, farm implements, fertilizers, land and agrochemicals are statistically significant at least 10% level of significance; means that these factors are important determinants of total cost associated with cashew production along the value chain. The expected relationship is that if the costs of a variable decrease, the total cost will decrease, and if the variable cost increases, the total cost will also increase, in direct proportion. This rejects the assumption of hypothesis 4 that there is no significant correlation between the costs of resources used and the total cost of production for smallholder farmers along the value chain.

Smallholder farmers are the backbone of sustainable agricultural development, and networking among them is crucial to their success. As Chaudhuri et al. (2021) argue, farmer-to-farmer interaction is key to disseminating new knowledge and ideas. By sharing information and best practices, smallholder farmers can adopt new technologies, crops, and cropping methods that can lead to improved farming practices and increased productivity. Social interactions within these networks are essential in facilitating the transfer of agricultural information, as noted by Pratiwi and Suzuki (2017). The Better Life Farming (BLF) multi-stakeholder alliance is one example of how social networking can be leveraged to promote sustainable agriculture. BLF creates local ecosystems of private and public partners that offer comprehensive and accessible services to smallholders, including education, training, access to credit and insurance, and supplies of seeds, fertilizers, crop protection, irrigation, and farming equipment.

Participation in multiple output markets is another way smallholder farmers can improve their livelihoods. Manda et al. (2021) found that smallholder farmers who jointly participated in multiple output markets spent as much as 24% of their income on food, indicating significant welfare impacts. Additionally, digital technologies can enhance smallholder farmers' inclusion in global value chains by reducing the costs of certification and opening up opportunities in international markets (Kos and Kloppenburg, 2019). In conclusion, social networking and knowledge sharing are critical to improving the livelihoods of smallholder farmers and promoting sustainable agricultural development. By collaborating and sharing information, smallholder farmers can adopt new technologies, participate in multiple output markets, and access international markets. These initiatives can lead to increased productivity, improved livelihoods, and ultimately contribute to sustainable agricultural development.

Costs of improved seeds: The cost elasticity with respect to cost of improved seed is positive and significant ($P < 0.01$). It can be inferred that an increase in the cost of improved seeds increases total production cost. That is, 1% increase in cost of improved seeds will increase total production cost by 13% to 23%. This indicates that the cost of improved is not cost efficient because it significantly adds to production cost. This supports the assertion from the qualitative study that improved seeds have shorter maturity; this makes it more expensive than the local seeds. This contradicts the findings of Chhetri *et al*. (2016) who stated that improved seeds have no significant implication on the cost of production. Also, Ojimba (2017) stated that the cost of improved cassava planting materials is negative and significantly influence the total production cost.

Costs of farm implements: The coefficient of farm implement estimated was negative and significant at 1% level of significance indicating when the cost of implements decreases by 1%, the cost of production of cashew decreases by 33.5% along the value chain. This reduction though inelastic is necessary as reduction in the cost of production will lead to higher profit level for small-scale farmers as found in Ochi *et al*. 2015.

Cost of fertiliser: The coefficient of cost of fertiliser was negative and significant at 1% and 5% levels of significance implying that 1% decrease in the cost of fertiliser will decrease the total cost by 12% while 5% decrease in the cost of fertilizer will reduce the total cost of cashew production by 11.6%. Although this reduction is inelastic, it indicates that fertiliser efficiently lowers the cost of production of cashew smallholder farmers, and this observation is consistent with the conclusions of Afreen and Haque, (2014) and Ojimba *et al*. (2017).

Land: The impact of the cost of land on the total cost of cashew production was negative and statistically significant at a 10% significance level. This suggests that a decrease in the cost of land per hectare by 10% leads to a reduction of 15.5% in the total production cost. This indicates that the cost of land accounts for more than 80% of the total cost of production of cashew and its reduction will lower cashew production cost and increase the profit of farmers. Maurice *et al*, (2104) found the cost of land to be a positive and significant determinant of production cost in Adamawa state.

Cost of agrochemicals: This suggests that as the cost of agrochemicals increases by 5%, the total cost of production also increases by 14.3%. This implies that agrochemicals are not cost-efficient and have a significant impact on the overall cost of production. Reducing the cost of agrochemicals would make cashew production more viable, as noted by previous authors e.g Audu *et al*. (2013) and Afreen and Haque (2014).

In Nigeria, the agricultural sector has been affected by economic turbulence, with the sector experiencing a decline in growth due to factors such as insecurity, climate change, and poor infrastructure (FAO, 2023). However, the sector has also shown resilience, with some farmers adopting new technologies and practices to improve their productivity and profitability (FAO, 2021). The Nigerian economy has been facing several challenges including inadequate infrastructure, tariff and non-tariff barriers to trade, obstacles to investment, lack of confidence in currency valuation, and limited foreign exchange capacity (Ibragimova, 2020). These issues can significantly impact the costs of resources used in agricultural production.

For example, inadequate infrastructure can increase the cost of transporting farm implements and fertilizers to rural areas where they are needed. Tariff and non-tariff barriers can increase the cost of imported seeds or agrochemicals (Ibragimova, 2020). Limited foreign exchange capacity can make it more expensive to import these items. All these factors can increase the costs of resources used in agricultural production, thereby increasing the total cost of production.

6.4.3 Logistics cost

The results of the analysis show that the costs of inbound logistics and outbound logistics have a significant impact on the total cost of cashew production along the entire value chain, as determined by a significance level of 1%. These factors are deemed crucial in determining the overall cost of production.

Inbound and outbound logistics: The cost of transportation is a significant factor that affects the economic performance of smallholder farmers in Nigeria. The cost elasticity with respect to both inbound and outbound logistics used in the analysis are positive, implying that an increase in the cost of inbound and outbound transportation increases total production cost. A 1% rise in the cost of inbound transportation will result in a 43% hike in the overall production cost, while a 1% rise in the cost of outbound transportation will lead to a 26% increase in the total production cost. The high cost of transportation will increase the total production cost, and negatively impact the profitability of farmers, making the production process less efficient. Reduction in the cost of production will lead to higher profit level for small scale farmers (Savic, 2020; Marsh, 2023). Joseph et al. (2019) also reported a positive and significant influence of transportation cost on the total cost of production of maize farmers in Adamawa state. This negates the assumption that there is no significant correlation between the costs of resources used and the total cost of production for smallholder farmers along the value chain. The study found that transportation costs represent a significant determinant of total operating costs, and therefore the selling price, which affects the economic performance of farmers.

Intangible resources such as social networking and knowledge sharing among smallholder farmers can play a significant role in reducing transportation costs and improving the economic performance of smallholder farmers. According to the Von Thunen model, the cost of transportation is a linear function of distance, which means that the cost of transporting goods increases proportionally with distance (Kaylan and Patel, 2023). Therefore, farmers located closer to the market will be more profitable because they can sell their products at a higher price and have lower transportation costs. This highlights the importance of networking and building relationships with buyers and other stakeholders in the value chain to reduce transportation costs and improve profitability (Volpe et al., 2013, Adamopoulos, 2011).

In Nigeria, the cost of transportation has been a major issue affecting the agricultural sector, with inadequate infrastructure and poor road networks leading to high transportation costs. This can significantly impact the costs of resources used in agricultural production, thereby increasing the total cost of production (Gathala *et al*., 2021). The government and stakeholders in the agricultural sector need to address these issues and develop strategies to reduce transportation costs and improve the efficiency of the value chain.

6.5 Correlation matrix of independent variables

Table 6.3 shows the correlation and statistical summary of the independent factors that affect the cost-effectiveness of small-scale sesame farmers. The table shows that the average values for socio-economic variables such as age, education, household size, farming experience, and monthly income are 44.3, 4.3, 6.9, 13.9, and 603.4 respectively. The tangible resources costs including improved seeds, farm implements, fertilizer, labour, land, and agrochemicals have an average value of 119.1, 78.6, 80.4, 806.0, 1364.3, and 81.7 respectively. The costs for both inbound and outbound logistics are 536 and 217.4 respectively. The mean for economic turbulence is 26.9.

The correlation matrix in Table 6.3 also revealed that economic turbulence has positive and significant association with education and monthly income. There is a positive and significant correlation between the cost of labour and economic turbulence, and a negative and significant correlation between the cost of land and economic turbulence. Similarly, economic turbulence has negative and significant relationship with the inbound logistics of inputs. The variance inflation factors in Table 6.3 indicated that the VIF values ranges from 1.047 to 5.369 and implies that the data pass the test of multicollinearity. Table 6.3 also shows that the predictive factors do not have any influence on one another.

Table 6.3: Descriptive statistics and correlation matrix

Variable	Mean	SD	MIN	MAX	VIF	AGE	EDU	HSZE	MINC	EXP	SEED	IMPL	FERT	LBOR	LND	AGRCHM	INBND	OUTBND	ETF
AGE	44.3	9.1	30	65	1.89	1													
EDU	4.3	1.4	1	5	1.42	-.037	1												
HSZE	6.9	3.7	3	25	2.28	.638**	-.267**	1											
MINC	603.4	610.3	68.9	4594.9	1.22	.200**	.013	.352**	1										
EXP	13.9	10.4	2	50	1.06	-.095	-.060	.032	-.008	1									
SEED	119.1	49.1	46	217	4.97	.039	.029	-.100	.003	-.049	1								
IMPL	78.6	9.5	13.8	82.7	5.37	-.102	-.006	-.142	.136	.116	.b	1							
FERT	80.4	30.4	57.4	114.9	1.28	-.165	.327	.982	.982	.619	.b	-.655	1						
LBOR	806	401.1	183.8	2067.7	3.51	-.042	.136	-.210	.089	-.088	.059	-.221	-.412	1					
LND	1364.3	637.7	183.8	2871.8	4.94	.230	.006	.367**	.113	.121	-.029	.192	.690	-.360**	1				
AGRCHM	81.7	37.9	11.5	147	4.8	-.178	-.116	-.049	.154	.062	-.019	.273*	-.159	-.139	.182	1			
INBND	536	804.9	0.02	3446.1	1.26	-.046	-.178	.077	-.138	-.058	.208	-.203	-1.0**	-.073	.032	.003	1		
OUTBND	217.4	418.4	23	3446.1	1.05	.213	.082	.103	-.004	-.093	-.076	-.696**	-1.0**	.253	-.214	-.039	.102	1	
ETF	26.9	2.5	18	30	1.19	.136	.160*	.054	.174*	-.167*	.139	.141	-.470	.362**	-.268*	-.042	-.250*	.236	1

6.6 Regression analysis of the determinants of the costs of production of sesame along the value chain

Table 6.4 provides a summary of the regression analysis. The table outlines the coefficients and statistical significance.

1. Model 1 explores the effects of socio-economic (control variables) on the total cost of production of sesame seeds along the value chain.

$$\ln COST = \propto + \beta 1 \ln AGE + \beta 2 \ln EDU + \beta 3 \ln HSIZE + \beta 4 \ln MINC + \beta 5 \ln EXP + \varepsilon$$

2. In Model 2, the tangible resources costs (improved seeds, farm implements, fertilizer, farm labour, land and agrochemicals) were analysed in addition to the control variables.

$$\ln COST = \propto + \beta 1 \ln AGE + \beta 2 \ln EDU + \beta 3 \ln HSIZE + \beta 4 \ln MINC + \beta 5 \ln EXP + \beta 6 \ln IMPSEED + \beta 7 \ln FARMIMPL + \beta 8 \ln FERT + \beta 9 \ln LBOR + \beta 10 \ln LAND + \beta 11 \ln AGCHEM + \varepsilon$$

3. Model 3 presents the addition of intangible resources costs (inbound and outbound logistics) in addition to the input costs and control variables.

$$\ln COST = \propto + \beta 1 \ln AGE + \beta 2 \ln EDU + \beta 3 \ln HSIZE + \beta 4 \ln MINC + \beta 5 \ln EXP + \beta 6 \ln IMPSEED + \beta 7 \ln FARMIMPL + \beta 8 \ln FERT + \beta 9 \ln LBOR + \beta 10 \ln LAND + \beta 11 \ln AGCHEM + \beta 12 \ln INBOUND + \beta 13 \ln OUTBOUND + \varepsilon$$

4. Model 4 includes the factor of economic turbulence in addition to all other variables previously listed in Model 3.

$$\ln COST = \propto + \beta 1 \ln AGE + \beta 2 \ln EDU + \beta 3 \ln HSIZE + \beta 4 \ln MINC + \beta 5 \ln EXP + \beta 6 \ln IMPSEED + \beta 7 \ln FARMIMPL + \beta 8 \ln FERT + \beta 9 \ln LBOR + \beta 10 \ln LAND + \beta 11 \ln AGCHEM + \beta 12 \ln INBOUND + \beta 13 \ln OUTBOUND + \beta 14 \ln ETF + \varepsilon$$

Table 6.4: Cost efficiency of sesame smallholder farmers along the value chain

Variables	Model I	Model II	Model III	Model IV
AGE	-0. 1899574	-0. 2707883	-0. 2400486	-0. 1884763
EDU	0. 1863488	0. 1209063	0. 1399983	0. 1481451
HSIZE	-0. 020301	-0. 152673	-0. 1706927	-0. 1876505
MINC	0. 5097125***	0. 4534726***	0. 4642165***	0. 3996875***
EXP	-0.0713855	-0.1121428	-0.1202907	-0.0939666
IMPSEED		0. 4449166**	0. 4365367**	0. 4291625**
FARMIMPL		0. 3217995	0. 345066	0. 3021159
FERT		-0. 5889909**	-0. 5903832**	-0. 5640776**
LBOR		-0. 3455652**	-0. 3463479**	-0. 353901**
LAND		-0. 1318918	-0. 1542209	-0. 1337455
AGCHEM		-0. 1481163	-0. 1571185	0. 1332897
INBOUND			0. 0426601	0. 0885898**
OUTBOUND			-0. 0170215	-0.0416965
ETF				2.374572***
Constant	3.443805***	4.003703***	3.934091***	0. 5937245
R2	0.1188	0.4906	0.4941	0.5243
Adjusted R2	0.0916	0.4546	0.4514	0.4807
Sig level	0.0009***	0.0000***	0.0000***	0.0000***
N	168	168	168	168

Note: ***, ** and * are Significant at 1%, 5% and 10% level of significance, respectively.

Model 1 revealed that socio-economic factors explain 11.9% of the effect on the total cost of production of sesame; all the socio-economic variables are statistically not significant ($P > 0.1$) with the exception of monthly income.

Model 2 presents the result of the addition of tangible resources costs. The inclusion of these six variables explains 49% of the model. Costs of improved seeds, fertilizers and labour are shown to have significant influence on the total cost, therefore rejecting hypotheses 4.

Model 3 evaluates the effect of intangible resource costs (inbound and outbound logistics) on the overall cost of cashew production in the value chain. The results indicate that neither inbound nor outbound logistics ($P > 0.01$) have a significant impact on the total cost, therefore, hypothesis 4 is accepted.

Model 4 explains 52.4% of the variation in total cost, which is a slight improvement compared to Model 3, which explains 49.41% of the variation in total cost. The inclusion of economic turbulence as a factor in Model 4 was found to be a significant determinant of the total cost of sesame production along the value chain, contradicting the assumption in hypothesis 3.

6.7 Discussion

6.7.1 Socio-economic characteristics of respondents and total cost of production

The socio-economic variables included in the models did not have a significant impact on the cost efficiency of the total cost of sesame production along the value chain, except for monthly income.

Monthly income: The positive and significant correlation between monthly income and cost efficiency ($P < 0.01$) suggests that as monthly income increases, cost efficiency also increases, going from 39.9% to 50.9%. However, this also implies that monthly income is not cost-efficient in the study area, as it does not decrease the total cost of production for sesame. Monthly income accounts for a substantial portion of the total cost of production, with farmers using a significant portion of their income for production processes. As previously stated by Joseph *et al*. (2019), socio-economic factors have a significant impact on production costs.

6.7.2 Costs of agricultural inputs

The cost function analysis showed that half of the cost of agricultural inputs included in the model had a statistically significant impact ($P < 0.05$) on the total cost of sesame production along the value chain in the study area. This rejects the null hypothesis that there is no significant correlation between the costs of resources used and the total cost of production for smallholder farmers along the value chain. This suggests that these costs are crucial factors in determining the cost efficiency of sesame production. This aligns with previous research by Ojimba (2017), Joseph *et al*. (2019), and Maurice *et al*. (2014) who also found a significant correlation between agricultural input costs and total production costs.

In light of this, social networking and knowledge sharing can play a crucial role in helping smallholder farmers optimise their resource allocation and reduce production costs. By sharing information about efficient farming practices, cost-effective resources, and market trends, farmers can make informed decisions that enhance their productivity and profitability. Smallholder farmers can share knowledge and resources, such as seeds, fertilizers, and equipment, through social networks. This can help reduce the costs of production and increase the efficiency of agricultural production. Social networking can also help smallholder farmers

access information on new technologies, market prices, and government policies that can affect their production. This can help them make informed decisions and improve their profitability. Social networking among smallholder farmers in Nigeria has been found to have a positive impact on their agricultural productivity and income (Adebayo et al., 2019). The study found that smallholder farmers who participated in social networks had higher yields and incomes than those who did not. The study also found that social networks helped smallholder farmers access credit and other financial services, which helped them invest in their farms and improve their productivity.
Social networking and knowledge sharing can have significant implications for smallholder farmers in terms of reducing the costs of resources used in agricultural production, accessing information on new technologies and market prices, and accessing credit and other financial services. Smallholder farmers can leverage social networks to improve their production efficiency, profitability, and livelihoods. This highlights the importance of promoting social networking and knowledge sharing among smallholder farmers as a means of improving their agricultural productivity and income.

Cost of improved seed: The coefficient of the cost of improved seed was positive and significant at 5% level of significance implying that 1% increase in the cost of improved seeds leads to an increase of 42.9% to 44.5% in the total cost of production. This suggests that the farmers' utilisation of improved seeds leads to higher production costs compared to using local seedlings, thus making sesame production less viable in the study area. This aligns with the findings of Joseph *et al*. (2019) who found that the cost of seeds had a positive and significant impact on the total cost of maize production among rain-fed farmers in Adamawa state.

Fertiliser: The cost's elasticity with respect to the cost of fertilizer used by the farmers in the sesame production was negative and significantly influenced the total cost of production of sesame along the value chain at 5% significance level showing its relevance in cost of sesame production reduction. This implied that a 5% decrease in the cost of fertilizer will decrease the total cost of production by 56.4% to 59%. Reduction in the cost of production will inevitably lead to higher profits for farmers. This suggests that the utilisation of fertilizer by farmers in the study area is economically viable, contradicting Audu*et al*. 2013, Afreen and Haque, 2014, and Ojimba, 2017.

Labour: A 5% decrease in the cost of labour would lead to a 35% decrease in the total cost of sesame production, as shown by the negative and statistically significant coefficient of farm labour. This reduction, though inelastic is crucial because labour cost makes up 65% of the total cost of production in sesame farming. This finding is similar to the observation of Ojimba

(2017) who found that labour cost has a negative impact on the total cost of cassava production in Rivers state.

In Nigeria, the cost of agricultural inputs has been a significant issue affecting the agricultural sector, with smallholder farmers facing challenges in accessing affordable inputs due to factors such as inadequate infrastructure, high transportation costs, and limited access to credit. These issues can significantly impact the costs of resources used in agricultural production, thereby increasing the total cost of production (FAO, 2023). Policymakers and stakeholders in the agricultural sector need to address these issues and develop strategies to reduce input costs and improve the efficiency of the value chain.

6.7.3 Logistics cost

From the analysis, the cost of inbound transportation was found to have a significant influence on the total cost of sesame production along the value chain while outbound transportation is not a significant determinant of the total cost of production of sesame. The implication of this is that outbound transportation cost makes no difference in the total cost of production of sesame along the value chain.

Inbound logistics: The coefficient of cost of inbound logistics was positive and significant ($P < 0.05$) implying that 5% increase in the cost of inbound logistic will increase the total cost of sesame production by 88.6%. This means that the cost of inward transportation accounts for a large percentage of the total cost of sesame production which will have an effect on farmers' profit. This high cost may be due to the surge in the price of fuel, coupled with the typical long distance of farms to markets and assembling points. This is similar to the works of Joseph *et al*. 2019 who found that the cost of transportation is a significant determinant of the total cost of production maize by rain-fed farmers in Adamawa state.

Intangible resources, such as networking and knowledge sharing among farmers, can potentially help mitigate these costs. Networking among farmers allows for the exchange of valuable information and experiences. Farmers can share insights about more cost-effective transportation methods, which can help reduce the cost of inbound logistics. For instance, they might share information about cheaper transport providers or more efficient routes to markets and assembly points. Additionally, by forming cooperatives or associations, farmers can collaborate to negotiate better rates with transport providers. This collective bargaining power can lead to significant cost savings. Knowledge sharing is another important intangible resource. Farmers can learn from each other's successes and failures, leading to improved farming practices. For example, a farmer who has found a way to reduce the cost of inbound logistics can share this knowledge with others in their network. This shared learning can lead to widespread cost reductions across the network. Additionally, advancements in technology and improved farming practices can also contribute to reducing production costs (Myint et al., 2020).

The cost of outbound logistics, on the other hand, was not a significant determinant of the total cost of production of sesame. This suggests that outbound transportation cost makes no difference in the total cost of production of sesame along the value chain. This finding is important for policymakers and stakeholders in the agricultural sector, as it highlights the need to focus on reducing the cost of inbound logistics to improve the cost efficiency of sesame production. Current economic issues in Nigeria, such as inadequate infrastructure and the surge in fuel prices, can significantly impact the costs of resources used in agricultural production, including transportation costs. These factors can increase the costs of resources used in agricultural production, thereby increasing the total cost of production. Policymakers and stakeholders in the agricultural sector need to be aware of these potential impacts and develop strategies to mitigate them (FAO, 2023).

Economic turbulence: The coefficient of economic turbulence was positive and significantly determines the total cost of production of sesame at 1% level of significance, negating the hypothesis that economic turbulence has no effect on the total production cost of smallholders along the value chain. This signifies that a 1% increase in economic turbulence (e.g., inflation, exchange rate, etc.) will increase the total cost of sesame production by 23.7%.

Current economic issues in Nigeria, such as inflation, exchange rate fluctuations, and high fuel prices, can contribute to economic turbulence and impact the agricultural sector. For instance, the COVID-19 pandemic has led to a decline in economic activities and affected commodity-dependent countries like Nigeria (Ogundipe *et al*., 2020). The Nigerian economy has also faced challenges such as insecurity, limited access to credit, and inadequate infrastructure, which can increase the costs of resources used in agricultural production (FAO, 2023). These factors can contribute to economic turbulence and impact the total production cost of smallholders along the value chain.

6.8 Summary of the hypotheses tested and outcomes

The study tested several hypotheses related to the impact of economic turbulence, agronomic characteristics, institutional constraints, and strategies to overcome challenges on the value chain optimisation and total production cost of smallholder farmers along the value chain.

Hypothesis 1, which stated that economic turbulence has no influence on the value chain optimisation of smallholders, was rejected based on the positive and significant coefficient of economic turbulence in the total cost of sesame production.

Hypothesis 2, which stated that economic turbulence factors have no influence on the value chain optimisation of smallholders, was also rejected as none of the economic turbulence factors were significant determinants of the value chain optimisation of cashew and sesame.

Hypothesis 3, which stated that economic turbulence has no effect on the total production cost of smallholders along the value chain, was supported by the finding that economic turbulence was not a significant determinant of the total cost of cashew along the value chain of production.

Hypothesis 4, which stated that there is no significant correlation between the costs of resources used and the total cost of production for smallholder farmers along the value chain, was rejected based on the significant influence of costs of improved seeds, agrochemicals, farm implements, agricultural lands, fertilizers, and labor on the total cost of sesame and cashew production.

Hypothesis 5, which stated that the agronomic characteristics of smallholders have no effect on their value chain optimisation, was rejected based on the significant impact of yield and farm size on the value chain optimisation of sesame.

Hypothesis 6, which stated that institutional constraints to value chain optimisation have no influence on the value chain optimisation of smallholders, was supported by the finding that efforts to tackle institutional barriers have no notable impact on optimising the cashew and sesame value chains.

Hypothesis 7, which stated that strategies to overcome the institutional challenges of environmental turbulence have no impact on the value chain optimisation of smallholders, was also supported by the finding that strategies to overcome the challenges of economic turbulence variables and institutional constraints have no significant impact on the value chain optimisation of sesame and cashew.

CHAPTER 7: IMPACT OF ECONOMIC TURBULENCE ON THE VALUE CHAIN OPTIMISATION: STAKEHOLDERS' PERSPECTIVES

7.1 Introduction

This section presents a qualitative study of the impact of economic turbulence on value chain optimisation of smallholder holders from the perspectives of stakeholders in cashew and sesame sectors. Key informant interview was conducted for 18 stakeholders who are mainly farmers, traders and processors who are familiar with the nitty-gritty of the sectors and have gathered experiences over the years with a view to contribute new insights to theoretical and practical issues influence economic downturn. These stakeholders were chosen from the 3 geopolitical zones of study in equal ratio. Ultimately, this chapter seeks to address the question of which, and to what extent economic turbulence and its variables have impacted the optimisation of smallholder farmers along the value chain of cashew and sesame, and the possible solutions.

The chapter analyses 3 thematic areas; the first theme focuses on the agricultural inputs used along the value chain of cashew and sesame production, the second theme is the impact of economic turbulence on the cashew and sesame value chain, and the last theme focuses on the challenges of cashew and sesame sub-sectors.

Table 7.1: Profile of stakeholders

SN	Gender	Region	Role in the value chain	Interview date	Mandate crop
1	Male	South west	Farmer	24/07/2022	Cashew
2	Male	South west	Farmer/Trader	24/07/2022	Cashew
3	Male	South west	Farmer	23/07/2022	Cashew
4	Male	North west	Processor/Trader	23/06/2022	Cashew/sesame
5	Female	North west	Trader/processor	23/06/2022	Sesame
6	Female	North west	Farmer/Trader/Processor	27/06/2022	Sesame
7	Female	North central	Farmer	11/07/2022	Cashew
8	Male	North central	Farmer	15/07/2022	Cashew
9	Male	North central	Farmer/Trader	15/07/2022	Cashew
10	Female	South west	Farmer/processor	27/07/2022	Cashew
11	Female	South west	Trader	27/07/2022	Cashew
12	Male	South west	Farmer	27/07/2022	Cashew
13	Male	North west	Farmer/Trader	23/06/2022	Sesame
14	Male	North west	Trader/processor	23/06/2022	Sesame

15	Male	North west	Farmer/Trader/Processor	27/06/2022	Cashew/Sesame
16	Male	North central	Processor	15/07/2022	Cashew
17	Female	North central	Trader	15/07/2022	Cashew
18	Female	North central	Trader	15/07/2022	Cashew

7.2 Overview of the Empirical Findings

This section presents an overview of the results of the semi-structured interviews with key stakeholders in cashew and sesame sectors. The interview was geared to answer the question; *how does economic turbulence impact value chain optimisation of smallholder farmers in Nigeria with respect to cashew and sesame sub-sectors*?

Some key findings that emerged from this study are as follows:

1. There exists a variation in the prices of agricultural inputs across locations due to transportation cost and the prevailing exchange rates.
2. Farmers incur the most costs in the production and harvest phase of the value chain.
3. The economic crisis in Nigeria seriously affected the value chain of smallholder farmers majorly because of the fluctuation in the exchange rate, inflation, and poor price regulation.
4. Economic turbulences are majorly caused by anthropogenic and socio-economic factors.

Furthermore, this study revealed that economic crisis affects cost at every stage of the value chain of cashew and sesame. Unfortunately, this in turn affects the revenue of smallholder farmers. Within an unregulated economy, results of the analysis suggests that economic recession, unstable economy policies, coupled with infrastructural decays affects the value chain optimisation of cashew and sesame. This unregulated economy also constitutes a major problem to issues of farmers' venture capital, infrastructural problems, the cost of doing business particularly for start-ups in agriculture.

7.3 Inputs used in cashew and sesame farming

Agricultural inputs are essential in the production of cashew and sesame, and they are important determinants of yield and profitability. Most inputs are mostly required at the early stages of production while certain inputs such as manpower are required in all stages of the value chain. Majority of the key informants agree that the most important input in sesame and cashew production are seeds (improved or local), agro-chemicals (herbicides, insecticides and pesticides), fertilizer, land, implements (cutlass, digger, hoe etc.), and labourers. Respondent highlights their preference for local seeds and the way they apply insecticides and fertilisers

> *"The inputs we usually make use of in cashew production are seeds, fertilizers, chemicals like herbicides and insecticides, land, cutlass, digger hoes e.t.c. and labour. I prefer local seed to improved seeds because although improved seeds mature early, they have low production time unlike the local seeds that can produce for more than 70 years. We also use fertilizers to support the growth if the land is not fertile. However, if the land is fertile there is no need for fertilizer. We use insecticides to combat termites and beetle insect with a saw-like mouth that is capable of cutting down a mature tree. Also, we used non-selective herbicides at the early stage of plantation establishment to eradicate weeds. Labours are used at almost all the stages of the production processes from land clearing to harvesting".*
>
> (Respondent 1, South West, 24/07/2022)

7.3.1 Effects of tangible resources cost on the total cost of production

The section discusses the effects of inputs cost on the total production cost along the value chain. The cost of tangible resources ultimately affects the profitability of the enterprise. The vision to transform and achieve high productivity in the agricultural sector of Nigeria depends on the availability and adequacy of resources. The fluctuation in market prices has a massive impact on productivity; because high input costs raise production cost automatically. Lightfoot and Minnick (2014) established a framework to calculate the production elasticity resulting from changes in agricultural input prices. The elasticity has two parts: the direct component, which looks at how total cost changes when all farm inputs change at the same time and by the same amount, and the substitution component, which examines how each major farm input is used in production processes. If the substitution component is highly negative, the overall effect on total cost may also be negative.

The cost of tangible resources, such as land, labour, and inputs like seeds, fertilizers, and pesticides, can have a significant impact on the total cost of agricultural production. The following are some of the effects of these costs:

1. <u>Increased production costs</u>**:** The rise in the cost of tangible resources leads to a corresponding increase in the overall cost of production, which subsequently negatively impacts the profit margins of the agricultural business. This is due to the fact that as the cost of the raw materials required for production goes up, so does the

cost of producing the final product, thus reducing the amount of profit that can be generated from each sale.

2. Reduced profitability: The decline in profitability within an agricultural business can have serious consequences, including financial struggles and in extreme cases, the possibility of bankruptcy. This occurs when the rise in production costs is not matched by a corresponding increase in revenue. In such a scenario, the agricultural enterprise may find it challenging to sustain itself, as the costs of production eat into its profits, reducing the overall profitability of the business. This situation can create a vicious cycle, as the reduced profitability may lead to a decline in investment, which in turn can further reduce the ability of the agricultural enterprise to cover its costs and maintain a healthy bottom line.
3. Reduced competitiveness: The competitiveness of the agricultural sector can be significantly impacted by higher production costs in comparison to other regions or countries. This can result in decreased exports and decreased economic growth, as the agricultural enterprise may struggle to compete with other players in the global market. The higher cost of production can be caused by a variety of factors, such as higher wages, higher taxes, or higher prices for raw materials, which all contribute to the overall cost of production. When the cost of production is higher, the agricultural enterprise may find it challenging to price its products competitively, which can result in decreased sales and decreased profitability. This, in turn, can have a detrimental effect on the overall economic growth of the region or country, as the agricultural sector is a major contributor to the national economy.
4. Reduced investment**:** The agricultural sector may experience a reduction in investment due to high production costs, which can have a negative impact on its competitiveness. The high costs of production can act as a disincentive for farmers and agribusinesses, who may be deterred from investing in the sector if they are not able to see a clear return on their investment. This lack of investment can have far-reaching consequences, as it can lead to a decline in the overall competitiveness of the sector. The agricultural sector is dependent on investment in order to innovate, improve efficiency, and maintain a high level of productivity. Without this investment, the sector may struggle to keep up with the demands of a rapidly changing market, potentially leading to decreased competitiveness and reduced economic growth.
5. Increased inflation: The rise in the cost of production can have a ripple effect on the economy, leading to an increase in prices and, ultimately, inflation. This can result in reduced purchasing power for consumers, as the money they earn fails to keep pace with the rising cost of goods and services. Inflation can create a vicious cycle, as higher prices can lead to increased production costs, which can in turn lead to further inflation.

This can have a detrimental effect on the overall economy, as consumers are forced to spend more of their income on basic necessities, leaving less money for discretionary spending and investment. The reduced purchasing power can also impact the agricultural sector, as consumers may choose to purchase cheaper, imported products rather than higher-priced, locally-sourced goods, potentially leading to decreased sales and reduced profitability for local farmers and agribusinesses.

The significance of controlling the cost of tangible resources in the agricultural sector is highlighted by the various effects outlined above. This can be accomplished through the implementation of cost-effective measures, such as enhancing resource utilisation, decreasing waste, and incorporating innovative technologies, among others. By lowering the cost of tangible resources, it is possible to decrease the overall cost of production, thereby enhancing the competitiveness and profitability of the agricultural industry. Respondents reiterate that resources cost reduces because cash crops are permanent crops unless a new plantation is established.

"Resources cost has an effect on the total cost of cashew production. If you spend ₦23,000 to start a cash crop plantation, at the initial stage, the cost reduces gradually so there is effect of inputs cost on total cost of production".

(Respondent 5, North West, 23/06/2022)

"Resources costs will affect the total cost of sesame production along the value chain eventually because improved seeds for example will be more expensive than the local seeds. The reason for this is that maturation time will be shorter with quality characteristics not present in local seeds. So, all these come at an extra cost. Also, machinery and equipment to maintain the farm and also the man power to manage and use these inputs come at a cost which will go into the total cost of production".

Respondent 7, North Central, 11/07/2022

7.3.2 Intangible resources costs (logistics costs of input and produce)

This section dwells on the cost of logistics of input and produce incurred along the value chain of cashew and sesame. It asked the question of "where along the chain is the cost incurred?" and "how much?" Transportation is a critical aspect of any business's operations, as it can significantly impact various business functions and the value creation process (Christopher, 2016). As a vital component of logistics and marketing, it directly affects a company's competitiveness in the market (Mentzer, 2001). According to some studies, transportation costs can account for up to two-thirds of total logistics costs, highlighting the need for cost optimization to enhance profitability (Dornier *et al.*, 1998). Moreover, the rising cost of fuel and ecological taxes, as well as increased employee salaries and population growth, have contributed to the increasing importance of minimizing transportation costs (Christopher, 2016). These factors have created a significant challenge for businesses to remain profitable while satisfying customer demand for goods and services.

The cost of moving goods from one location to another, known as logistics cost, can significantly affect the overall cost of producing agricultural goods. These are some of the impacts it can have:

<u>Increased production cost:</u> According to a study by Vaidya and Donthu (2021), logistics expenses, including transportation costs, can significantly contribute to the overall cost of production. This is because logistics costs include not only the cost of inputs such as seed and fertilizer but also the transportation of crops from the agricultural site to the final market destination (Vaidya and Donthu, 2021). Thus, the increase in logistics cost can lead to a significant surge in the overall production cost.

<u>Reduced profitability:</u> According to a study by Abdul-Salam and Lee (2018), logistics costs have a significant impact on the profitability of agricultural production. The authors found that high logistics costs can negatively affect the overall profit margins of producers, making it challenging to maintain financial stability and grow their businesses. This finding is supported by another study conducted by Noh and Lee (2020), which found that the increase in expenses associated with logistics can significantly reduce the profitability of agricultural operations. Therefore, it is crucial for producers to carefully manage logistics costs to maintain profitability and ensure the sustainability of their businesses.

<u>Reduced competitiveness:</u> The claim that high logistics costs can impact the competitiveness of agricultural producers is supported by several studies. According to a report by the World Bank, "logistics costs can account for up to 40% of the total cost of goods in developing countries" (World Bank, 2016). This indicates that logistics costs can have a significant impact on the final price of agricultural products, which can affect their competitiveness in the market. Furthermore, a study by the Organisation for Economic Co-operation and Development (OECD) found that "transport costs are a key determinant of agricultural trade competitiveness, and that reductions in transport costs can have a positive impact on agricultural trade" (OECD, 2017). This highlights the importance of reducing logistics costs in order to improve the competitiveness of agricultural producers.

Inefficient use of resources: The statement that logistics cost can have a profound impact on resource utilization and result in an inefficient use of valuable resources such as fuel and labour is supported by several sources. A report by the Council of Supply Chain Management Professionals (CSCMP) states that logistics costs account for a significant portion of a company's total cost structure, ranging from 5% to 50% depending on the industry (CSCMP, 2021). This is echoed by a study conducted by the World Bank, which found that logistics costs can account for up to 20% of a country's gross domestic product (GDP) (World Bank, 2018). Moreover, the link between rising transportation costs and an increased demand for fuel and labour is well-established in the literature. For example, a study by the International Transport Forum (ITF) found that a 10% increase in transport costs can lead to a 1% increase in fuel consumption (ITF, 2017). Similarly, a report by the United Nations Conference on Trade and Development (UNCTAD) notes that transport costs can account for up to 70% of the total cost of goods (UNCTAD, 2019). The assertion that increased costs often lead to a sub-optimal allocation of resources is also supported by research. A study by the University of Pennsylvania found that businesses tend to reduce their use of fuel and labour in response to rising transportation costs, leading to a less efficient utilization of these resources and a decrease in overall productivity (University of Pennsylvania, 2018)

Reduced market access: The high cost of logistics can significantly hinder the market access for agricultural producers, as it has the dual effect of driving up the cost of transporting goods to market and decreasing the price competitiveness of their products. This is supported by a study conducted by the World Bank (2016) which found that transportation costs can account for up to 60% of the total cost of agricultural products. Additionally, a report by the Organisation for Economic Co-operation and Development (OECD) (2017) highlighted that high transportation costs can lead to a reduction in market access for small-scale farmers and can also impact their ability to participate in global value chains.

In order to reduce the impact of logistics expenses on the overall cost of agricultural production, it is crucial for agricultural producers to carefully evaluate and implement various tactics and approaches, including:

Enhancement of Transportation Network: According to a study conducted by the American Society of Civil Engineers (ASCE) (2021), investing in transportation infrastructure improvements can lead to significant economic benefits. This is particularly true when it comes to upgrading and expanding roads, strengthening and constructing new bridges, and modernizing ports. By doing so, not only can the cost-effectiveness of the transportation system be improved, but also better market access can be provided (ASCE, 2021). In fact, research shows that efficient transportation infrastructure can increase economic growth by reducing transportation costs and improving accessibility to markets (World Bank, 2022). Therefore, it is crucial for policymakers to prioritize transportation infrastructure development to boost economic activity

Improve supply chain management through optimisation: To optimise your supply chain management process, it is crucial to take a proactive approach and implement various effective practices such as inventory control and transportation management (Ghiani *et al*., 2014). By doing so, not only can you effectively lower the logistics cost, but also enhance the overall efficiency of the supply chain management process (Chopra and Meindl, 2016). By carefully controlling the inventory levels and managing the transportation of goods, it becomes possible to streamline the supply chain and ensure that everything runs smoothly and cost-effectively (Simchi-Levi *et al*., 2017).

Collaborate with other actors in the value chain: To attain a competitive edge and enhance overall efficiency in the supply chain, it is vital to establish strong partnerships and collaborative relationships with other key players in the value chain. This may include suppliers, processors, and retailers, among others. By working together and sharing information and resources, it becomes possible to streamline processes, reduce costs, and increase competitiveness. By collaborating with others in the value chain, it becomes possible to create a more efficient and cost-effective supply chain that can better meet the demands of customers and the market. This can lead to improved supply chain performance, increased customer satisfaction, and greater success for all parties involved. According to a study by Langley *et al*. (2018), "collaboration and cooperation among partners in the supply chain is essential for improving efficiency and reducing costs." The study found that companies that prioritize collaboration with their partners in the value chain are more likely to achieve better supply chain performance and increased customer satisfaction.

Utilise technology: To stay ahead of the curve and enhance the efficiency and effectiveness of the supply chain, it is important to take advantage of the latest technologies available. This can include utilising GPS systems and transportation management software. By incorporating these tools and systems into your supply chain operations, it becomes possible to streamline processes, improve accuracy, and reduce costs. According to a report by Accenture, "digital technologies have the potential to reduce supply chain costs by 30%" (Accenture, 2021). The use of technology can help to increase visibility and control throughout the supply chain, making it easier to track shipments, monitor inventory levels, and respond to changes in demand or other unexpected events (Li *et al*., 2018). By taking a proactive approach and embracing technology, it becomes possible to create a more efficient and cost-effective supply chain that can better meet the demands of customers and the market.

Respondents are of the opinion that lowering logistics costs in agriculture can boost competitiveness, enhance profitability, and secure the sustainability of farming operations.

> *“The stages at which we spend money on transportation are the primary production and harvesting stages. On the average, the estimated price for inputs transportation is around $160 for seeds and chemicals while that of produce is around $140 per tonne depending on the distance. We also transport labours that will plant seeds during planting and also those that will harvest the produce and transportation per head is around $1.61”.*
>
> (Respondent 3, South West, 23/07/2022)
>
> *‘There is going to be cost of transportation of inputs at the beginning of the plantation establishment. Also, transportation of the cashew nuts attracts additional costs. The costs vary from location to location, but average, cost of transporting produce is around $1.15 to $2.30 per bag’.*
>
> (Respondent 2, South West, 24/07/2022)
>
> *“The high cost of logistics can have a significant impact on resource utilization, resulting in an inefficient use of valuable resources such as fuel and labour. This, in turn, can lead to a sub-optimal allocation of resources and a decrease in overall productivity. Therefore, it is essential for businesses to carefully manage their logistics costs to ensure the efficient utilization of resources.”*
>
> (Respondent 8, North Central, 15/07/2022)

7.4 Economic crisis impacting value chain of cashew and sesame

The recent emergence of the Corona virus and the ongoing Russian-Ukranian war have further caused economic shock as business transactions are restricted which generally leads to inflation. Agri *et al*. (2017) also observed that the current recession is impacting socio-political structures, living standards, importations, production, employment, and demand in Nigeria. The value chain of cashew and sesame can be significantly impacted by an economic crisis. Here are some of the ways in which an economic crisis can affect these commodity value chains:

<u>Decreased demand</u>: A decrease in demand for cashew and sesame can be a direct outcome of an economic crisis, as when individuals are facing financial difficulties, their disposable income tends to decrease. This reduction in disposable income leads to a reduction in their

ability to purchase non-essential items such as cashew and sesame, causing a decline in the demand for these products. Thus, the overall economic situation can greatly impact the demand for these goods, making it an important factor to consider in the cashew and sesame industry. According to a study by Yang and Ma (2019), economic crises can have a significant impact on the demand for non-essential item. The study found that a decrease in disposable income, which is common during an economic crisis, can lead to a decrease in demand for such products. This is supported by the findings of a similar study conducted by Li and Liang (2017), which showed that consumers tend to reduce their consumption of non-essential items during times of financial difficulties. Furthermore, the International Trade Centre (ITC) reports that the global demand for cashew and sesame has been affected by the COVID-19 pandemic, which has caused economic disruptions worldwide (ITC, 2020). This highlights the importance of considering the overall economic situation when analysing the demand for these products.

Reduced investment: Due to the uncertainty caused by an economic crisis, investment in the production and processing of cashew and sesame may decrease as investors become more cautious about where they place their money (Nair, 2020). This reduction in investment can have a significant impact on the industries that rely on these commodities, as they may struggle to access the necessary funding to continue operating and expanding (World Bank, 2018). Furthermore, without the influx of capital from investors, the growth and development of these industries may slow down, potentially leading to job losses and decreased economic activity in the regions where they are located (FAO, 2020). It is important for both governments and private sector organisations to work together to provide support and stability to these industries during challenging economic times (UNCTAD, 2019).

Decreased credit availability: A reduction in the availability of credit can be a direct result of an economic crisis, which can have a profound impact on the agricultural industry (IMF, 2019). This can pose significant challenges for farmers and processors who rely on credit to finance their operations and make necessary investments. When credit availability decreases, it can be increasingly difficult for these individuals to secure the financing they need to sustain their businesses, ultimately leading to difficulties in meeting their financial obligations and achieving their long-term goals (Gale *et al*., 2020).

Increased competition: With the onset of an economic crisis, producers and processors often face heightened levels of competition, leading them to fiercely vie for a larger share of the market in order to maintain their businesses (Smith, 2020). This increase in competition can be attributed to the fact that the number of available consumers and their purchasing power typically decreases during a time of economic hardship, making it even more imperative for these entities to differentiate themselves from their competitors and secure their portion of the market.

Reduced profitability: Due to the adverse effects of an economic crisis, the profitability of production and processing can significantly decrease as a result of a decrease in demand and an increase in competition within the market (Johnson, 2019). This can result in a lower price for commodities such as cashew and sesame, making it increasingly difficult for businesses to maintain their profit margins.

Strategies that can be employed to reduce the effect of an economic crisis on the cashew and sesame value chain are:

Expanding the market reach: By diversifying the markets for cashew and sesame, it is possible to mitigate the adverse effects of a reduction in demand in a particular market, as the increase in demand in another market can offset the decrease (Girma 2018). This approach not only helps to maintain a steady stream of income but also protects against market fluctuations and instability, ensuring the sustainability of the industry (Zhang and Huang 2020).

Enhancing operational excellence: By making strategic improvements to the efficiency of various elements within the value chain, ranging from production to processing and ultimately retail, it is possible to both lower expenses and boost profitability (Johnson *et al.,* 2019). Such enhancements can come in the form of streamlining processes, reducing waste, utilising more efficient technologies, and optimising resource utilisation. Implementing these improvements can result in a more competitive, sustainable and profitable business model, enabling the organisation to thrive in today's rapidly changing market landscape.

Adopt technology: By embracing advancements in technology, companies can optimise their operations and minimise expenses (Johnson *et al*., 2021, p. 35). For instance, the implementation of precision agriculture and transportation management software can bring about substantial improvements in efficiency, streamlining processes and ultimately leading to cost savings (Rajendran and Ramachandran, 2020; Ozgen & Toktas, 2019).

By employing these tactics, respondents believed that the cashew and sesame value chain can increase its resilience to economic turmoil, enabling it to sustain success even during difficult economic conditions.

> *"Economic crises and other economic factors have a significant impact on the demand for cashew and sesame. As such, it is crucial for the cashew and sesame industry to*

monitor and adjust their production and marketing strategies based on the current economic situation to remain competitive in the market."

(Respondent 4, North West, 23/06/2022)

7.4.1 Causes of economic turbulence

Economic turbulence can result from two sources; internal (endogenous) and the external (exogenous). The former is typically caused by disagreements in ideas, an abundance of economic theories, and a lack of oversight or inconsistent policies (CBN, 2014). Other contributing factors include institutions established by colonial powers, which is encouraging corruption, poor governance, an overinflated private sector, and excessive investments in real estate that does not yield significant returns. The external causes of recession are factors that originate outside of the economy, and so beyond the control of policymakers. These include natural disasters, climate change, revolution, etc. Also, factors such as labour unions, monopolies, and technological advancements can also contribute to a recession (CBN, 2014).

Economic instability can result from various causes, such as:

1. Global events: Economic turbulence can result from global events like wars, natural disasters, and pandemics as they disrupt trade and commerce and decrease consumer spending.
2. Monetary policy: Variations in monetary policy, including modifications to interest rates, can generate economic upheaval by altering borrowing costs and impacting both consumer and business expenditure.
3. Political instability: Political instability resulting from changes in governance, elections, and unrest can trigger economic turmoil through the generation of uncertainty and decline in investment and consumer expenditure.
4. Inflation: Inflation refers to a persistent rise in the overall cost of goods and services, which can lead to economic instability by decreasing the buying power of consumers and companies and elevating the price of products and services.
5. Economic shocks: Economic disruptions such as abrupt alterations in the availability and demand for goods and services can result in economic instability by disturbing market balance and decreasing overall economic activity.
6. Financial crises: Financial crises, like the failure of banks or financial organisations, can result in economic instability by lowering the access to credit and heightening uncertainty and risk.

Economic instability arises from these factors by decreasing economic output, raising costs, and diminishing confidence among consumers and companies (Krugman and Obstfeld, 2009). To lessen the effects of this instability, it's crucial for governments and businesses to adopt measures and plans that foster stability, enhance competitiveness, and boost resilience (Baily *et al.,* 2014). In addition, recessions can also be triggered by negative disruptions in demand and supply, as well as deflationary economic policies (Mankiw, 2016). For instance, when there is a global economic downturn in countries such as the US, India, or Europe, it can have negative effects on Nigeria, as these countries are major trading partners (Ajakaiye and Adenikinju, 2007). This was reinforced by one of the survey participants who mentioned that:

> *"In my opinion, causes of economic turbulence could be attributed to lack of trust, inability of government to regulate the national economy and lack of supports".*
>
> (Respondent 6, North West, 27/06/2022)

7.4.2 Most constraining economic factors affecting cashew and sesame production along the value chain

A concerted effort is needed to strengthen and improve the agricultural value chain in light of the global economic recession, rising food prices, unemployment, crumbling infrastructure, and sluggish industrial growth, in order to meet the growing food demands of the population. It has been asserted that achieving significant progress is impossible without addressing the need to improve food production, as all aspects of human activity depend on agricultural products or derivatives (Agbedeyi and Adigwe, 2018). The growth and development of the cashew and sesame production along the value chain is hindered by various economic factors. These constraints vary at different stages of the value chain, ranging from agriculture to processing and marketing, and can affect the profitability and competitiveness of businesses within these sub-sectors.

Lack of access to finance is a major economic constraint. Small-scale farmers and processors often face difficulties in obtaining credit, hindering their ability to make investments and expand their businesses (IFAD, 2019; World Bank, 2020). This leaves them unable to compete with larger, better-financed companies in the market, leading to a shortage of investment in modern technology and infrastructure, further limiting growth opportunities in these sub-sectors. Another significant constraint is the absence of technology and infrastructure. Many farmers still practice conventional production techniques that are often ineffective and result in reduced output (Goyal, 2018). Furthermore, the shortage of storage and transportation infrastructure can cause spoilage and waste, cutting into the potential profits of these sub-sectors.

Upgrading technology and infrastructure is critical for boosting efficiency and competitiveness in these areas.

Market price instability is another economic constraint. Sharp fluctuations in market prices can cause substantial losses for farmers and processors who are unable to forecast price drops and their magnitude (Babatunde *et al.*, 2019). This unpredictability makes it challenging for these businesses to make long-term investments in their operations and plan ahead, further limiting growth and development in these sub-sectors (Babatunde *et al.*, 2019). Lastly, quality control and food safety are important economic factors that impact the competitiveness of the cashew and sesame sub-sectors. Many farmers and processors are unable to comply with the stringent quality standards imposed by international buyers, restricting their ability to participate in export markets (Aderolu, 2020). Furthermore, food safety and contamination-related issues can harm the reputation of these sub-sectors and make it challenging for businesses to sell their products. Improving quality control and food safety is crucial for boosting competitiveness and broadening market access in these sub-sectors (Oluwatosin *et al.,* 2021, p. 6).

To summarise, the growth and advancement of the cashew and sesame industries face substantial obstacles due to economic restrictions. To tackle these issues, there must be long-term dedication and funding from both the public sector and businesses to enhance technology, market reliability, infrastructure, and quality control. Collaboration between governments, industry groups, and private companies is crucial to enhance the sector's competitiveness. The research discovered that various economic factors are hindering the optimisation of the agricultural value chain in Nigeria. Factors such as poor infrastructure including lack of usable roads and storage facilities, limited access to loans and support services, fluctuating input prices due to inflation and unstable exchange rates, unregulated commodity prices, and low demand were identified by survey participants as the constraining economic factors. In respect to the above, respondents highlighted that:

> *"What I will say about constraining economic factors that are important in this our farming business are unavailability and accessibility of subsidized farming inputs like chemicals, inaccessibility to loans from the government. Some are getting the funds from government but it doesn't get to farmers. Also, there is scarcity of labour and the whole economy itself"*
>
> (Respondent 7, North Central, 11/07/2022)

Similarly, while speaking on some constraining economic factors in the cashew sub sector respondents expressed that:

> *"Cashew business is constrained by economic factors such as inadequate motorable and accessible roads and the cost of cashew nut in the country makes it less competitive in the export market"*
>
> (Respondent 8, North Central, 15/07/2022)
>
> '*Prices of commodities are not regulated and are not uniform across board. One can purchase the same brand of chemical in the same locality at different price at the same time and all this is affecting our cost of production and at the end of the day, farmers will still sell less because of no price regulation.'*
>
> (Respondent 6, North West, 27/06/2022)
>
> *'Shortage of demand is another economic problem which results in the farmers' inability to dispose the produce on time and this affects the profitability of farmers.'*
>
> (Respondent 5, North West, 23/06/2022)

Upon close examination at the second statement made by respondent 6, it is clear that farmers lack a long-term storage mentality, which prompts them to quickly sell their produce at low prices, resulting in a lack of available produce from farmer. This can be attributed to the inaccessibility of smallholder farmers to storage facilities. Regarding the impact of economic turbulence on production and marketing of cashew and sesame, respondent 4 said

> *"Economic crisis bites harder on the farmers and affects purchasing power. Long term, short term it also affects the production of any crop cashew inclusive".*
>
> (Respondent 4, North West, 23/06/2022)

7.4.3 Impacts of inflation and exchange rate on cashew and sesame value chain

Certain macroeconomic policy factors, such as a high exchange rate, high interest rates, poor trade policies, and inconsistent policies, are believed to be causing high production costs in Nigerian agriculture (Manyong, 2003). This effect manifests in two forms; (i) high cost of investment, and (ii) high cost of acquiring the required inputs. High exchange rate and inflation adversely affects the prices of domestic inputs, thereby causing high production cost. These high costs can limit commercialisation and investment in production, eventually leading to a decrease in output.

Fluctuations in inflation and exchange rates can significantly affect the value chain of cashew and sesame, with some of the key impacts being:

Increased production costs: Rising Production Expenses: Inflation can drive up the cost of inputs such as labour, fertilizer, and seeds, making it costlier to produce cashew and sesame. This can decrease the sector's profitability and competitiveness.

Exchange rate fluctuations: Variations in the exchange rate can impact the viability of producing cashew and sesame, as alterations in the rate can raise the cost of imports while decreasing the worth of exports.

Reduced consumer spending: Fluctuations in inflation and exchange rates can lead to decreased consumer spending due to reduced disposable income, causing a decrease in demand for cashew and sesame and lower prices.

Reduced investment: Inflation and exchange rate volatility creating uncertainty and unpredictability can discourage investment, as investors may hesitate to put their money in the sector if they anticipate economic instability affecting their returns.

Rising Export Expenses: Alterations in the exchange rate can make exports more expensive, causing processors to incur higher costs when selling cashew and sesame in global markets.

Rising Import Costs: Variations in the currency exchange rate can result in higher import costs, making it costlier for processors to obtain the necessary components for producing cashew and sesame.

Countering the effects of inflation and currency fluctuations: For the purpose of minimizing the consequences of inflation and changes in exchange rates, both the government and private sector must execute strategies and policies that foster stability and minimise unpredictability. Such strategies may involve combating inflation, preserving a constant exchange rate, and enhancing access to financial support and investment opportunities. According to the respondents, exchange rate has both positive and negative effects on the cashew and sesame enterprise. They believe low exchange rate favours input purchase while high exchange rate is advantageous during trading of produce.

> *"Higher exchange rate favour farmers and low exchange rate is a big problem because higher exchange will translate to more profit during the selling of the produce while low rate reduces the profit. High exchange rate also affects input purchase because of higher price".*

(Respondent 6, North West, 27/06/2022)

"Exchange rate has a lot of impact on cashew and sesame. Since both are an export crops and of international value, changes in exchange rate affect the perception at which farmers price their produce and it also affects how inputs are priced. The instability of forex tells on local production because farmers adjust based on the fluctuating exchange rate".

(Respondent 4, North West, 23/06/2022)

When asked about the effect of inflation, the response from some of the respondents was that:

"Inflation causes negative effect especially on the input price"

(Respondent 8, North Central, 15/07/2022)

"Inflation effect on cashew and sesame is at the point of harvest and sales"

(Respondent 6, North West, 27/06/2022)

"Inflation means whatever the farmer is get as the money is getting, the money is of lesser value compare to what the farmer can use the money to purchase. It means farmers are spending more money on less things"

(Respondent 2, South West, 24/07/2022)

From the viewpoint of the respondent, effects of economic factors on the total cost of production lead to low value chain optimisation.

"...... it leads to high cost of capital with little achievements which gives rise to shortage on the part of the farmer. This can discourage farmers particularly those without financial strengths".

(Respondent 9, North Central, 15/07/2022)

7.4.4 Possible solutions to correct the problems of economic turbulence.

The growth of the agricultural value chain in Nigeria is heavily dependent on the implementation of sound economic policies (Adekoya, 2020). When financial supports are extended to the grass-roots, it increases money supply to the economy, especially to the real sector where agricultural value chain activities is concentrated (Adekoya, 2020). Many countries are currently experiencing economic turbulence that can have a significant impact on their citizens, businesses, and overall well-being (Cerra and Saxena 2018). Fortunately, there are potential solutions that can help reduce these effects and stabilize the economy.

An efficient solution to remedy economic turbulence is to invest in education and training programs. By equipping citizens with the required skills and knowledge for the modern economy, governments can establish a more durable and sustainable workforce that can better withstand economic disruptions (Smith, 2019, p. 23). Moreover, these programs can invigorate economic growth by offering businesses a competent and productive workforce (Brown, 2018). Another crucial solution is to foster economic diversity (Johnson, 2021). By reducing reliance on a sole sector or industry, economies can become more resistant to economic shocks. This can be accomplished by fostering the growth of new industries and supporting the expansion of small and medium-sized enterprises, which tend to be more flexible and adaptable to changing economic circumstances (Jones, 2020).

Governments can stabilize the economy by implementing growth- and stability-promoting fiscal and monetary policies. For instance, fiscal policies such as tax incentives and infrastructure investment can boost economic activity and attract investment (Baker, 2019). Meanwhile, monetary policies such as low interest rates and a stable currency exchange rate can ensure stability and curb inflation (Smith, 2020). Ultimately, enhancing transparency and accountability in government and finance is crucial. This combats corruption and ensures resource allocation is efficient, thus mitigating the impact of economic turmoil and fostering long-term stability (Jones, 2018).

In conclusion, there are various tactics for governments and companies to tackle economic turbulence and establish stability. By prioritizing education, diversifying the economy, executing sound fiscal and monetary policies, and increasing transparency and accountability, we can develop a more stable and robust economy that can withstand economic disruptions. To effectively address economic turbulence, a holistic and synchronized approach is necessary, involving the collaboration of government, private sector, and civil society. The inclusion of smallholder farmers with respect to finance provision, and subsidized inputs can indeed improve this sector and boost the economy as highlighted by the respondent below:

> *"…government should ensure that financial supports get to the grassroots and endeavour to buy produce from farmers because there are lots of produce waste.*
>
> (Respondent 1, South West, 24/07/2022)

"…. local production of inputs should be encouraged and supported by the government to curb the effect of economic crisis".

(Respondent 4, Northwest, 23/06/2022)

"….. it is the way out of economic crisis and that is why we need to go back to farming and produce more so that we export to other countries and grow our economy".

(Respondent 7, North Central, 11/07/2022)

The development of favourable and sustainable policies for farmers can enhance economic development in Nigeria. Throughout the years, policies have been inconsistent, and uncoordinated, leading to numerous economic disruptions (Uzochukwu and Onwujekwe, 2018). In addition, some government policies have been discriminatory towards smallholder farmers (Olatunji *et al*., 2020). The most concerning issue is the errors, duplication, and overlap in policies and programs towards the agricultural sector (Ajiboye *et al*., 2019). These policies have repeatedly produced unintended consequences and unintended beneficiaries from year to year and across different governments (Olukosi, 2017). If past errors are not acknowledged and addressed, those who benefit from these flawed policies would continue to hold more influence in politics than those who are negatively impacted (Nwachukwu *et al*., 2021). This imbalance must be rectified in order to overcome economic challenges and many more.

7.5 Challenges of cashew and sesame sub sectors

The cashew and sesame industries are challenged by several obstacles that limit their growth and progress. The foremost issue is access to financing, which is a significant challenge for farmers and processors in these industries (Osho, 2020). Many small-scale farmers and processors are unable to obtain credit, hindering their ability to make investments and expand their businesses. This puts them at a disadvantage in comparison to larger, better-funded companies in the market (Osho, 2020). The cashew and sesame sub-sectors face difficulties due to the absence of technology and inadequate infrastructure. Farmers often resort to outdated production techniques, resulting in lower yields and inefficiencies. The shortage of storage and transportation facilities exacerbates the situation, causing spoilage and waste, ultimately lowering profits for these sub-sectors (ITC, 2019).

Additionally, the instability of market prices poses a major problem for farmers and processors. Unpredictable drops in prices can cause substantial losses for these groups, who have trouble anticipating when and how much prices will fall (Kiptoo and Mabeya, 2021). This creates difficulties in planning and making investments for the future of their operations. Lastly, the cashew and sesame sub-sectors struggle with issues surrounding quality control and food safety. Farmers and processors often struggle to meet international quality standards, hindering their chances of accessing export markets (FAO, 2020). Food safety and contamination concerns can also harm the reputation of these sub-sectors and make it harder for businesses to sell their products (FAO, 2020).

In conclusion, these challenges present significant obstacles to the growth and progress of the cashew and sesame sub-sectors, and overcoming them requires continuous effort and investment from both the private sector and government. Results from the qualitative analysis showed that participants in all three geo-political zones experience similar challenges such as lack of government support, inadequate research, erratic rainfall, and inadequate market etc.

> *"The major challenge is lack of holistic government support. There are crops and commodities that are getting government interventions like the CBN anchor borrowers' scheme that intervenes in rice, maize cassava e.t.c. Cashew does not have such governmental support and ditto for most cash crops in Nigeria. There are issues around research not been enough to improve farming techniques and quality of seeds that are being used".*
>
> (Respondents 2, South West, 24/07/2022)
>
> *"We are too traditional and there is need for continual research to improve in the area of improved seeds and modern technologies. Also lack of support from the government is a big challenge to sesame farming in the area of funding and subsidized farming inputs".*
>
> (Respondent 6, North West, 27/06/2022)

In summary, this study showed that all the interviewees are of similar opinion, with an ardent desire of the government's intervention. There is a general belief that the major problem affecting agricultural value chain is the government; the lack of interventions and unfavourable policies.

All the respondents are in agreement that inputs for agriculture are essential for the optimisation of the agricultural value chain because they contribute significantly to the overall cost of production. Furthermore, these individuals interviewed believe that the current economic crisis is having a severe impact on the optimisation of the cashew and sesame value chains due to the high cost of inputs caused by the unfavourable economic conditions in the country.

7.6 Value Chain Analysis of Cashew and Sesame

7.6.1 Introduction

Gaining a more thorough understanding of the connections and interactions between farmers, traders, and other actors involved in the value chain, the difficulties in promoting and selling cashew and sesame can be overcome. Value chain mapping serves as an efficient starting point for involving producers, traders, consumers, and other stakeholders in the chain, according to Lundy *et al*. (2014). According to Hellin (2006), value chain analysis should begin by identifying and mapping out the various players involved in the input or output value chain, which will help to build a deeper understanding of the different actors involved. This process is called "delineating the value chain by creating a chain map". The VCM tool allows for a visual representation of the journey an agricultural commodity takes, from the point of origin at the farm gate to the final destination with the consumer. This technique helps to illustrate the connections and interactions between businesses and other market players within the value chain. It also assists in determining significant players and processes involved in the production, distribution, and consumption of the commodity (see Figure 7.1).

Input suppliers: The main input for cashew plantations is the seeds which are usually distributed to farmers through cooperatives or input dealers. Other times, seeds are obtained from neighbouring farms for free, while some farmers also purchase improved seeds. So far, the quantities of seed delivered through research channels and NGOs remain low compared to the farmers' requirement. Over the study area, chemical inputs (e.g., insecticides, fertilizers, etc.) is very uncommon in cashew production. Although some producers apply herbicides for weeding, others do not because of the high cost; so, manual weeding is the standard practice. Over all, Smallholder farmers often inherit cashew farms, but some also acquire them through purchase or lease. The main seed suppliers in the sesame value chain are local markets, previous markets and Ministry of Agriculture and Rural Development. Farm inputs are generally obtained from local markets and Agricultural Development Programmes offices at subsidized rate. Some peculiar tools (e.g., harrowers and ridgers) are often fabricated locally, and draught animals are also sourced locally. Like the cashew farms, sesame farms are mostly inherited or acquired.

Producers: Majorly, cashew producers conduct on-farm production activities such as land preparation, planting and post-planting operations. The farming method employed in sesame production is simple. Farmers use draught animals for land preparation, broadcast planting, weeding, harvesting, drying and threshing. As such, over this study area, sesame farming system remains subsistence due to lack of mechanisation.

Rural assemblers: Rural assemblers, also known as local middlemen, are crucial in the collection of cashew nuts. Operating in close proximity to producers, they act as intermediaries between producers and buyers. Typically, a buyer provides a cash amount to the rural assembler, equivalent to the quantity of nuts to be purchased at the farm gate price set by the buyer based on their available information. In practice, the rural assembler's goal is to purchase the nuts at a lower price than the buyer's set price, in order to retain the difference. Unfortunately, these middle men do not add value but merely enjoy benefits which could have accrued to the producers.

In the study region, rural assemblers in the sesame value chain travel from market to market or door to door on designated market days to purchase sesame from farmers, thus moving it from the farm gate to traders. This type of trading is seasonal. Sesame collectors, who work independently, gather the crop from small-scale farmers and bring it to market, adding value and quantity to it in the process. Collectors aim to make a profit by purchasing items from producers and reselling them to traders or consumers at a higher price, thus obtaining a profit margin from the difference between the purchase and sale prices. This profit margin includes a portion of the profit that would have gone to the producer and the trader in a traditional supply chain. Some sesame collectors lack the necessary capital to make purchases, and thus work with advances provided by private traders.

Wholesalers: The wholesalers aka bulk buyers are licensed suppliers with bigger facilities and better financial capabilities. These sellers purchase cashew nuts in large volume directly from farmers or rural assemblers, dry and store these nuts in warehouses, and resell in small portions to retailers, processors and exporters.

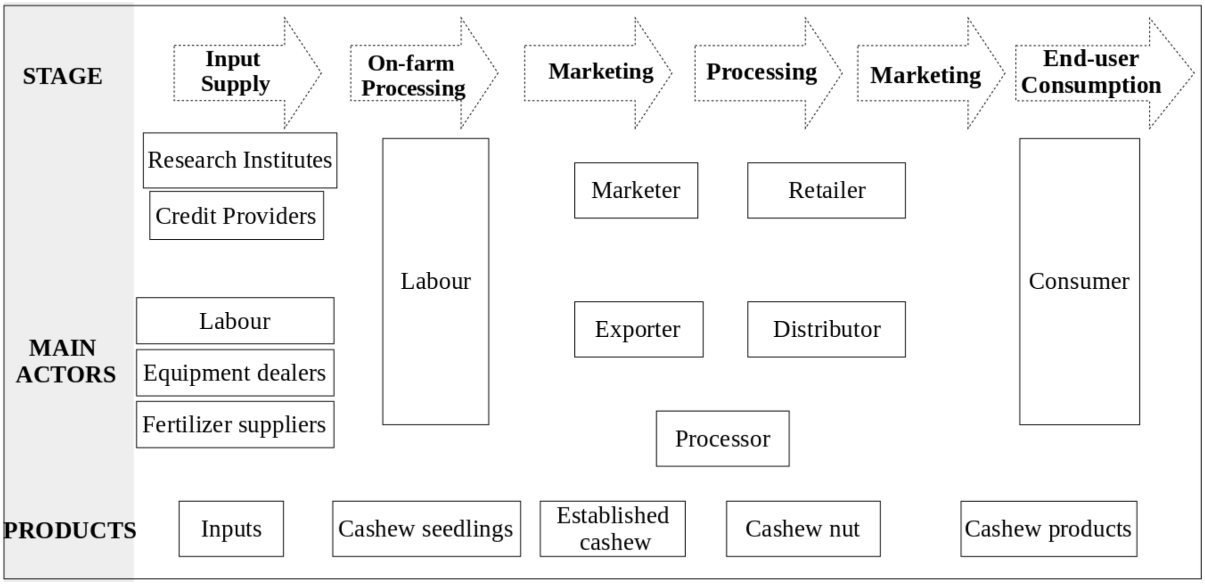

Figure 7.1: Map of cashew value chain in the study area. (Source: Adapted from Adesanya *et al*., 2021).

Retailers: Retailers found in this study area are self-financed, they buy from wholesalers or processors to sell to final consumers in retail price. They are independent buyers and also form associations where they register and pay dues.

Processors: Small percentages of smallholder cashew farmers are processors in the study area. Those that process only add value to what they will consume within the household and sell the excess. Also, there are few local processors that purchase for commercial processing. These processors clean the seeds, de stone with sieves, and dehull occasionally. Afterwards, the processed seeds are sold to supermarkets, retail stores, and exporters on special demands.

Exporters: Exporters buy in bulk from wholesalers or producers, and sell to foreign markets. Often times, these buyers are under contract, and so they advance the funds needed to purchase the nuts. The sesame exporters found in the study area buy from wholesalers, assemblers and producers. These exporters screen, clean and bag before exporting. They also have buyers under contract that help them source for sesame, buy and then transport to regional centres for cleaning and final exportation.

Consumers: Local consumers are the end users of cashew kernels and sesame seeds, and they buy from supermarkets and roadside hawkers. Confectioneries and snacks from sesame are gotten from stores and supermarket in the city centre.

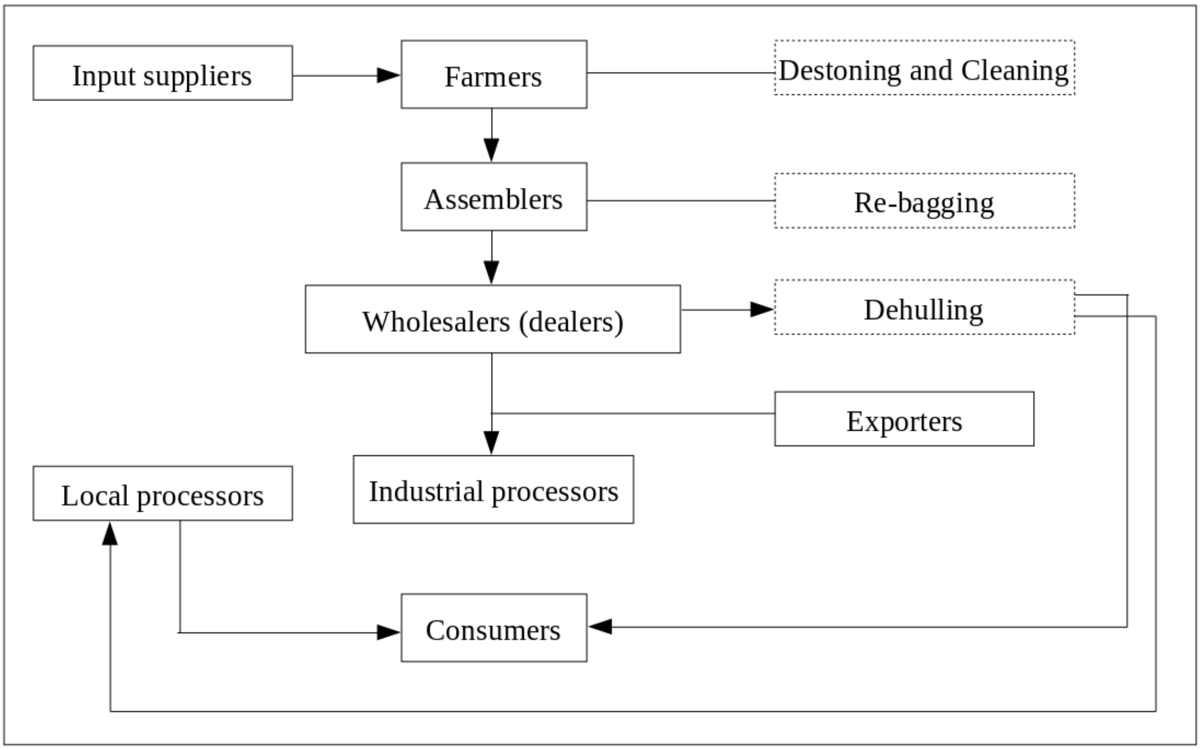

Figure 7.2: Map of sesame value chain in the study area (Source: Author's sketch)

CHAPTER 8: CONCLUSION AND PERSPECTIVES

8.1 Introduction

This chapter summaries the study's findings, its implications, and contributions. This research examined how economic turbulence impacts the agricultural value chain optimisation of smallholder farmers in Nigeria. By utilising both qualitative and quantitative research methods, the study was able to gain a deeper understanding and wealth of data, as well as solid analysis. The findings provide significant and fresh insights on how the current economic crisis in Nigeria is affecting the agricultural value chain of cashew and sesame in the three geo-political zones.

8.2 Summary

The cashew and sesame value chain presents a market integration opportunity for small-holder farmers in Nigeria. The south west and North central regions of the country are suitable for cashew production while sesame thrives better in the core north due to its drought-resistant nature. The data employed in this study were drawn from primary and secondary sources. The primary data were collected from 450 respondents using structured questionnaires. Qualitative data were also collected through key informants' interviews.

The data collected was analysed through the application of both descriptive statistics and an econometric model using Stata Software Package. The methodology used to study the factors affecting optimisation in the value chain of cashew and sesame was the two-stage least squares regression model, while multiple linear regression was employed in the analysis factors that affect production cost. The findings of this study are summarised as follows:

1. Econometric result of the 2SLS regression model indicated that the age of the household heads, level of education, cashew yield, area of cultivation, and economic turbulence are significant factors that determine the value chain optimisation of cashew smallholder farmers. Moreover, value chain optimisation of sesame was significantly affected by household size, monthly income, years of farming experience, yield of sesame, area of land allocated for sesame and inflation rate.
2. The multiple linear regression model applied in this study was intended to investigate factors influencing the total cost of production of cashew and sesame farmers. The result indicated that the age of the household heads, education level, monthly income, costs of improved seeds, farm implements, cost of farm inputs, inbound and outbound logistics costs are driving factors.

3. Production cost of sesame farming in a turbulent economy is also affected by monthly income, costs of improved seeds, fertilizers, and labours.

8.3 Theoretical contributions

The results of the study are in perfect harmony with the three pivotal theories that formed the backbone of this research. These are the global value chain analytical theory, institutional theory, and resource-based theory. These theories provided a foundation for the study's arguments and concepts and allowed for an in-depth examination of relevant variables and theories.

The discovery that fair value distribution occurs when key stakeholders have equal representation in governing national regulatory bodies, rather than lead firms holding the majority of power as previously believed according to the global value chain analytical framework, marked a departure from the GVCA theory. The prevailing viewpoint within the GVCA field of study is that while highly regulated structures can facilitate the rapid acquisition of production capabilities, they can also impede functional advancement and/or investments in forward linkages, thus limiting the ability to generate greater profits over time.

The findings in this study added another perspective by showing that the economic crisis which is related to the governance aspect of the GVCA framework created barriers in optimising value chain by making product optimising (product upgrading in GVCA) that will generate further revenue for the farmers (hinged on informal economy) expensive with increasing cost of resources. This helped in answering the question how has economic turbulence hindered the value chain optimisation? Having gone through the various debates surrounding value chains, governance structure and the informal economy, it has revealed the importance of cashew and sesame, the operating market, and the actors along the value chain. This study also identified the meaning of optimisation in the cashew and sesame value chain.

The contribution of this study to institutional theory is the aspect of quality institutions' economy and agricultural value chain.

1 The economic instability in Nigeria is primarily caused by the lack of appropriate institutions and their inadequate enforcement, which fail to create incentives for smallholder farmers to engage in productive or wealth-maximising activities within the agricultural value chain. It is argued that good institutions provide a favourable economy for smallholder farmers to thrive and optimise- thereby combating the influence of economic downturn.

2 Another significant contribution of this study is that it successfully underscored the intimate interactions between institutions and technology to influence economic performance. For example, the use of improved seeds allows productivity gains which improve the optimisation of the smallholder farmers.

3 Institutional theory can help in identifying obstacles for smallholder farmers to participate in agricultural value chains and guide the creation of policies and programs to enhance their involvement. The theory also sheds light on the influence of various actors in creating the institutional environment in which smallholder farmers operate and how this environment can be altered to benefit smallholder farmers and optimise agricultural value chains

The contribution of the study to resource base theory is in the aspect of the resources used in optimising the agricultural value chain. The choice to optimise should be based on matching opportunities in the external environment with the appropriate internal resources. As such, smallholder farmers considering value chain optimisation are clearly encouraged to identify, develop, and strengthen the resources in the optimised stage of the chain that will be strategic, and which will form the basis of sustained competitive advantage. The study also revealed that resources serve different functions in the optimisation process. According to the Resource-Based View, resources that were classified basic in the original farming business became strategic when they are re-purposed in the optimisation process. Whether resources are “basic” or “strategic” is context-specific, and it is dependent on the nature of the optimisation along the chain. The results of this study demonstrate that the participants were cognisant of the importance of various types of resources for enhancing the value chain optimisation. Additionally, it is clear that smallholders are attuned to the importance of resources in optimising the value chain.

8.4 Implications

8.4.1 Practical implication

The selected study areas are primarily involved in the cultivation of cashew and sesame as their primary cash crops, while the majority of the farmers rely on subsistence agriculture. The productivity and profitability of farmers are significantly impacted by the unfavorable economic conditions (Fowowe, 2020). Therefore, it is essential to emphasize collective efforts among the main stakeholders in the agricultural sector to reduce the impact of the unfavorable economy on farmers' productivity and profitability (Olomu *et al*., 2020).

One of the crucial practical implications of this study is the need for strategies to overcome the institutional obstacles faced by farmers in the agricultural sector. Economic instability and unfavorable conditions pose significant challenges to farmers' productivity and profitability (Okuthe, 2017). Therefore, stakeholders in the agricultural sector must come together and collaborate to create effective strategies to tackle these challenges. This can be achieved through the implementation of appropriate policies, providing access to credit facilities, and encouraging the adoption of innovative technologies to enhance productivity.

Furthermore, the study highlights the need for significant investments and creative solutions to boost agricultural production and value creation throughout the agricultural value chain in Nigeria. Investment in research and development, infrastructure development, and effective value chain management can help increase agricultural productivity, create jobs, and enhance economic growth (Olomu and Akinlo, 2020). There is a need to explore the potential for crop diversification and value addition to agricultural products to enhance their marketability and generate more income for farmers.

In summary, the study emphasizes the need for collaborative efforts among the main stakeholders in the agricultural sector to overcome the institutional obstacles posed by economic instability. It calls for the implementation of appropriate policies, significant investment in research and development, and the adoption of innovative technologies to enhance productivity and profitability. These measures will help create jobs, enhance economic growth, and contribute to the overall development of Nigeria's agricultural sector.

8.4.2 Policy implication

To achieve optimisation in cashew and sesame value chain, this study's findings highlight crucial factors that need to be addressed for successful policy implementation and management in order to incentivize smallholder farmers, processors, and exporters of cashew and sesame and its related products (Adesanya *et al*., 2021). In this context, price of cashew and sesame is one of the important incentive factors. In order to attain better prices, ensuring high quality is crucial. This has implications for creating an effective educational program targeted at cashew and sesame growers (Iyaji *et al*., 2022). This could be accomplished through educating local purchasing agents who will then educate the farmers. By doing so, the agro-industry would be motivated to process more cashew and sesame, which would lead to an increase in processing capacity and the conversion of cashew and sesame into more valuable final products (Katanga and Haruna, 2022). This would allow for the expansion of exports to new markets, rather than just exporting raw cashew nuts and sesame seeds.

Infrastructural limitations and high operational costs are caused by inadequate infrastructure in rural areas. Alleviating these obstacles should be a priority for the Nigerian government in order to drive economic development. The processing operations within the agricultural sectors, including the cashew and sesame sub-sectors, are marked by increased expenses due to shortcomings in transportation systems (Mengstu *et al*., 2019). A lack of good roads results in large wastage in cashew after harvesting, and this is true for many agricultural crops. In fact, non-functioning transport systems increases distribution cost, makes delivery untimely, and retard productivity. Additionally, the lack of infrastructure like electricity and water in rural communities leads to increased costs, which discourages investment.

The main components of political instability are high interest rates, a strong exchange rate, and widen gap in wages between urban and rural areas. This has contributed significantly to the operations cost. High and increasing interest rates have been identified as a contributing factor to farmers' limited access to credit. In the light of these challenges, the following policy strategies should be prioritised to improve value chain optimisation of cashew and sesame in Nigeria.

1. Addressing Quality and Productivity as a Critical Concern: Inadequate infrastructure and the absence of relevant skills are the primary hindrances to achieving high quality and productivity. These factors hinder the ability of farmers to obtain necessary resources, restrict processing businesses' access to essential materials, and make it challenging for these farmers to participate in global production and distribution networks. Therefore, Nigerian government need to invest heavily on infrastructural rebuilding to be able to offer competitive, safe, reliable and cost-effective products in the global market. Additionally, allocating a greater portion of the budget towards agriculture should be directed towards providing sufficient infrastructure in order to improve market opportunities, increase competitiveness, and increase the rate of return on investment. Additionally, a more reliable power source, well-functioning rural roads, and strong connections to urban centres would promote consistent delivery of cashew-to-cashew processing industries; this would enhance the prospects of exploiting growth potentials of cashew in Nigeria. Furthermore, the utilisation of local raw materials, diversifying products, and improving marketing logistics will assist cashew and sesame processing companies to compete and remain successful. Agro-industrial growth and competitiveness will be also be enhanced by improved infrastructural capacity.

2. Primary commodity markets and input markets should be strengthened by the government: Farm inputs should be made available to smallholder farmers at affordable prices to give them the opportunity to expand their farms. They can be helped through the provision

of accurate market information and effective market connections to avoid exploitation by intermediaries.

3. The interest rate on agricultural loans should be reduced to increase access to credit, allowing farmers and small to medium scale processors to receive credit facilities at a more affordable single digit rate. The Nigerian Bank of Agriculture should be strengthened to provide more efficient loan delivery for farm operations at a reduced interest rate.

4. Stable macroeconomic policies: It is important to maintain a stable macroeconomic policy environment, particularly in terms of price stability, to attract and retain investors and potential investors in the cashew and sesame industries and other sub-sectors of agriculture.

8.5 Limitation of the study

1. The first limitation of this study is the security issues affecting many Nigerian states, which can be a threat to life and property and make road transportation dangerous. These challenges include farmer-herder conflicts, banditry, kidnapping, and separatist movements, among others.

2. Another limitation is the difficulty in obtaining cooperation from respondents during the data collection process. Many respondents were unwilling to provide information due to competition concerns, while others demanded or expected compensation in exchange for their information.

3. Another constraint of this research is the lack of comprehensive data and information on the subject matter, which made it difficult to fully analyse the relationship between agricultural value chain and economic instability. Additionally, there is a lack of research on optimising the value chain for rural farmers, particularly in the processing and packaging stages, and on the various stages of sesame seed processing in Nigeria and the actors involved.

8.6 Recommendation for further studies

This study has provided valuable insights into the impact of economic turbulence on the value chain optimisation of cashew and sesame in Nigeria. However, it has also highlighted several areas that warrant further investigation. Firstly, this study revealed that economic turbulence only influences the value chain optimisation of cashew and not that of sesame. This suggests that there may be other factors at play in the relationship between economic instability and optimising the value chain. Therefore, additional studies are needed to explore these factors. This could include investigating the role of market dynamics, government policies, and socio-cultural factors in influencing the value chain optimisation of these crops. Secondly, this study employed a cross-sectional survey approach to gather data. While this approach has its merits, it also has limitations. For instance, it provides a snapshot of a particular point in time and may not capture changes over time. Therefore, future studies could consider using a longitudinal survey style to track changes over time and provide a more comprehensive understanding of the issues at hand. Thirdly, the measures used for economic turbulence in this study were perceptual; most of the data collected for key variables were qualitative. This raises concerns about common method bias and the honesty of the source. Future studies should consider alternative methods of measurement beyond the Likert scale. This could include using objective measures such as economic indicators or employing mixed methods approaches that combine qualitative and quantitative data. While this study has contributed significantly to our understanding of the impact of economic turbulence on the value chain optimisation of cashew and sesame in Nigeria, there is still much to be learned. This study further recommends more local scale assessments to corroborate the findings of this study by using various questions directed at different individuals within the value chain. This could include farmers, processors, exporters, and other stakeholders in the agricultural sector. By addressing these areas in future research, we can gain a more nuanced understanding of the challenges and opportunities facing smallholder farmers in Nigeria and develop more effective strategies for improving agricultural productivity and profitability in a turbulent economy.

REFERENCES

Aaron, S. (2011). Climate change adaptation and conflict in Nigeria. Special Report United States Institute of Peace. Available at: www.usip.org.

ABA (2015). Australian Board of Almonds, Annual Report 2014/15 Retrieved from www.australianalmonds.com.au. [8 May 2016].

Abate, G. and Peterson. H.C. (2005). The Strategic Marketing Institute Rapid Opportunity Assessment: Fruit Sector, Report prepared as part of the work plan for the Great Lakes Agriculture Innovation Program funded by a USDA Rural Development Grant, Michigan State University, Retrieved from http://productcenter.msu.edu/uploads/files/Fruit percent20Sector percent20ROA.pdf [15 November 2015].

Abay A. (2007). Vegetable Market Chain Analysis: The Case of Fogera Woreda in ANRS of Ethiopia. MSc Thesis, Haramaya University, Haramaya, Ethiopia.

Abbass, K., Qasim, M.Z., Song, H. *et al.* (2022) A review of the global climate change impacts, adaptation, and sustainable mitigation measures. *Environ Sci Pollut Res* **29**, 42539–42559 (2022). https://doi.org/10.1007/s11356-022-19718-6

Abdul Salam M. and Peter K.V. (2010). Cashew, a monograph. Studium Press (India) Pvt. Ltd. 2010.

Abdul-Salam, Y., & Lee, T. H. (2018). The impact of logistics costs on agricultural productivity: Evidence from selected countries in sub-Saharan Africa. Journal of Transport and Supply Chain Management, 12, 1-10. https://doi.org/10.4102/jtscm.v12i0.308

Abebe, A. (2009). *Market chain analysis of honey production in AtsbiWemberta District, Eastern zone of Tigray National Regional State.* Dissertation for Award of MSc. Degree at Haramaya University, Ethiopia. 101pp.

Abu, A. G., Abah, D. and Okpachu, A. S. (2011). Analyisis of costs and returns for sesame production in Nasarawa state: Implication for sustainable development in Nigeria. *Journal of Sustainable development in Africa, 13*(3): 238 – 249.

ACA (2015). African Cashew Alliance Annual Report 2014, Retrieved from www.africancashewalliance.com[15 November 2015].

Accenture. (2021). Digital Supply Chain: How Technology is Transforming the Supply Chain. https://www.accenture.com/_acnmedia/PDF-35/Accenture-Digital-Supply-Chain.pdf#zoom=50

Adamopoulos, T. (2011). Transportation costs, agricultural productivity, and cross-country income differences. *International Economic Review*, *52*(2), 489–521. http://www.jstor.org/stable/23016641

Adamu, T. and Bakari, U. M. (2015) Profit Efficiency among Rain-Fed Rice Farmers in Northern Taraba State. *Journal of Biology, Agriculture and Healthcare* 5(8):113-119.

Adebayo, O. R., Adekunle, W. O., & Ogunniyi, L. T. (2019). Social networking and agricultural productivity among smallholder farmers in Nigeria. Journal of Agricultural Extension, 23(1), 1-12. https://www.ajol.info/index.php/jae/article/view/186758

Adedoyin, S. F., & Adedoyin, O. O. (2020). Agricultural finance in Nigeria: Evolution, challenges, and prospects. International Journal of Agricultural Management and Development, 10(1), 55-68.

Adegbite, A. E., & Adegbite, S. A. (2020). Agriculture and Economic Growth in Nigeria: An Empirical Analysis. Journal of African Business, 21(1), 1-18.

Adegbola, J. A., & Ayinde, O. E. (2020). Enhancing Market Access through Value Chain: An Analysis of Nigerian Agricultural Value Chain. In Value Chain Development and Management (pp. 181-199). Springer, Cham. https://doi.org/10.1007/978-3-030-45322-7_11

Adegbola, Y.P., Adjovi, N.R.A., Adekambi, S.A., Zossou, R., Sonehekpon E.S., Komlan, F.A. and Djossa, E. Consumer Preferences for Fresh Tomatoes in Benin using a Conjoint Analysis. *Journal of International Food & Agribusiness Marketing*, 2019;31(1), 1-21. DOI: 10.1080/08974438.2018.1469448.

Adegoke, O. A., &Adediran, T. A. (2015). An Analysis of Informal Sources of Agricultural Finance in Nigeria. International Journal of Economics, Commerce and Management, 3(11), 1-7.

Adeigbe, O.O., Olasupo, F.O. and Muyiwa, A.A. (2015) A review on cashew research and production in Nigeria in the last four decades. Scientific Research and Essay. Vol (10)5, pp, 196-209 ISSN:1992-2248.

Adeigbe, O.O., Olasupo, F.O., Adewale, B.D. and Muyiwa, A.A .2015. A review on cashew research and production in Nigeria in the last four decades. *Scientific Research and Essays* 10(September 2016):196-209. doi: 10.5897/SRE2014.5953.

Adejo P.E., Otitolaye J.O. and Onuche U (2011). Analysis of marketing channel and pricing system of cashew nuts in North Central Nigeria, Journal of Agricultural Science. 2011; 3(3): 246-248.

Adejo, P.E., Otitolaye J.O., and Onuche, U., (2011): Analysis of Marketing Channel and Pricing System of Cashew nuts in the North Central of Nigeria. Journal of Agricultural Science, 3 (3), 246-250.

Adejo, P.E., Otitolaye, J.O., & Onuche, U. (n.d.). Analysis of Marketing Channel and Pricing System of Cashewnuts in the North Central of Nigeria.

Adejuwon, J. O., & Osiname, O. A. (2018). Impacts of climate change on agriculture in Nigeria: A review. Journal of Agricultural Extension, 22(1), 1-12.

Adelegan, O. J. (2011), Infrastructure deficiencies and investment in manufacturing firms in Nigeria. Journal of Economics and International Finance, vol. 3, no. 9, pp. 542–552, available at: https://academicjournals.org/article/article1379685600_Adelegan.pdf.

Adeniji, A. M., (2018): Proceedings of 4th Edition of the World Cashew Convention & Exhibition held in Macu 1-3 February, 2018. Organised by CashewInfo.com Accessed 5th August, 2020. http://www.cashewconvention.com/wcc2018/WCC_Proceedings_2018_EBook.pdf

Adeniyi L. (2010). Women Farmer's and Agriculture Growth: Challenge and Perspective for Africa face the economic crisis. Poster 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, September 19-23, 2010.

Adeoye, B.W., & Olowu, T.A. (2018). Quality control in agricultural produce marketing in Nigeria. International Journal of Agricultural Management and Development, 8(1), 1-10.

Adeoye, M. O. (2013), Impact of Business Environment on Entrepreneurship performance in Nigeria. *Computing, Information Systems, Development Informatics & Allied Research*, vol. 4, no. 4, pp. 59–66.

Adepoju, A. A., & Adegbite, D. A. (2019). Assessment of the impact of transportation cost on marketing of agricultural produce in Kwara State, Nigeria. Journal of Agricultural Extension and Rural Development, 11(8), 139-145.

Adesina, A. (2017). Transforming Nigerian agriculture: A presidential priority. Address delivered at the Feed Nigeria Summit, Lagos, Nigeria, 14 February. Retrieved from http://www.afdb.org/en/news-and-events/transforming-nigerian-agriculture-a-presidential-priority-16880/

Adesina, A. and Fakorede, M. A. (2015). Rural Transport in Nigeria: Challenges and Opportunities. Journal of Transport Economics and Policy, 49(2), 179-200.

Adesina, A., &Fosu, K. (2010). Access to credit and agricultural productivity in Sub-Saharan Africa. Agricultural Economics, 41(s1), 63-73.

Adeyeye A.O., Kolade O., Obembe D. and Ogunsade A.I. (2021). Agricultural value chain in a turbulent environment. Conference: Institute for Small Business and Entrepreneurship Conference, Cardiff

Adeyonu, A.G., Ajala, A.O., Adigun, G.T., Ajiboye, B.O. and Gbotosho, O.O. (2016). Determinants of sweet potato value addition among smallholder farming households in Kwara State, Nigeria. Agro-Science Journal of Tropical Agriculture, Food, Environment and Extension, 15(1), 17-22[1].

Adisa, R. S., & Agbaje, G. O. (2021). Evaluating the effects of mechanisation on agricultural productivity in Nigeria: A case study of Ogun state. Journal of Agriculture and Rural

Development in the Tropics and Subtropics (JARTS), 122(1), 111-120. doi: 10.17170/kobra-202011172654

Adole, S. O. (2016). *Economic analysis of sesame production among small-holder farmers in Benue State, Nigeria.* Published Dissertation Submitted to the Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University, Zaria in Partial Fulfillment of the Requirements for the Award of the Degree of Master of Science in Agricultural Economics. Retrieved March 18 2018 from https://iproject.com.ng/agriculturaleconomics-and-extension/economic-analysis-of-sesame-production-a

ADVISEN LTD, 2013. The Vulnerability of Global Supply Chain: The Importance of Resiliency in the Face of Systemic Risk. White Papers, 2013.

Afreen N. and Haque M.S. (2014). Cost-benefit analysis of cassava production in Sherpur district of Bangladesh. *J. Bangladesh Agri.Univ.* 12 (1):119-126.

Africa Cashew Alliance. (2011). "CASHEWS - highlights of the cashew industry". June 2011.

African Cashew Alliance. (2018) Growing cashew industry in focus annual report. 2018.

African Development Bank Group (2013). Agricultural Value Chain Financing (AVCF) and Development for Enhanced Export Competitiveness, Tunis, I.S.B.N.:978-9938-882-17-9 Retrieved from http://www.afdb.org/en/documents/document/agricultural-value-chain-financing-avcf-and-development-for-enhanced-export-competitiveness-47028.

African Development Bank. (2019). Agricultural Value Chains in Africa: Lessons Learned and the Way Forward. Retrieved from https://www.afdb.org/en/documents/document/agricultural-value-chains-africa-lessons-learned-and-way-forward-144996

African Development Bank. (2019). Nigeria Country Strategy Paper 2019-2023. https://www.afdb.org/fileadmin/uploads/afdb/Documents/Strategies--Operations/Nigeria_Country_Strategy_Paper_2019-2023.pdf

AfriCashew splits (2020): The international market, published by African Cashew Alliance ACA, Week 25: June 15 – 21, 2020 – N°11.

Agada M.O. and Sule E.M. (2020) Cashew Nuts Production and Marketing among Farmers in Ugwolawo District, Kogi State, Nigeria International Journal of Research Studies in Agricultural Sciences (IJRSAS). 2020; 6(5).

Agbedeyi O.D. and Adigwe R. U (2018) A Statistical Analysis of the Impact of Economic Recession on Food Production in Nigeria. *Global Scientific Journal* 6(2) www.globalscientificjournal.com Accessed on 20th June, 2020. 6(2).

Aggarwal, S., Brian, G., Dahyeon, J., Jonathan, R. and Alan, S. 2018. assessment of industrial and social vulnerability to indirect disaster losses. Natural Hazards 67(2), 145-167.

Agri, E. M., Mailafia, D. and Umejiaku, R., I. (2017). Impact of Economic Recession Macroeconomic Stability and Sustainable Development in Nigeria. *Science journal of Economics.* ISSN: 2276-6286.

Agricultural Research Council of Nigeria http://www.arcnigeria.org/index.php/explore/research-institutes/118-nationalanimal-production-research-institute [Accessed 7th May, 2017].

Agritech. Sesame Seed Consumption Continues to Increase. Available online: https://www.agriorbit.com/sesame-seed-consumption-continues-to-increase/

Agrojiva (2021) Post-Harvest losses of Vegetables https://agrojiva.com/post-harvest-losses-of-vegetables/

Aguirre, D., & Makino, S. (2015). Diversification and internationalization strategies of Japanese SMEs: How do they relate to firm performance? Journal of World Business, 50(4), 8-18. doi: 10.1016/j.jwb.2015.01.005

Aina, I. V., Ayinde, O. E. and Falola, A. (2015). Effect of Price Variation on Rice Production in Nigeria. International Conference of Agricultural Economists, Milan, Italy. August 8-14.

Ajani, E.N., and E.M, Igbokwe (2014) "A Review of Agricultural Transformation Agenda in Nigeria: The Case of Public and Private Sector Participation" Available: https://www.researchgate.net/publication/267507156_A_Review_of_Agricultural_Transformation_Agenda_in_Nigeria_The_Case_of_Public_and_Private_Sector_Participation

Ajmal A., Lukas B. and Gereffi G. (2013). Realizing the Potential of African Agriculture: Innovations and Market Access for Smallholder Farmers

Akidi, I.L., Wamala, S.K. and Mugonola, B., 2018. Determinants of smallholder indigenous chicken farmers, market participation decisions and value of sales in Gulu district. *J. Dev. Agric. Econ.*, 10(8):271-278.

Akinbode, S. O., Adeyemi, S. L., & Ogunyinka, A. O. (2021). Improving the productivity of smallholder farmers in Nigeria: The role of transport infrastructure. Journal of Agriculture and Rural Development in the Tropics and Subtropics (JARTS), 122(1), 119-130. https://doi.org/10.17170/kobra-202103223276

Akinbola, A. O., Adewuyi, S. A., & Akinwale, M. G. (2021). The role of adequate infrastructure in enhancing agricultural productivity in Nigeria. Heliyon, 7(6), e07205.

Akinlua, J.T., Richard, M., Umar, A.M., and Freemantle, N. (2015). Current prevalence pattern of hypertension in Nigeria: A systemic review.

Akinwale, Y. A., Oyebisi, T. O., & Ogunniyi, L. T. (2019). Role of informal sources of finance in agricultural value chain optimization in Nigeria. Journal of Agriculture and Rural Development in the Tropics and Subtropics (JARTS), 120(1), 81-93. https://doi.org/10.17170/kobra-20190612230

Akinwunmi Adeshina Leadership Newspaper (2015) http://leadership.ng/business/399129/2015-defining-year-agriculturaltransformation-agenda-ata and TimelinesNG newspaper (2015) http://timelineng.com/index.php/society/466-akinwunmiadesina-slams-gov-oshiomhole [Accessed 20th March, 2020].

Akinyemi, O., Alege, P. O., Ajayi, O. O., Adediran, O. S. and Urhie, E. (2017). A simulation of the removal of fuel subsidy and the performance of the agricultural sector in Nigeria using a dynamic computable general equilibrium approach. Covenant Journal of Business and Social Sciences. 8(1), 60-70.

Akor, A., Ibitoye, S. J. and Ayoola, J. B., (2014): Analysis of socio economic characteristics and profitability in cashew nut production in Kogi State, Nigeria. *International Journal of Agric.and rural development,* 17 (2), 1739 -1745.

Alam, K. and Shahiduzzaman, M. (2008). Inflation and food security: Some Emerging Issues in developing Countries. Proceeding of the 37th Australian Conference of Economists, Gold Coast, queesland, Australia, 1-17.

Alamu, J., Adepoju, A. A., Olanrewaju, R. F., & Taiwo, R. A. (2021). An analysis of the determinants of agricultural exports in Nigeria. Journal of Agricultural Extension and Rural Development, 13(3), 66-73.

Alberta Government (2018), "Agriculture and forestry", available at: http://www.agric.gov.ab.ca/$department/deptdocs.nsf/all/agp4936

Albizua, A., Bennett, E.M., Larocque, G., Krause, R.W. and Pascual, U. (2021) Social networks influence farming practices and agrarian sustainability. PLoS ONE 16(1): e0244619. https://doi.org/10.1371/journal.pone.0244619

Alegbejo M. D., Iwo G. A., Abo M. E. and Idowu A. A. (2008). Sesame: A Potential Industrial and Export Oilseed Crop in Nigeria. Journal of Sustainable Agriculture, Vol. 23(1) 2003 http://www.haworthpress.com/store/product.asp?sku=J064

Alemnew A. (2010). Market Chain Analysis of Red Pepper: The Case of Bure Woreda, West Gojjam Zone, Amhara National Regional State, Ethiopia. MSc Thesis, Haramaya University, Haramaya, Ethiopia.

Ali A., Salawu A.J. and Sanni R.M. (2015). Factors Influencing Sesame (*Sesamun Indicum* L) Marketing in Jigawa State, Nigeria. Journal of Agricultural Extension Vol. 19 (2) December, 2015 ISSN(e): 24086851; ISSN(Print); 1119944X http://journal.aesonnigeria.org http://www.ajol.info/index.php/jae Email: editorinchief@aesonnigeria.org

Aliyu O.M. and Hammed L.A. (2008) Nigerian cashew economy: A review of nut production sector. Paper presented at the International Academy of African Buisiness and Development (IAABD) Conference. University of Florida, Gainesville, USA. 20□24 May 2008.

All Africa. (2021). Nigeria: Reviving Cashew Industry Key to Achieving Sustainable Economic Growth - Experts. Retrieved from https://allafrica.com/stories/202102090589.html

Altieri, M.A. and Koohafkan, P. (2008). Enduring farms: Climate change, smallholders and traditional farming communities. Environment and Development Series 6. Penang, Malaysia: Third World Network.

Amare T. (2013). Determinants of Agricultural Commodity Market Supply: A Case Study in the Upper Watershed of the Blue Nile, Northwestern Ethiopia. Journal of Agribusiness and Rural Development, 4(30): 243-256.

Amaza, P. S. and Olayemi, J. K. (2000). The influence of education and extension contact on crop in Gombe state, Nigeria. *Nigeria Journal of Agribusiness and Rural Development*. 1: 80-92.

Ameh, O. E, Ater, I. P. and Ayoola J. B. (2022) Market Performance of Cashew Nuts among Marketers in North–Central Geo-Political Zone, Nigeria. International Journal of Innovative Science and Research Technology Volume 7, Issue 2, ISSN No:-2456-2165.

American Society of Civil Engineers. (2021). Infrastructure report card. Retrieved from https://infrastructurereportcard.org/

Amit, R., &Schoemaker, P. (1993). Strategic assets and organisational rents. *Strategic Management Journal, 4*(1), 33–47.

Annan, K., Conway, G. and Dryden, S. (2015). 'African Farmers in the Digital Age: How Digital Solutions Can Enable Rural Development'. *Foreign Affairs*, November/December (special issue).

Apata, T., Apata, O., Igbalajobi, O. and Awoniyi, S. (2018). Determinants of rural poverty in Nigeria: Evidence from small holder farmers in South-western, Nigeria.

Appuhami, R. B. A. (2007). The impact of intellectual capital on investors' capital gains on shares: An empirical investigation of Thai Banking. *Finance & Insurance Sector, International Management Review*, *3*(2), 14-25.

Ardiani, F., Noviana, G., Gunawan, S. and Santi, I.S. (2020).Farmer's cashew (*Anacardium occidentale*) cultivation pattern: Study case in Gunungkidul Regency. *PalArch's J. Archaeol.*

Aremu F. J. 2020. Strenghtening the Nigeria Sesame Value Chain: Opportunities, Challenges, and Policy Options. DOI: 10.13140/RG.2.2.23870.31048

Aremu-Dele, O., Adesanya, K.A.,Olorundare, B.O., Asunbo, O.I. and Odeyemi, E.F. (2021).Intercrop practices in cashew production. *N.a.J.Adv. Res. Rev.,* 10(3): 281-288, DOI:10.30574/wjarr.2021.10.3.0268

Asfaw, S., Mithöfer, D. and Waibel, H. (2010a). Agrifood supply chain, private-sector standards, and farmers' health: Evidence from Kenya. Agricultural Economics 41(3–4):251–263.

Asongu, S. A. (2017). The challenge of financing agricultural value chain development in Africa. Agricultural Finance Review, 77(1), 75-95.

Astewel T. 2010. Analysis of Rice Profitability and Marketing chain: The Case of Fogera Woreda, South Gondar Zone, Amhara National Regional State, Ethiopia. MSc Thesis, Haramaya University, Haramaya, Ethiopia.

Atube, F., Malinga, G.M., Nyeko, M. *et al.* (2021) Determinants of smallholder farmers' adaptation strategies to the effects of climate change: Evidence from northern Uganda. *Agric & Food Secur* **10**, 6 (2021). https://doi.org/10.1186/s40066-020-00279-1

Audu S.I., Otitolaiye J.O. and Ibitoye S.J. (2013). A stochastic frontier approach to measurement of cost efficiency in small scale cassava production in Kogi State, Nigeria. *Euro. Sci. J.* 9 (9), 114 – 122.

Avcı, E., and Güngörmüş, A. H. (2018). Investigating the effects of tangible and intangible resources on firm performance: Evidence from Turkish agricultural cooperatives. Journal of International Food & Agribusiness Marketing, 30(3), 220-234.

Avidime, S.S., and Obi, S.e, (2020), Agricultural Policyand economic Development in Nigeria. (eds) Adesola, O. and Ajibade, D., (2020). *Tropical Issues in Social Sciences*. Faculty of Social Sciences, Kogi State University, Anyigba. *Indonesian Journal of Innovation and Applied Sciences* (*IJIAS*), 1 (3), 237-244 244

Ayelech T. (2011). Market Chain Analysis of Fruits for Gomma Woreda, Jimma zone, Oromia National Regional State. MSc Thesis, Haramaya University, Haramaya, Ethiopia

Ayeni, M.D., Adewumi, M.O. Food security among cashew farming households in Kogi state, Nigeria. *GeoJournal* **88**, 3953–3968 (2023). https://doi.org/10.1007/s10708-023-10846-1

Ayodele, O. E. and Amole, D. (2017). Regulatory challenges in the Nigerian agricultural sector. Journal of Agricultural Extension, 21(3), 70-80. https://doi.org/10.4314/jae.v21i3.9

Azam-Ali, S. and Judge, E. (2001). *Small-scale Cashew nut Processing*. Food and Agriculture Organisation of the United Nation, Rome, Italy. 70pp.

Babarinsa F. A.and Omodara M. A. 2017. Post-Harvest Handling and Packaging of Cashew Nut for Export. Being a Paper presented at an Awareness Seminar on "Handling and Packaging of Cashew for Export" Organised by Nigerian Export Promotion Council (Akure Zonal Office) at the Multipurpose Hall, family support Programme (FSP), Fate Road, Ilorin Kwara State, on Thursday 29th November, 2017.

Bachetta, M. (2009). "Globalisation and Informal Jobs in Developing Countries" published by WTO (World Trade Organisation) and ILO (International LabourOrganisation) 2009.

Bacon, C.M., Jokisch, B.D., & Sagoe, R. (2012). The shea butter value chain in Ghana. Sustainable Food Lab.

Badiru, I.O. (Undated). Review of small farmer access to agricultural credit in Nigeria.

Baily, M. N., Goolsbee, A., & Mankiw, N. G. (2014). Policies for reducing unemployment. Journal of Economic Perspectives, 28(1), 3-24.

Baker, M. (2019). The impact of fiscal policies on economic growth: Evidence from developed and developing countries. International Journal of Economics and Finance, 11(2), 28-42.

Balineau, G. 2018. "Experiences in smallholder inclusion: Contracting, certification, and evaluation of Inventory Credit in Sierra Leone." 3ie Impact Evaluation Report 14.

Ball, L., & Sheridan, N. (2004). Does inflation targeting matter? In The Inflation-Targeting Debate (pp. 249-282). University of Chicago Press.

Balogun, O.Y. (2009), Senior Secondary Atlas, 2nd Edition, Longman, Ibadan.

Banerjee, Abhijit, Esther Duflo, Nathanael Goldberg, Dean Karlan, Robert Osei, William Parienté, Jeremy Shapiro, Bram Thuysbaert, and Christopher Udry. 2015. "A multifacetedprogram causes lasting progress for the very poor: Evidence from six countries." Science 348(6236): 1260799-16.

Banmeke, T. O. A. (2003) accessibility and Utilisation of Agricultural Information in the Economic Empowerment of Women Farmers in South Western Nigeria. Unpublished Ph.D Thesis, Department of Agricultural Extension and Rural Development, University of Ibadan, Nigeia.

Baptista, R. D. (2012). Technological transition and the new skills required by the agribusiness sector. *International Food and Agribusiness Management Review* 15(Special Issue A).

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1): 99-120.

Bello, W (2008). Destroying African Agriculture.Foreign Policy in Focus, Washington D.C. See fpif.org/destroying_african_agriculture.

Bellù, G. (2013). A Software for Value Chain Analysis, Manual for FAO VCA Software Tool 3.1. EASYPol series n. 074, Food and Agriculture Organisation of the UN, Rome, Italy. Retrieved from www.fao.org/easypol [15 November 2015].

Bellú, L. 2013. Value chain analysis for policy making methodological guidelines and country cases for a quantitative approach. *EASYPol Series 129.* Food and Agriculture Organisation of the United Nations, Rome, Italy.

Benjamin, N., Aly Mbaye, A. "Les entreprises in formelles de l'Afrique de l'ouest francophone". World bank, 2012.

Berdegué, J. A., & Bebbington, A. (2019). The new rurality: Globalization, peasants and the paradoxes of territorial development. Routledge.

Bertazzoli, A., R. Ghelfi and S. Rivaroli. 2011. Value sharing and food system dynamics for milk, tomato, and cereals food chains. *International Journal on Food System Dynamics* 1(4): 330-341.

Beugelsdijk, C., Nell, P. C. and Ambos, P. (2017), When do distance effects become empirically observable? An investigation in the context of headquarters value creation for subsidiaries. Journal of International Management, vol. 23, is. 3, pp. 255–267. https://doi.org/10.1016/j.intman.2017.03.002.

Bianca D and Stefano C, Cashew from seed to market: A review, Agronomy for Sustainable Development, Springer Verlag. 2014; 34(4): 753-772.

Binuomote, S. O. and Odeniyi, K. O. (2013). Effect of crude oil price on agricultural productivity in Nigeria (1981-2010). International Journal of Applied Agricultural and Apicultural Research. 9 (1&2), 131-139.

Birthal, P.S., Hazrana, J. & Negi, D.S. (2021) Effectiveness of Farmers' Risk Management Strategies in Smallholder Agriculture: Evidence from India. *Climatic Change* **169**, 30 (2021). https://doi.org/10.1007/s10584-021-03271-1

Bismuth, A., and Tojo, Y. (2008). Creating value from intellectual assets. *Journal of Intellectual Capital*, *9*(2), 228-245.

Blanchard, O. (2018). Should we throw fiscal policy out the window? Journal of Economic Perspectives, 32(4), 167-186.

BNRCC (2011).Building Nigeria's response to climate change. Report on National Adaptation Strategy and Plan of Action on Climate Change for Nigeria. Prepared for the Federal Ministry of Environment Special Climate Change Unit.

Bogdan, R. C., & Biklen, S. K. (2007). *Qualitative Research for Education: An introduction to Theories and Methods*. Boston, MA: Pearson/Allyn & Bacon.

Bold, Tessa, KayukiKaizzi, Jakob Svensson, and David Yanagizawa-Drott. 2017. "Lemon assessment of industrial and social vulnerability to indirect disaster losses. Natural Hazards 67(2), 145-167

Bonney, B. (2009). Sustainable value chain analysis: an agri-food chain diagnostic, approved for use in National Lamb Chain Project by IDC, http://www.researchgate.net/publication/251236688

Bontis, N. (1998). Intellectual capital: an exploratory study that develops measures and models. *Management Decision, 36*(2) pp. 63-76. https://doi.org/10.1108/00251749810204142

Bosena T. 2008. Analysis of Cotton Marketing Chains: The Case of Metema Woreda, North Gonder Zone, Amhara National Regional State. MSc Thesis, Haramaya University, Haramaya, Ethiopia.

Bourlakis, M., & Weightman, P. (2004). Logistics and retail management: insights into current practice and trends from leading experts. Kogan Page Publishers.

Bowman, E.H. and Helfat, C.E. (2001), "Does corporate strategy matter?," *Strategic Management Journal*, 22, pp. 1-23.

Brannan, R. G., and Drouillard, J. S. (2020). Water requirements of beef cattle. Kansas State University Agricultural Experiment Station and Cooperative Extension Service.

Brouthers, L. E., Marshall, V. B. and Keig, D. L. (2016), Solving the single-country sample problem in cultural distance studies. Journal of International Business Studies, vol. 47, is. 4, pp. 471–479.

Brown, C, Haltiwanger, J. & Lane, J (2005). Economic Turbulence: The Impact on Workers and Businesses, University of Chicago Press, Chicago, Illinois.

Brown, T. (2019). Building a Strong Agricultural Network. Journal of Agribusiness, 37(2), 123-138.

Brown, T. (2021). The Importance of Developing Effective Strategies to Mitigate the Effects

Brown, T., & Green, R. (2021). Resource-Based Theory in Agriculture: A Review and Future Directions. *Journal of Agricultural Studies*, 59(3), 123-139.

Bruton, G. D., Ahlstrom, D., & Li, H. L. (2010). Institutional theory and entrepreneurship: where are we now and where do we need to move in the future? *Entrepreneurship theory and practice*, *34*(3), 421– 440.

Brynjolfsson, E., & McAfee, A. (2014). The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies. W. W. Norton & Company.

Cai, J. 2016. “The impact of insurance provision on households’ production and financial

Cai, J., Alain de J., and Elisabeth S. 2019. “Subsidy Policies and Insurance

Carana Corporation (2017) “Sub-Saharan Africa: Nigeria Expanded Trade and Transport (NEXTT)” Available: http://www.carana.com/projects/subsaharanafrica/824-nigeria-expanded-trade-and-transport-nextt [Accessed 30th May, 2017].

Carter, M., Alain de J., Elisabeth S. and Alexandros S. 2017. "Index Imperfect Information and Heterogeneity." Department of Agricultural and Resource

Carvalho, B. P. and H. Mendes (2015). Cashew Chain Value in Guiné-Bissau: Challenges and Contributions for Food Security: A Case Study for Guiné Bissau, International Journal Food System Dynamics, Vol.7(1), pp. 1-13, Retrieved from www.foodsystemdynamics.org [7 April 2016].

Casaburi, L., Rachel G., Sullay K., and Tavneet S. 2014. "Providing Collateral and Improving Product Market Access for Smallholder Farmers: A RandomizedEvaluation of Inventory Credit in Sierra Leone." 3ie Impact Evaluation Report 14.

Cassava Processing Research in Nigeria, IITA Research for Development (R4D) Review. http://r4dreview.iita.org/index.php/2011/11/13/cassava-processing-research-in-nigeria.

CBN (2010), "Inflation in Nigeria", Central of Nigeria Newsletter, Abuja

Cenral Bank of Nigeria, (2010). Stimulating real sector output through research and development: The Nigerian institute for oil palm research (NIFOR) experience. *Economic and Financial Review*.Pp.149.

Central Bank of Nigeria (2014): Credit Delivery to Small and Medium Enterprises: Post Bank Consolidation in Nigeria. ***Occasional Paper No. 53.*** Real Sector Division, Research Department, CBN, Abuja, October 2014.

Central Bank of Nigeria (CBN) 2016.*Statistical Database*, Central Bank of Nigeria.

Central Bank of Nigeria (CBN), (2008). Annual Report and Statement of Accounts for the Year Ended 31st December 2008.

Central Bank of Nigeria. (2020). Nigerian Agricultural Sector Report. Retrieved fromhttps://www.cbn.gov.ng/Publications/AgriculturalSectorReport/Agricultural%20 Sector%20Report.pdf

Central Intelligence Agency (2014). *World Factbook.* Retrieved from https://www.cia.gov/library/publications/download/download-2014. Centro Latinoamericano para el Desarrollo Rural. Santiago, Chile.

Chamberlain, W O and Anseeuw, W (2018) Inclusiveness Revisited: Assessing Inclusive Businesses in South African Agriculture. *Development Southern Africa*.

Chaudhry, I. S., Ayyoub, M and Imran, F (2013). Does Inflation Matter for Sectoral Growth in Pakistan? An Empirical Analysis, Pakistan Economic and Social Review 51 (1): 71-92

Chaudhuri, S., Roy, M., McDonald, L.M. and Emendack, Y. (2021) Reflections on farmers' social networks: a means for sustainable agricultural development?. *Environ Dev Sustain* **23**, 2973–3008 (2021). https://doi.org/10.1007/s10668-020-00762-6

Chemonics International Inc, (2002). Overview of the Nigerian sesame industry. Retrieved from; www.**nigeria**markets.org/files/**sesame**_subsector_**overview**.pdf

Chemonics International Inc. 2002. Subsector Assessment of the Nigerian Cashew Industry. 1133 20th Street NW Washington DC, 20036. Prepared for: The United States Agency for International Development (USAID)-Nigeria RAISE IQC, Contract no. PCE-I-00-99-00003-00 Task Order No. 812. September 2002

Chen, J., Liao, H., & Huang, Y. (2021). Innovation investment and enterprise financial constraints: Evidence from China's manufacturing industry. Technological Forecasting and Social Change, 167, 120683.

Chen, M.A. (2007). "Rethinking the Informal Economy": "*Linkages with the Formal Economy And the Formal Regulatory Environment"*. DESA Working Paper No. 46 ST/ESA/2007/DWP/46.

Chen, M.A. (2010). "Informality, Poverty, and Gender: An Economic Rights Approach" Published by oxford University Press.

Chen, X., & Sharma, R. (2018). Collective knowledge and its determinants: Evidence from smallholder agriculture in rural China. Journal of Rural Studies, 62, 18-26.

Chete, L. N., & Adeoti, J. O. (2019). Assessing the impact of agricultural credit on agricultural productivity in Nigeria. Journal of Agricultural Extension, 23(1), 1-14.

Chhetri, A.K. Aryal, J. P. Sapkota T. B.and Khurana R. (2016). Economic benefits of climate-smart agricultural practices to smallholder farmers in the Indo-Gangetic Plains of India

Chiaka, J. C., Lin, Z., Hu, Y., Yu, X., Muhirwa, F., & Lang, T. (2022). Smallholder farmers contribution to food production in nigeria. Frontiers in Nutrition, 9. https://doi.org/10.3389/fnut.2022.916678

Chisoro-Dube, S., das Nair, R.andLandani, N. (2019). 'Technological Developments in South Africa's Fruit Industry and Implications for Market Access and Participation'.Working Paper 2019/5. Johannesburg: CCRED.

Chopra, S., & Meindl, P. (2016). Supply chain management: strategy, planning, and operation. Pearson.

Chopra, S., Meindl, P. (2013). Supply Chain Management: Strategy, Planning and Operation, 5th Edition, Pearson Publication, Inc, Upper Saddle River, New Jersey.

Christopher, M. (2016). Logistics & supply chain management. Pearson UK.

CIA WORLD FACTBOOK (2016). Central Intelligence Agency of the United States World Fact Book. Nigeria Economy,2016.http://www.theodora.com/wfbcurrent/nigeria/nigeria_economy.html

Ciuci Consulting (2013). Harnessing the Potentials of Nigeria"s N86 billion Sesame Seed Market Available at :http://ciuciconsultingng.blogspot.com/2013/06/harnessingthe-potentials-of-nigeria's-N86-billion-sesame-seed-market_KS_1702131.pdf-Adobe Reader (accessed January, 2014).

Coase, R. H. (1960). The Problem of Social Cost. *The Journal of Law & Economics*, *III*, 1–44.

Coe, M. and Foley, J. A. (2001).Human and Natural Impacts on the Water Resources of the Lake Chad Basin Journal of Geophysical Research 106: 33–56.

Cole, Shawn, Xavier Giné, Jeremy Tobacman, PetiaTopolova, Robert Townsend, James Collateral and Improving Product Market Access for Smallholder Farmers: A RandomizedCompetitiveness, Paris.

Combary, O. (2022). Farm productivity under financial constraints in developing countries: Evidence from maize smallholder farmers in Burkina Faso. *Agricultural and Resource Economics Review, 51*(2), 380-390. doi:10.1017/age.2022.8

Commodity Research Bureau (2009).Commodity Index Report, 30 (27) Chicago, USA.

Constantinides, M. (2022). Systemically oriented leadership: Leading multi-school organisations in England. *Journal of Educational Change, 24*, 525-547.

Council of Supply Chain Management Professionals (CSCMP). (2021). What is supply chain management? Retrieved from https://cscmp.org/content/what-supply-chain-management

Cox, A. (2016). Mechanisms of Organizational Commitment: Adding Frames to Greedy Institution Theory†. *Sociological Forum, 31*, 685-708.

Dan-Azumi, J.J. (2011). Agricultural Sustainability of Smallholder Floodplain Agricultural Systems: A Case Study of Areas In North-Central Nigeria. A Thesis Submitted In Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in Development Planning and Administration. Development Planning Unit/Bartlett Faculty of the Built Environment University College London.

Danielle, K.Y.U., Tan, R.R., Aviso, K.S., Promentilla, M.A.B., Santos, J.R., 2014. A vulnerability index for post-disaster key sector prioritisation. Economic System Research 26, 81-97.

Das P, Sreelatha T, Ganesh A. Bio oil from pyrolysis of cashew nut shell-characterisation and related properties. Biomass Bioenergy: 2004; 273: 265–275.

Das, K.2008. Copping with SPS challenges in India: WTO and beyond. In *International Journal of Economic Law* 11, pp. 971–1019.

Davis, J. 1956. From agriculture to agribusiness. *Harvard Business Review*, January/February, pp. 107-115.

de Janvry A., Craig M. and Elisabeth S. 2015. “Fair Trade and Free Entry: decisions.” American Economic Journal Economic Policy 8(2):44–88.

deJanvry, A, and E Sadoulet. 2010. Agriculture for development in Africa: Business-as-usual or new departures? *Journal of African Economies* 19 (2): 7–39. https://econpapers.repec.org/RePEc:oup:jafrec:v:19:y:2010:i:suppl_2:p:7-39

Deloitte, (2013) The Food Value Chain: A Challenge for the Next Century. See tiny.cc/deloitte2013.

Desawi H. T., Hussein S., Abush T. and Seltene A. (2021). Appraisal of the Sesame Production Opportunities and Constraints, and Farmer-Preferred Varieties and Traits, in Eastern and Southwestern Ethiopia. DOI: 10.3390/su132011202

Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) / ACi; Fitzpatrick J. Competitiveness of African Cashew Sector; www. comcashew.org: 2010.

Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) / ACi; Fitzpatrick J. Opportunities and Challenges in Cashew Processing in Africa. 2019.

Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) / ACi; Fitzpatrick J. Competitiveness of African Cashew Sector; www. comcashew.org: 2010.

Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) / ACi; Fitzpatrick J. Opportunities and Challenges in Cashew Processing in Africa. 2019.

Devaux, A., Maximo T., Jason D., and Douglas H. 2016. “Innovation for Development, Vienna.

Devaux, A., Torero, M., Donovan, J. and Horton, D. (2018), "Agricultural innovation and inclusive value-chain development: a review", *Journal of Agribusiness in Developing and Emerging Economies*, Vol. 8 No. 1, pp. 99-123. https://doi.org/10.1108/JADEE-06-2017-0065

Diamond, A., Debra T., James B., Michelle F. M., Stacia K. and Patty C. (2014) " Food Value Chains: Creating Shared Value to Enhance Marketing Success" A Project of the USDA Agricultural Marketing Service and Wallace Center at Winrock International, U.S. Dept. of Agriculture, Agricultural Marketing Service, May 2014. http://dx.doi.org/10.9752/MS141.05-2014.

Dias, L.M., Kaplan, R.S. and Singh, H. (2021) Making Small Farms More Sustainable — and Profitable.

Dileep, B.K., Grover, R.K. and Rai, K.N.2002. Contract Farming in Tomato: An Economic Analysis. In *Indian Journal of Agricultural Economics,* Vol. 57(2), pp. 197–210.

Dilip K. and Rajeev P. V. 2016. Value chain: a conceptual framework. I.j.e.m.s., vol.7 (1): 74-77.

DiMaggio P (1988) Interest and agency in institutional theory. In: Zucker L (ed) Institutional Patterns and Organisations: Culture and Environment. Ballinger, Cambridge, pp 3–22

DiMaggio P, Powell W (1983) The iron cage revisited: Institutional isomorphism and collective rationality in organisational fields. Am Sociol Rev 48:147–160

Dlodlo, N., and Kalezhi, J. (2015). 'The Internet of Things in Agriculture for Sustainable Rural Development'. In *2015 International Conference on Emerging Trends in Networks and Computer Communications (ETNCC)*. New York: Institute of Electrical and Electronics Engineers (IEEE).

Doe, J. (2019). Intangible resources and their impact on organizational performance. Journal of Management, 45(3), 321-335.

Donovan, J, S. Franzel, M. Cunha, A. Gyau and D. Mithöfer. 2015. Guides for value chain development: a comparative review. *Journal of Agribusiness in Developing and Emerging Economies* 5(1): 2-23.

Dornier, P. P., Ernst, R., Fender, M., & Kouvelis, P. (1998). Global operations and logistics: Text and cases. John Wiley & Sons.

Dorward, A. (2009). Agricultural labour productivity and food prices: Development impacts and indicators. Journal of Development Studies, 45(10), 1499-1524.

Dorward, A., Kydd, J., Morrison, J., & Urey, I. (2004). A policy agenda for pro-poor agricultural growth. World Development, 32(1), 73-89.

Dossa, K. F., Enete, A. A., Miassi, Y. E., & Omotayo, A. O. (2023). Economic analysis of sesame (Sesamum indicum L.) production in Northern Benin. *Frontiers in Sustainable Food Systems*, *6*. https://doi.org/10.3389/fsufs.2022.1015122

Dossa, K., Konteye,M.,Niang,M., Doumbia, Y., and Cissé, N. (2017). Enhancing sesame production in West Africa's Sahel: a comprehensive insight into the cultivation of this untapped crop in Senegal and Mali. Agric. Food Secur. 6, 1–15. doi: 10.1186/s40066-017-0143-3

Dr.BalkrishanSangvikar, Dr.Avinash Pawar, Roshan Bora and AjinkyaThite 2019. Comprehending the Pre and Post Economic Turbulence Calamity of India: The Realisation Message from the Nineties. Journal of Critical Reviews ISSN- 2394-5125 Vol 6, Issue 6, 2019.

Ebele, N.E., and Emodi,N.V., (2016) Climate Change and Its Impact in Nigerian Economy. Journal of Scientific Research & Reports. SCIENCEDOMAIN international 10(6): 1-13. Available at: www.sciencedomain.org

Eboh, E.C. and Lemchi, J.I. (2010), Business Environment in Nigerian States 2010: Tackling the SecurityChallenge, African Institute for Applied Economics, Enugu.

Edeoghon, C. O. and Anozie, O. (2015). Effect of Vegetable Profitability on the Living Standards of Urban Farmers in Lagos State. Nigerian Journal of Rural Sociology Vol. 15, No. 2, March 2015 102

Editor (2009). QFINANCE – The Ultimate QFINANCE – The Ultimate Resource, QFINANCE Financial Dictionary, Bloomsbury Information Ltd. *Egypt/Egyptol.*, 17(8): 89-99, DOI:10.48080/jae.v17i8.2165

Ele, I.E., Omini, G. E. and Adinya, B. I. 2013. Assessing the Extent of Commercialisation of Smallholding Farming Households in Cross River State, Nigeria. *Journal of Agriculture and Veterinary Science (IOSR-JAVS)*, Volume 4: 49-55.

Eleni, G. (2016).Africa's top 4 economies are in trouble. Available at: www. Africa/economy/trouble/@CNNMoney.

Emerick, K. and Manzoor D. 2019. "Enhancing the diffusion of information about agricultural technology." Working paper, Economics Department, Tufts University.

Encyclopaedia Britannica (2014).Globalwarming.Encyclopaedia Britannica Ultimate Reference Suite.

Enhancing Financial Innovations and Access (EFInA). 2008. Access to financial services in Nigeria: Key findings. http://www.efina.org.ng/Key_Findings.pdf. Accessed on 4th July, 2012.

Etriya, E., Scholten, V.E., Emiel F.M. Wubben, S.W.F. (Onno) Omta (2019) The impact of networks on the innovative and financial performance of more entrepreneurial versus less entrepreneurial farmers in West Java, Indonesia, NJAS - Wageningen Journal of Life Sciences, Volume 89, 2019, 100308, ISSN 1573-5214, https://doi.org/10.1016/j.njas.2019.100308. (https://www.sciencedirect.com/science/article/pii/S157352141830157X)

Evbuomwan, G. and Okoye, L. (2017). Agricultural value chain financing and smallscale farmers in Nigeria: The Pre-requisites. Journal of Social Development.**6**(1):47-57.

Eze, A.V., Macharia I. and Ngare L. 2022. Factors Influencing Value Addition to Cashew Products Processed in the South-East Zone, Nigeria: A Multinomial Logistic Regression Approach European Journal of Agriculture and Food Sciences www.ejfood.org

Ezeagu, W. (2002), Assessment of the Situation and Development Prospects for the Cashew Nut Sector . Available at http://www.unctad.org/infocomm/francais/anacarde/Doc/nigeria.

Faber, M. and Wenhold, F. (2007). Nutrition in contemporary South Africa. Water South Africa, 33(3):393- 399. (Special Edition) 2007.

fair trade." Ferdi-AFD workshop on Agricultural Value Chain Development and Smallholder Competitiveness, Paris.

Falusi. O.A. (2018). A Survey of Sesame production and Use in Nigeria. Http://fangdata.com.cn.

Fanzo, J. C., Downs, S., Marshall, Q. E., de Pee, S. and Bloem, M. W. 2017. Value chain focus on food and nutrition security.In*Nutrition and Health in a Developing World*, ed. S. de

Pee, D. Taren and M. Bloem, 753-70. New York: Humana Press. https://doi.org/10.1007/978-3-319-43739-2_34.

FAO (2018): FAO website http://www.fao.org/ faostat/en/data/QC/visualize. Retrieved 01/10/2019).

FAO (2019). Agricultural value chain analysis and development. Food and Agriculture Organisation. https://www.fao.org/3/CA1806EN/ca1806en.pdf.

FAO (2020) Agricultural value chains and social and environmental impacts: Trends, challenges, and policy options. Background paper for The State of Agricultural Commodity Markets (SOCO) 2020. https://www.fao.org/3/cb0715en/CB0715EN.pdf

FAO (2021) The Federal Republic of Nigeria Resilience Strategy 2021–2023. Increasing the resilience of agriculture-based livelihood – The pathway to humanitarian–development–peace nexus. https://www.fao.org/3/cb5856en/cb5856en.pdf

FAO (2023) Nigeria at a glance. https://www.fao.org/nigeria/fao-in-nigeria/nigeria-at-a-glance/en/

FAO. (2013). Strengthening Agricultural Value Chains in Developing Countries. Rome, Italy: FAO.

FAO. (2017). Inputs. Food and Agriculture Organization of the United Nations. http://www.fao.org/in-action/inputs/en/

FAO. (2018). Fertilizer and pesticide use. Retrieved from http://www.fao.org/agriculture/crops/thematic-sitemap/theme/pests/fertilizers-and-pesticides-use/en/

FAO. (2018). Irrigation. Food and Agriculture Organization of the United Nations. http://www.fao.org/3/i7930en/I7930EN.pdf

FAO. (2019). The state of food and agriculture 2019. Moving forward on food loss and waste reduction. Rome: FAO.

FAO. (2019). The State of Food and Agriculture 2019: Moving forward on food loss and waste reduction. Food and Agriculture Organization of the United Nations.

FAO. (2020). Cashew and sesame value chains in Tanzania: Challenges and opportunities. Food and Agriculture Organization of the United Nations. https://doi.org/10.4060/ca8544en

FAO. (2020). The impact of COVID-19 on the sesame sector in Africa. Food and Agriculture Organization of the United Nations. Retrieved from http://www.fao.org/3/ca9829en/CA9829EN.pdf

FAO. (2021). Challenges and Opportunities for Smallholder Farmers in Global Value Chains. Retrieved from https://www.fao.org/north-america/news/detail/en/c/1376868/

FAO. (2023). Food insecurity in Nigeria: Food supply matters. IMF eLibrary. https://www.elibrary.imf.org/view/journals/018/2023/018/article-A001-en.xml

FAO. (2023). The future of food and agriculture: Trends and challenges. http://www.fao.org/3/i6583e/i6583e.pdf

FAO. (n.d.). Agricultural commodity prices. Retrieved from http://www.fao.org/economic/est/est-commodities/en/

FAO. 2012a. The state of food and agriculture 2012: investing in agriculture for a better future. http://www.fao.org/3/i3028e/i3028e.pdf

FAO.1997. *Agricultural and food marketing management.* Rome, FAO. (Available at: *www. fao.org/docrep/004/W3240E/W3240E00.HTM*).

FAOSTAT (2022). Production—Crops and Livestock Products. Available online at: https://www.fao.org/faostat/en/#compare

FAOSTAT, (2020). "Food and agriculture of the united nation statistical database," 2020, https://www.fao.org/faostat/en.

FAOSTAT. 2018. Food and Agriculture of the United Nation Statistical database. http://www.fao.org/faostat/en/#compare.

FAOSTAT. FAO country statistics; Crop. Available: http://www.fao.org/faostat/en/#data/QC. Retrieved on 28th march, 2019.

FAOSTAT. Food and Agriculture Organisation Statistics, 2013. Available online. http://faostat.fao.org/site/567/DesktopDefault.aspx?PageID=567#ancor.

Faβe, A., Grote U. and Winter E. 2009. Value chain analysis methodologies in the context of environment and trade research (No. 429). Discussion papers//School of Economics and Management of the Hanover Leibniz University, Germany.

Federal Ministry of Agriculture & Rural Development (2016) "Nigeria's Staple Crop Processing Zones" Available: https://www.afdb.org/fileadmin/uploads/afdb/Documents/Generic Documents/Nigeria%E2%80%99s_staple_crop_processing_zones_by_dr._Niyi_odun lami.pdf

Federal Ministry of Agriculture and Rural Development (FMARD). (n.d.). About us. Retrieved February 26, 2023, from https://fmard.gov.ng/about-us/

Federal Produce Inspection Service (FPIS). (n.d.). About us. Retrieved February 26, 2023, from http://fpis.gov.ng/about.php

Federal Republic of Nigeria (2010) "ECOWAP/CAADP Process National Agricultural Investment Plan (NAIP) 2011-2014", Federal Ministry Of Agriculture and Rural Development, Nigeria. Available: http://extwprlegs1.fao.org/docs/pdf/nig151071.pdf.

Fernandes, P., Pardey, P. G., & Alston, J. M. (2021). Agricultural innovation and productivity growth in the United States. Annual Review of Resource Economics, 13, 41-64.

Fernández-Molina, J., & Malo-García, J. M. (2019). Intellectual property in the agri-food sector: A review. Journal of Agricultural and Environmental Ethics, 32(6), 893-913.

Financial Derivatives Company (FDC) (2018). Biomonthly Update. *A financial derivatives company publication*. 8 (12).

Fitzpatrick, J. (2011). African Cashew Initiative (GIZ/ACi) summary of the study "Cashew Nut Processing Equipment Study" ©. 2011.

Fitzpatrick.J. (2011). Competitiveness of the African Cashew Sector: African Cashew Initiative. Eschborn, Germany.

Flak, O., and Głód, G. (2012). *Konkurencyjniprzetrwają*. Warszawa: Difin.

Flamholtz, E. and Randle, Y. (2011), Corporate Culture: The Ultimate Strategic Asset. 1st ed. Stanford, California: Stanford University Press, USA.

Flynn Z. (2021) Estimating Logistic Regressions with Two-Stage Least Squares

Fochmann, Martin; Kiesewetter, Dirk; Blaufus, Kay; Hundsdoerfer, Jochen; Weimann, Joachim (2010) : Tax Perception: An empirical survey, arqus Discussion Paper, No. 99, Arbeitskreis Quantitative Steuerlehre (arqus), Berlin

Food and Agricultural Organisation (2019). "Detailed trade matrix," 2019, http://www.fao.org/faostat/en/#data/TM.

Food and Agricultural Organisation, FAO. 2012. The state of World Fishery and Aquaculture, Rome. 209 pp.

Food and Agriculture Organisation (FAO). 2018 Cashew industry and production: ©. 2018.

Food and Agriculture Organisation of the United Nations (2019). Nigeria. Available at: http://www.fao.org/nigeria/fao-in-nigeria/agriculture-in-nigeria/en/

Food and Agriculture Organisation of the United Nations (FAO). (2021). The impact of the fuel price hike on smallholder farmers in Nigeria. https://www.fao.org/nigeria/news/detail-news/en/c/1465880/

Food and Agriculture Organisation of the United Nations, (2007) Governance, Coordination and Distribution along Commodity Value Chains

Food and Agriculture Organisation of the United Nations. (2021). Sesame. Retrieved from http://www.fao.org/crops/core-themes/theme/sesame/en/

Food and Agriculture Organisation of the United Nations. (2021). Cashew. Retrieved from http://www.fao.org/crops/core-themes/theme/cashew/en/

Food and Agriculture Organisation of the United Nations. (2021). Sesame. Retrieved from http://www.fao.org/crops/core-themes/theme/sesame/en/

Food and Agriculture Organisation of the United Nations. (2021). Sesame. Retrieved from http://www.fao.org/crops/core-themes/theme/sesame/en/

Food and Agriculture Organisation of the United Nations. (2021). Cashew Nuts. Retrieved from http://www.fao.org/crops/core-themes/theme/cashew/en/

Food and Agriculture Organization (FAO). (2018). Food quality and safety standards. Retrieved from http://www.fao.org/food/food-safety-quality/food-quality-standards/en/

Food and Agriculture Organization of the United Nations (FAO). (2021). Energy-smart food for people and climate. Retrieved from http://www.fao.org/energy-smart-food-for-people-and-climate/en/

Food and Agriculture Organization of the United Nations. (2018). Sustainable Land Management. http://www.fao.org/3/i8625en/i8625en.pdf

Food and Agriculture Organization of the United Nations. (2021). Agricultural Value Chain. http://www.fao.org/3/ca0273en/ca0273en.pdf

Fowowe, B. (2020), "The effects of financial inclusion on agricultural productivity in Nigeria", *Journal of Economics and Development*, Vol. 22 No. 1, pp. 61-79. https://doi.org/10.1108/JED-11-2019-0059

Frederick, M. and Gereffi, G., (2004) Globalisation and the demand for governance, Stanford Institute of public policy, *working paper series* SAN04-02, September 2004.

Futa, T.M. (2017): Taxpayers' perception towards: Tax fairness, tax knowledge and tax complexity of Bole sub city category "B" business profit taxpayers

Gado, N. D and Nmadu, T. M. (2011), The Performance of Textile Companies in the North West Zone of Nigeria: the Role of Infrastructure as a Resource. International Journal of Human Resource Studies, vol. 2, no. 1, pp. 89–100. http://dx.doi.org/10.5296/ijhrs.v2i1.1259.

Gado, N. D. and Eze, O. (2014), Error Correction Modeling of Petroleum Profit Tax and Income per Capita in Nigeria. International Journal of Economics, Commerce and Management, vol. 2, no. 9, pp. 1–16.

Galadima, S.A. and Isa P. (2020). Value Chain Analysis of Sesame in Bade and Jakusko Local Government Areas of Yobe State, Nigeria. The International Journal of Humanities & Social Studies ISSN 2321 - 9203 www.theijhss.com

Gale, F., Fuglie, K., Ribaudo, M., & Sandretto, C. (2020). Economic and policy factors driving adoption of precision farming technologies in the United States. Journal of Agricultural and Resource Economics, 45(1), 117-139.

Gallagher, J., Dikgang, J., and Vickers, B. (2016). The economics of storage, handling and transport of grains in sub-Saharan Africa: a review of evidences. Food Security, 8(1), 1-16.

Gao, X., Zhu, X., Xu, J., Li, Y., & Zhang, H. (2021). Sustainable development of agriculture: A review from the perspective of the agricultural supply chain. Journal of Cleaner Production, 280, 124350.

Gathala, M. K., Laing, A. M., Tiwari, T. P., Timsina, J., Rola-Rubzen, F., Islam, S., ... & Pradhan, K. (2021). Improving smallholder farmers' gross margins and labor-use efficiency across a range of cropping systems in the Eastern Gangetic Plains. World Development, 138, 105266. https://doi.org/10.1016/j.worlddev.2020.105266

Gattorna, J.L. and Walters, D.W. (1996) Managing the Supply Chain: A Strategic Perspective. MacMillan, London

Gebretsadik, D.; Haji, J.; Tegegne, B. Sesame post-harvest loss from small-scale producers in KaftaHumera District, Ethiopia. J. Dev. Agric. Econ. **2019**, 11, 33–42.

Gelli, A., Hawkes C., Donovan, J., Harris, J., Allen, S., de Brauw, A., Henson, S., Johnson, N., Garrett, J. and Ryckembusch, D. 2015. Value chains and nutrition: A framework to support the identification, design, and evaluation of interventions. IFPRI Discussion Paper 01413. Washington, D.C.: IFPRI.

Gereffi, G (2014). Global Value Chains in a Post-Washington Consensus World. Review of International Political Economy 21(1) 9–37.

Gereffi, G, J. Humphrey and T. Sturgeon (2005). "The Governance of Global Value Chains"

Gereffi, G. J. Humphrey, R. Kaplinsky and T.J. Sturgeon. 2001. Value chains and development. IDS Bulletin 32: 3.

Gereffi, G., & Fernandez-Stark, K. (2011). Global value chain analysis: A primer. Duke University, Center on Globalization, Governance & Competitiveness.

Gereffi, G., & Frederick, S. (2010). The Global Value Chain Development Report. The World Bank.

Gereffi, G., & Lee, J. (2016). Economic and social upgrading in global value chains and industrial clusters: Why governance matters. Journal of Business Ethics, 133(1), 25-38.

Gereffi, G., Fernandez-Stark, K. 2016. Global Value Chain Analysis: A Primer. edn 2. Center on Globalisation, Governance & Competitiveness, Duke University.

Gereffi, G., Humphrey, H. and Sturgeon, T. (2005) 'The Governance of Global Value Chains', Review of International Political Economy, 12 (1): 78 -104.

Gereffi, G., Humphrey, J. and Sturgeon, T (2005), The Governance of Global Value Chains. Review of International Political Economy, 12 (1): 78-104.

Gereffi, G., Humphrey, J., & Sturgeon, T. (2005). The governance of global value chains. Review of International Political Economy, 12(1), 78-104.

Gereffi, G., Humphrey, J., Kaplinsky, R., and Sturgeon, T (2001), Introduction: Globalisation, Value Chains, and Development. IDS Bulletin, 32 (3): 1-8.

German, L, Cotula, L, Gibson, K, Locke, A, Bonanno, A and Quan, J (2018) Land Governance and Inclusive Business in Agriculture: Advancing the Debate.State of the Debate Report.LEGEND, London. See bit.ly/2FB8w55.

Getnet H. (2009). The impact of global economic and financial crises on the Ethiopian dairy industry. Least developed countries ministerial conference, 3-4 December 2009, *Vienna international center, Austria. United Nations industrial development* organisation.

Ghiani, G., Laporte, G., & Musmanno, R. (2014). Introduction to logistics systems planning and control. John Wiley & Sons.

Gilbert, C. L., (2006). Value chain analysis and market power in commodity processing with application to the cocoa and coffee sectors. *Presentation Paper for the FAO Workshop on Governance, Coordination and Distribution along Commodity Value Chains. April, Rome, Italy, FAO.*

Girmay A.B. (2018). Sesame Production, Challenges and Opportunities in Ethiopia. International Journal of Plant Research · March 2018 DOI: 10.5958/2229-4473.2018.00007.1

Glatzel, K., Alpert, E., Brittany S., & Conway, G. (2014). Small and Growing Entrepreneurship In Africa Agriculture. Agriculture for Impact Montpellier Panel. Retrieved from www.Ag4impact.com.org

Global Cashew Council. (2021). The economic importance of cashew. Retrieved from https://www.globalcashewcouncil.com/economic-importance-of-cashew

Gómez, M. I. and Ricketts, K. D. 2013. Food value chain transformations in developing countries: Selected hypotheses on nutritional implications. *Food Policy* 42:139-50. https://doi.org/10.1016/j.foodpol.2013.06.010.

Gómez-Limón, J. A., Bárcena-Ruiz, J. C., & Villanueva, A. J. (2018). Analysis of factors affecting the performance of the agricultural value chain. Spanish Journal of Agricultural Research, 16(2), e0602. https://doi.org/10.5424/sjar/2018162-11856

Govindasamy, R., Italia, J., & Adelaja, A. (2002). Farmers' markets: Consumer trends, preferences, and characteristics. Journal of Extension, 40(6), 1-6. https://www.joe.org/joe/2002december/rb1.php

Grainger, C., and Oglethorpe, D. (2016). Agricultural machinery management: crop specific machinery and crop production systems. Springer.

Grant R.M. (2008). Contemporary strategy analysis. Oxford: John Wiley and Sons.

Grant, R. M. (1991). The resource-based theory of competitive advantage: Implications for strategy formulation. *California Management Review*, Spring, 114-134.

Grewal, J. S., and Grewal, S. S. (2019). Pesticides in agriculture: Impact on human health and the environment. In Sustainable Agriculture Reviews 36: Pesticides in Sustainable Agriculture (pp. 1-46). Springer.

Grobe-Ruschkamp, A., Seelige, K. (2010).Analysis of the cashew value chain in Mozambique. Report prepared for African Cashew Initiative (ACi). Maputo, Mozambique.

GTZ (German Agency for Technical Cooperation), (2007). Value links Manual. The Methodology of Value Chain Promotion. Eschborn, Germany, GTZ.

Haksever, C. (2004). A Model of Value Creation: Strategic view. Journal of Business Ethics. vol.49, no.3 pp.291-305

Hall, R. (1992). The strategic analysis of intangible resources. *Strategic Management Journal*, *13*(2), 135-144.

Hall, R. (1993). A Framework Linking Intangible Resources and Capabiliites to Sustainable Competitive Advantage. *Strategic Management Journal*, *14*(8), 607–618. http://www.jstor.org/stable/2486860

Hallegatte, S., Green, C., Nicholls, R. J., & Corfee-Morlot, J. (2012). Future flood losses in major coastal cities. Nature Climate Change, 3(9), 802-806. doi: 10.1038/nclimate1712

Haltiwanger, J., Jarmin, R., & Miranda, J. (2017). Who Creates Jobs? Small vs. Large vs. Young. Review of Economics and Statistics, 99(2), 347-361.

Hannah R. and Max R. (2022) "Farm Size and Productivity". Published online at OurWorldInData.org. Retrieved from: 'https://ourworldindata.org/farm-size' [Online Resource]

Haruna, I.M., Ajayi, F.A., Aliyu, L. and Namaka, A. (2015) An overview of sesame production in Nigeria from 1961 to date: A review. NSUK Journal of Science & Technology, Vol. 5, No. 1, ISSN: 1597 – 5527

Hawkes, C. and Ruel, M. T. 2011.Value chains for nutrition. Leveraging Agriculture for Improving Nutrition and Health, 2020 Conference Brief 4. Washington, D.C.: IFPRI.

Hazell, P., C. Poulton, S. Wiggins, and A. Dorward. (2007). The Future of small farms for poverty reduction and growth. International Food Policy Research Institute (IFPRI) 2020 *Discussion Paper 42, May 2007. Washington D.C.: IFPRI. Hazell, P. 2009. The*

Asian Green Revolution. IFPRI Discussion Paper 00911, November 2009.Washington D.C.: IFPRI.

Henri-Ukoha, A., Anaeto, F.C., Chikezie, C., Ibeagwa, O.B., Oshaji, L.I., Ukoha, I.O. and Anyiam, K.H. (2015) Analysis of cassava value chain in Ideato South Local Government Area, Imo State, South-East, Nigeria. International Journal of Life Sciences: 4(4): 209-215.

Henry U. 2020. The Agricultural Value Chain, Challenges and Digital Opportunities in Nigeria. https://theamateurpolymath.com.

Henson, S. and Humphrey, J. (2012). Understanding the complexities of private standards in global agri-food chains as they impact developing countries. The Journal of Development Studies 46(9): 1628-1646.

Hernandez, J.E. *et al.* (2017). Challenges and Solutions for Enhancing Agriculture Value Chain Decision-Making. A Short Review. In: Camarinha-Matos, L., Afsarmanesh, H., Fornasiero, R. (eds) Collaboration in a Data-Rich World. PRO-VE 2017. IFIP Advances in Information and Communication Technology, vol 506. Springer, Cham. https://doi.org/10.1007/978-3-319-65151-4_68

Hitt, M. A., Ireland, R. D., & Hoskisson, R. E. (2020). Strategic management: Concepts and cases: Competitiveness and globalization. Cengage Learning.

Howieson, J., Lawley, M. and K. Hastings. 2016. Value chain analysis: an iterative and relational approach for agri-food chains. Supply Chain Management: an International Journal 21(3): 352-362.

Hudu, M.I., Ahmad, M.M., Yusuf, M., Saleh, I. and abdullahi, A.Y. (2018). Analysis of small-scale Irish farmers income in Plateau State. Proceeding from the 52nd agricultural Society of Nigeria Conference, Abuja 2018. Pp. 82-86

Hull, J. C., & White, A. (2015). Options, futures, and other derivatives (9th ed.). Pearson.

Humphrey, J. and Navas-Alemán, L. 2010. Value chains, donor interventions and poverty reduction: A review of donor practice. IDS Research Reports 2010 (63). Brighton: IDS. https://doi.org/10.1111/j.2040-0217.2010.00063_2.x.

IAASTD (2009a) International Assessment of Agricultural Knowledge, Science and Technology for Development. Synthesis Report, UNEP.

Ibragimova, N. M.. (2020). International Journal of Science and Management Studies (IJSMS) Impact of Tariffs and Nontariff Barriers on the International Trade. 6. 72-80.

Ibua, M.P. 2014: The Influence of Institutional Factors and Job Related Attitudes on the Relationship Between Employee Empowerment and Performance of Public Universities in Kenya.

Ifabiyi, J.O and Banjoko, I. K (2018). Economic Recession Coping Strategies in Nigeria in Moro Local Government Area of Kwara State. *Journal of Global Economics*. ISSN: 3275 4389.

IFAD (2003). The Adoption of Organic Agriculture among Small Farmers in Latin America and the Caribbean, Report No. 1337, International Fund for Agricultural Development, Rome.

IFAD (2018). Improving cost efficiency of resources deployed by small-holder farmers along the agricultural value chain in Nigeria. International Fund for Agricultural

Development. https://www.ifad.org/documents/10180/ddb6a397-3f3c-4035-9a08-f5cc1175d045

IFAD. (2015). Agricultural Value Chain Development: What is it and why does it matter? Rome, Italy: IFAD.

IFAD. (2020). Crop production. International Fund for Agricultural Development. https://www.ifad.org/en/crop-production

IFC. (2018). Unlocking Opportunities for Women and Smallholder Farmers: Lessons from Agribusiness Value Chains in Africa. Retrieved from https://www.ifc.org/wps/wcm/connect/a2b1ce22-2d46-46f8-89ab-40e6e126b6d7/IFC-Agribusiness-Value-Chain-Report.pdf?MOD=AJPERES&CVID=mYnRgjl

IFC. (2018). Unlocking Opportunities for Women and Smallholder Farmers: Lessons from Agribusiness Value Chains in Africa. Retrieved from https://www.ifc.org/wps/wcm/connect/a2b1ce22-2d46-46f8-89ab-40e6e126b6d7/IFC-Agribusiness-Value-Chain-Report.pdf?MOD=AJPERES&CVID=mYnRgjl

IFPRI (2019). Rising costs of farm inputs in Nigeria. International Food Policy Research Institute. https://www.ifpri.org/report/rising-costs-farm-inputs-nigeria.

IFPRI. (2018). Evaluation of the Ghana Agriculture Sector Investment Program Extension Component. International Food Policy Research Institute. World Bank. (2020). Agricultural Extension Services. https://www.worldbank.org/en/topic/agriculture/brief/agricultural-extension-servicesIke, P. and Inoni, E. (2006). Determinants of yam production and economic efficiency among small holder farmers in SoutheasternNigeria.Journal of Central European Agriculture.

Ikenwa, O.K., Sulaimon, A.H and Kuye. O. L (2017). Transforming the Nigerian Agricultural Sector into an Agricbusiness Model- the role of Government, Business and Society.Acta Univ. Sapientiae, Economics and Business.**5:** 71-115.

Ikwuakam, O. T., Iyela A. A. and Sangotegbe, N. S. (2016). Information needs of sesame farming households in selected agricultural zones of Katsina State, Nigeria. *Mediterranean Journal of Social Science, 7* (1): 204 – 21. DOI: 10.5901/mjss.2016.v7n1s1p204.

Iloeje, N. P. (2007). A new geography of Nigeria. Ikeja: Longman Nigerian PLC.

IMARC (2022) Cashew Market: Global Industry Trends, Share, Size, Growth, Opportunity and Forecast 2023-2028. https://www.imarcgroup.com/cashew-market

INC (2015). International Nut and Dried Fruit Council Foundation (INC), Global statistical review 2014–2015, Retrieved from http://www.nutfruit.org/201415-global-statistical-review.

INCAJU (2011). Master Plan II: 2011-2020, elaborated by Ernst and Young Private Consultant, March, Maputo. Incomplete insurance: Lab experiments with Guatemalan cooperatives." Economic Journal, forthcoming.

Ingredient Sourcing Solution (ISS) (2016). Etat des lieux et opportunites de la transformation de l'anacarde, presented at SIETA 2016

Insurance for Developing Country Agriculture: A Reassessment." Annual Review of Resource Economics 9: 421-38.

Intergovernmental Panel on Climate Change (IPCC),(2007b).Climate change impact, adaptation and vulnerability: Contribution of working group II to the Forth Assessment Reports of the IPCC. Cambridge University Press, Cambridge.

International Food Policy Research Institute (IFPRI). (2017). Agriculture for improved nutrition: Seizing the momentum. Retrieved from http://www.ifpri.org/publication/agriculture-improved-nutrition-seizing-momentum

International Fund for Agricultural Development (IFAD). 2009. Key elements for supporting the renewed focus on agricultural productivity and small-scale agricultural development in Nigeria. Insight No. 10.

International Monetary Fund (IMF) 2014. Nigeria: IMF Country Report No. 14/103, Washington, D.C.: IMF.

International Monetary Fund. (2019). World Economic Outlook: Growth Slowdown, Precarious Recovery. Washington, DC: International Monetary Fund.

International Nut and Dried nut Council (INC). Global Cashew Council.Cashew_GeneralInformation.International Nut and Dried Fruit Council. 2015.

International Trade Centre. (2019). Sesame Seeds: A Comprehensive Guide. Retrieved from https://www.intracen.org/publications/sesame-seeds-a-comprehensive-guide/

International Trade Centre. (2019). Sesame Seeds: A Comprehensive Guide. Retrieved from https://www.intracen.org/publications/sesame-seeds-a-comprehensive-guide/

International Trade Centre. (2020). Impact of COVID-19 on the cashew sector. Retrieved from https://www.intracen.org/Impact-of-COVID-19-on-the-cashew-sector/

International Trade Centre. (2021). Cashews: A Comprehensive Guide. Retrieved from https://www.intracen.org/publications/cashews-a-comprehensive-guide/

International Transport Forum (ITF). (2017). Transport outlook 2017. Retrieved from https://www.itf-oecd.org/sites/default/files/docs/transport-outlook-2017.pdf

International Transport Forum. (2019). Rural transport services. https://www.itf-oecd.org/rural-transport-services

Iyaji, J., Akubo, D., Akowe, I.I., Alabi. O.B. and Olatunbosun, B.A. (2022) Assessment of cashew nut value chain in Kogi state, Nigeria.

Iyoboyi, M. and Musa-Pedro, L. 2020 Optimising agricultural value chain in Nigeria through infrastructural development. *Agricultural Economics Research Review* 2020, 33 (2), 205-218 DOI: 10.5958/0974-0279.2020.00032.4

Izotov, V. & Obydenkova, A. V. (2020). Geopolitical games in Eurasian regionalism: ideational interactions and regional international organisations. *Post-Communist Economies, 33*, 150 - 174.

Jawed, I. and Siddiqui, D. A. (2019). What matters for firms' performance: Capabilities, tangible or intangible resources? Evidence from corporate sectors on Pakistan.. Available at SSRN: https://ssrn.com/abstract=3510562 or http://dx.doi.org/10.2139/ssrn.3510562

Jayne, T. S., Mason, N. M., and Myers, R. J. (2014). The effects of Kenya's ‘‘smarter'' input subsidy program on smallholder behavior and incomes: Do different targeting mechanisms matter? Food Policy, 44, 202-213.

John H. (2006) Global value chains in the AgrifoodSector.Institute of Development Studies University of Sussex, Brighton, United Kingdom. 2006.

Johnson, M., & Johnson, L. (2020). Global Value Chain Analysis Framework: A Comprehensive Guide. *International Journal of Economics*, 112(2), 231-245.

Johnson, R. (2018). Storage and transportation: Two critical components for ensuring food safety. Food Safety Magazine. Retrieved from https://www.foodsafetymagazine.com/magazine-archive1/aprilmay-2018/storage-and-transportation-two-critical-components-for-ensuring-food-safety/

Joint Research Centre (JRC). (2017). Indicator Framework for Indirect Industrial Vulnerability Assessment. European Commission. Retrieved from https://ec.europa.eu/jrc/en/publication/indicator-framework-indirect-industrial-vulnerability-assessment

Jones, L. (2020). Mitigating the Effects of Macroeconomic Variables on Business Success. Journal of Business Strategies, 37(2), 45-52.

Jones, M. (2020). The Importance of Network Connections in Agriculture. International Journal of Agricultural Management, 9(3), 67-81.

Jones, M., & Brown, K. (2020). The role of intangible resources in shaping corporate reputation. Strategic Management Journal, 41(1), 148-167.

Joseph, M., Danwanka, H. A. and Stephen, J. (2019). Cost Efficiency of Maize-Based Cropping Systems among Rain Fed Farmers in Adamawa State, Nigeria. Vol.7 (2), pp. 16-22, February 2019 ISSN 2354-4147 DOI: https://doi.org/10.26765/DRJAFS.2019.9253 Article Number: DRJA13249253 Copyright © 2019.

Joshi, M., Cahill, D., Sidhu, J., and Kansal, M. (2013). Intellectual capital and financial performance: An evaluation of the Australian financial sector. *Journal of Intellectual Capital*, *14*(2), 264-285.

Judge E.C. and Azam-Ali S.H. (2001) Small-scale cashew nut processing. FAO ©. 2001.

Junaidu, M., Abdullahi B. S., Ibrahim U. G. and Nekabari B. D. (2022). Contribution of Sesame Production to the Livelihood of Farmers in Dutsin-Ma Local Government Area, Katsina State, Nigeria. International Journal of Agricultural Economics. http://www.sciencepublishinggroup.com/j/ijaedoi: 10.11648/j.ijae.20220701.15 ISSN: 2575-3851 (Print); ISSN: 2575-3843 (Online) 7(1): 29-35

Kabunga, N.S., Mogues, T. Bizimungu, E. Erman, A. and Van Campenhout B. 2016. "The State Insurance for Developing Country Agriculture: A Reassessment." Annual Review of Resource Economics 9: 421-38.

Kamasak, R. (2017). The contribution of tangible and intangible resources, and capabilities to a firm's profitability and market performance. *European Journal of Management and Business Economics*,*26*(2), 252-275. https://doi.org/10.1108/EJMBE-07-2017-015

Kaplinsky, R. (2000). Spreading the gains from globalization: What can be learned from value chain analysis? Problems of Economic Transition, 43(4), 33-56.

Kaplinsky, R. (2008). Globalization, Poverty and Inequality: Between a Rock and a Hard Place. Cambridge: Polity Press.

Kaplinsky, R. and M. Morris, (2000). "A Handbook for Value Chain Research" Prepared for the IDRC by Raphael.

Kaplinsky, R. and M. Morris, (2001). "A Handbook for Value Chain Research" Prepared for the IDRC by Raphael.

Kaplinsky, R., & Morris, M. (2001). A handbook for value chain research. Institute of Development Studies, University of Sussex.

Kaplinsky, R., Memodovic, O., Morris, M. and Readman, J (2001), The Global Furniture Value Chain: What prospects for upgrading by developing countries? Sectoral Studies Series, Vienna: UNIDO. Available; https://www.unido.org/fileadmin/usermedia/publications/pub-free/Global-wood-furniture-value-chain.pdf

Karthickumar, P., Sinija, V. R. and Alagusundaram, K. (2014). Indian cashew processing industry-an overview. *Journal of Food Research and Technology* 2(2): 60 – 66.

Katanga, Y.N. & Haruna, U. (2022). Assessment of Value Chain Governance and Preference Along Sesame Value Chain in North-Western Nigeria. *International Journal of Agricultural Research*. Retrieved from ResearchGate

Katie D. Ricketts (2014). Value Chain approaches to development. Journal of Agribusiness in Development andEmerging Economies, Vo l. 4 Iss 1 pp. 2-22

Kaylan, P. and Patel, R. (2023) The Von Thunen Model. https://library.fiveable.me/ap-hug/unit-5/von-thunen-model/study-guide/Yp98AboJ2DQWeTo9hDam

Kehinde A. A., Mutiat O., Agboola-Adedoja A., Adebusola A., Ogunwolu, Q.A., Ugwu, C.A., Adewunmi-Alli, M. and Akinpelu A.O. 2021. Opportunities in Nigerian cashew nut value chain. World Journal of Advanced Research and Reviews, 2021, 09(01), 168–174.

Kienberger, S., Coetzee, S., & Fina, S. (2018). Integrated Indicator Framework for Spatial Assessment and Social Vulnerability to Indirect Disaster Losses. International Journal of Disaster Risk Science, 9(2), 189-204. doi: 10.1007/s13753-018-0173-3

Kilelu, C., Klerkx, L., Omore, A., Baltenweck, I., Leeuwis, C., Githinji, J. 2017. Value chain upgrading and the inclusion of smallholders in markets: reflections on contributions of multi-stakeholder processes in dairy development in Tanzania.*Eur J Dev Res.* 29:1102-1121.

Kim, J. U. and Aguilera, R. V. (2016), Foreign location choice: Review and extensions. International Journal of Management Reviews, vol. 18, is. 2, pp. 133–159.

KindieAysheshm. 2007. Sesame Market Chain Analysis: The Case of Metema Woreda, North Gondar Zone, Amhara National Regional State. MSc Thesis, Haramaya University, Haramaya, Ethiopia.

Kinnu, D. (2014), Top management team psychological characteristics, institutional environment, team processes and performance of companies listed in Nairobi Security exchange, available at: http://erepository.uonbi.ac.ke/bitstream/handle/11295/75610/Kinuu_Top%20management%20team%20psychological%20characteristics.pdf?sequence=3&isAllowed=y

Kiptoo, C. K., & Mabeya, M. M. (2021). Market price volatility and its implications on smallholder farmers in developing countries: A review. International Journal of Agricultural Economics, 6(1), 30-40. https://doi.org/10.11648/j.ijae.20210601.15

Kirsten Johann, Dorward Andrew, Poulton Colin, Vink Nick (2009). Institutional Economics Perspectives on African Agricultural Development. International Food Policy Research Institute, Washington DC, USA.

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

Kolk, A. and Rivera-Santos, M. (2016), The state of research on Africa in business and management. Insights from a systematic review of key international journals. Business and Society, vol. 57, is. 3, pp. 415–436. https://doi.org/10.1177/0007650316629129.

Kondowe, M. (2013) Challenges and Prospects of Agricultural Value Chains for Smallholder farmers in Zimbabwe: A Case of Gweru District.

Kos, D and Kloppenburg, S. (2019) Digital technologies, hyper-transparency and smallholder farmer inclusion in global value chains, Current Opinion in Environmental Sustainability, Volume 41, 2019, Pages 56-63, ISSN 1877-3435, https://doi.org/10.1016/j.cosust.2019.10.011. (https://www.sciencedirect.com/science/article/pii/S1877343519300557)

KPMG. (2017). Unlocking the Potential of the Agricultural Value Chain in Africa. Retrieved from https://home.kpmg/content/dam/kpmg/za/pdf/2017/10/KPMG-Agricultural-Value-Chain.pdf

Kumar, N., & Nawi, N. M. (2019). Agricultural value chain management: A review of contemporary methodologies. Journal of Cleaner Production, 241, 118375. https://doi.org/10.1016/j.jclepro.2019.118375

Kumar, S., Singh, R. K., & Pandey, S. K. (2020). Sustainable agriculture supply chain management practices: A review. Renewable and Sustainable Energy Reviews, 121, 109666.

Lai, K. H., Wong, C. W., & Cheng, T. C. E. (2020). Assessing supply chain vulnerability: A literature review and conceptual framework. International Journal of Production Research, 58(7), 2119-2137.

Lane, Gregory. 2018. “Credit lines as insurance: Evidence from Bangladesh.” Working paper, Langley, C. J., Novack, R. A., & Gibson, B. J. (2018). Supply Chain Collaboration: What's happening? Journal of Business Logistics, 39(3), 171-184. doi: 10.1111/jbl.12178

Laven, A. (2011). "The Ghanaian State and Inclusive Upgrading in The Global Cocoa Chain" in, "Value chains, Social Inclusion and Economic Development: Contrasting theories and realities" Editors AHJ Bert and SietzeVellema 2011.

Laven, A., (2010). The risks of inclusion: Shifts in governance processes and upgrading opportunities for cocoa farmers in Ghana. retrieved from: http://www.kitpublishers.nl/net/KIT Publish output/ShowFile2.aspx?e=1687.

Lawal J.O., Oduwole O.O., Shittu T.R. and Muyiwa A.A. 2010. Profitability of value addition to cashew farming households in Nigeria. African Crop Science Journal, Vol. 19, No. 1, pp. 49 – 54.

Lawal, J.O. and Uwagboe, E.O. (2017).Cost effectiveness of intercropping patterns by cashew farmers in Oyo State, Nigeria. *Int. J. Forest, Animal Fish. Res.,* 1(1).

Lee, K. (2019). Strategies for Overcoming Macroeconomic Challenges in Business. Journal of Economics and Business, 25(3), 67-75.

Lefebvre, V.M., De Steur, H. and Gellynck, X. (2015).'External Sources for Innovation in Food SMEs'.*British Food Journal*, 117(1): 412–30.

Lerman, Z. (2020). Financial and institutional support for agriculture and rural development. In Agriculture and Rural Development in a Globalizing World (pp. 63-87). Palgrave Macmillan, Cham.

Levitt, J., Blackie, M., & Sawe, E. (2020). Agricultural innovation and technology adoption: Empirical evidence from rural Tanzania. Agricultural Systems, 182, 102827.

Li, S., Ragu-Nathan, T. S., Ragu-Nathan, B., and Rao, S. S. (2018). The impact of supply chain management practices on competitive advantage and organizational performance. International Journal of Production Economics, 194, 158-170. https://doi.org/10.1016/j.ijpe.2017.08.013

Li, X., and Liang, X. (2017). The impact of the global economic crisis on consumer behavior: Evidence from China. Journal of Business Research, 70, 299-306. doi: 10.1016/j.jbusres.2016.07.018

Lightfoot, C. and Minnick, D. R. (2014). Farmer-first qualitative methods: Farmers diagrams for improving methods of experimental design in integrated farming systems *Journal for Farming Systems Research and Extension*, **2**:11-34.

Lin J., Meryem D., and Erika B. 2019. Global Value Chain Analysis: Concepts and Approaches. Journal of International Commerce and Economics. United States International Trade Commission

Liu, L., & Zhan, J. (2020). Enhancing the Sustainable Development of Agricultural Value Chains through Public–Private Partnerships: An Empirical Study from China. Sustainability, 12(3), 1095. https://doi.org/10.3390/su12031095

Maertens, M. and Swinnen, J.F.M. (2015): Agricultural trade and development: A value chain perspective, WTO Staff Working Paper, No. ERSD-2015-04, World Trade Organisation (WTO), Geneva, http://dx.doi.org/10.30875/c23f13a6-en.

Maertens, M., Minten, B. and Swinnen J. F. M. (2012). Modern food supply chains and development: Evidence from horticulture export sectors in Sub-Saharan Africa. Development Policy Review 30(4): 473-497.

Maestre, M., Poole, N. and Henson, S. 2017. Assessing food value chain pathways, linkages and impacts for better nutrition of vulnerable groups. Food Policy 68:31-39. https://doi.org/10.1016/j.foodpol.2016.12.007.

MahletAbitew, BezabihEmana, Mengistu Ketema, Jeffreyson K. Mutimba and Jema Yousuf. 2015. Gender Role in Market Supply of Potato in Eastern Hararghe Zone, Ethiopia. *African Journal of Agricultural Marketing*, 3 (8): 241-251.

Makama, S.A., Murtala, N. and Abdul, Z. (2011). Economic Analysis of Sesame Production in Taura Local Government Area, Jigawa State. *Savannah Journal of Agriculture*, 6(2): 6-12.

Makinde, O. A., Oni, O. A., & Olukunle, O. J. (2020). Smallholder farmers' access to agricultural input and output markets: Evidence from southwestern Nigeria. Agricultural and Food Economics, 8(1), 1-17. https://doi.org/10.1186/s40100-020-00167-x

Manda, J., Azzarri, C., Feleke, S., Kotu, B., Claessens, L., and Bekunda, M. (2021) Welfare impacts of smallholder farmers' participation in multiple output markets: Empirical evidence from Tanzania. PLoS ONE 16(5): e0250848. https://doi.org/10.1371/journal.pone.0250848

Mango, N, L Mapemba, H Tchale, C Makate, N Dunjana, and M Lundy. 2015. Comparative analysis of tomato value chain competitiveness in selected areas of Malawi and Mozambique. *Cogent Economics and Finance* 3 (1). https://doi.org/10.1080/23322039.2015.1088429

Mansfield, E. (2012). Microeconomic policy and economic growth. Washington, DC: Brookings Institution Press.

Manyong VM (2003). Agriculture in Nigeria: Identifying Opportunities for Increased Commercialisation and Investment, USAID.

Mariano, R.S. (2011). Two-Stage Least Squares. In: Lovric, M. (eds) International Encyclopedia of Statistical Science. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-04898-2_599

Marin, D.C (2016) “Agriculture Business to the rescue” Available: https://www.gfmag.com/magazine/april-2016/agribusinessrescue-brazil [Accessed 20th March, 2020]

Maris, C. (2017). Analysis of Value Chain In Rice Production Systems In Ebonyi State, Nigeria. Thesis Submitted as a Partial Fulfilment of the Requirements For The award of the Degree of Doctor of Philosophy (Ph.D.) In Agricultural Economics to the Post Graduate School Federal University of Technology, Owerri Imo state.

Market Research Future. (2021). Cashew Market - Global Forecast to 2026. Retrieved from https://www.marketresearchfuture.com/reports/cashew-market-9869

Marketlinks. 2018. VC governance: Overview. [Online] Available: https://www.marketlinks.org/good-practice-center/value-chain-wiki/value-chain governance-overview

Markets and Markets (2015). Retrieved from http://www.marketsandmarkets.com/Market-Reports/nut-ingredients-market-200090153.html Publishing Date: April 2015, Report Code: FB 3359.

Marsh, J. (2023) The Impact of Transportation on a Farmer's Bottom Line. https://agrilinks.org/post/impact-transportation-farmers-bottom-line

Martins, G. R., da Silva, J. B. L., Ribeiro, J. L. D., and Lopes, F. M. (2020). Factors influencing the performance of the agribusiness value chain: A systematic review. International Journal of Production Economics, 218, 113-125.

Marx, A., Maertens, M., Swinnen, J. &Wouters, J. (2012). Private standards and Global Governane: Legal and economic perspectives. Edward Elgar Publishing.

Mastrandrea, M., and Schneider, S.H., (2008) "Global Warming."Microsoft® Encarta® 2009 [DVD]. Redmond, WA: Microsoft Corporation, 2008. Microsoft ® Encarta ® 2009. © 1993-2008 Microsoft Corporation. All rights reserved.

Mauki, C. R. - Ngowi, A. R," Value Chain Approach Limitations to Agricultural Extension Training among Extension Staff in Maize" Research Report Series (RRS), Vol. 2, Issue 1, 2018.

Maurice, D.C., Adamu Y.and Joseph M. (2014). Analysis of Cost Efficiency in Food Crop Production Among Small-Scale Farmers in Adamawa State, Nigeria. Global Journal of Agricultural Sciences Vol. 14, 2015: 17-25. www.globaljournalseries.com, Email: info@globaljournalseries.com. Copyright© Bachudo Science Co. Ltd Printed in Nigeria ISSN 1596-2903 http://dx.doi.org/10.4314/gjas.v14i1.3

McIntosh, Craig, Felix Povel, and Elisabeth Sadoulet. 2018. "Utility, risk, and demand for

Mendelsohn, R., Dinar, A., Basist, A., Kurukulasuriya, P., Ihsan Ajwad, M., Kogan, F., Williams, C. and Ajwad, M. I. (2004). Cross-Sectional Analyses of Climate Change Impacts. Policy Research Working Paper;No.3350. © World Bank, Washington, D.C.. http://hdl.handle.net/10986/14172 License: CC BY 3.0 IGO.

Mengstu Berhe Gebremedhn, Worku Tessema, Girma Gezimu Gebre, Kahsay Tadesse Mawcha & Mewael Kiros Assefa (2019) Value chain analysis of sesame (Sesamum indicum L.) in Humera district, Tigray, Ethiopia, Cogent Food & Agriculture, 5:1, 1705741, DOI: 10.1080/23311932.2019.1705741

Mentzer, J. T. (2001). Supply chain management. Sage Publications.

Metcalfe, L (2010). *Economic Turbulence and Global Governance*, Being Text of a Paper Presented at the 14th Conference of the International Research Society for Public Management on the Theme: The Crisis – Challenges for Public Management, Berne, Switzerland, April.

Meyer J, Rowan B (1977) Institutionalised organisations: Formal structure as myth and ceremony. Am J Soc 83:340–363

Meyer, R. 2011. Subsidies as an instrument in agriculture finance: a review. World Bank, Washington, DC.https://hdl.handle.net/10986/12696

Mgbenka, R.N., and E.N, Mbah (2016) "A Review of Smallholder Farming In Nigeria: Need For Transformation" International Journal of Agricultural Extension and Rural Development Studies, Vol.3, No.2, pp.43-54, Available: http://www.eajournals.org/wp-content/uploads/A-Review-of-Smallholder-Farming-In-Nigeria.pdf [Accessed 21th March, 2020].

Middelberg, S. (2017).Value Chain Financing: Evidence from Zambia on smallholder access to finance for mechanisation.Enterprise Development and Microfinance.**28**:1-2.

Miller, C. (2011). « *Agricultural Value Chain Finance Strategy And Design, Technical Note* ». IFAD, Rome, November, 2011.

Miller, Calvin-Linda Jones, (2013) "Financing the Value Chain in the Agricultural Sector - Tools and Lessons", Food and Agriculture Organisation of the United Nations, Regional Office for the Near East, Cairo, Egypt, May 2013.

Mills, J., and Wong, R. (2021). The Role of Corporate Culture and Values in Enhancing the Agricultural Value Chain. Journal of Agricultural Economics, 72(3), 845-863. doi: 10.1111/1477-9552.12413cs, 69(1), 23-36.

Minten, B., Randrianarison, L. &Swinnen, J. F. M. (2009). Global retail chains and poor farmers: Evidence from Madagascar. *World Development* 37(11): 1728-1741.

Mkamilo, G.S. 2004 . Maize-sesame intercropping in Southeast Tanzania: Farmers' practices and perceptions, and intercrop performance. PhD Thesis, Wageningen University, The Netherlands, 112 pp., with English and Dutch summaries.

Mmbengwa, V. M., Rambau, K., Rakuambo, J., Tempia, N. and Qin, X. 2019. Participation of Smallholder Farmers in Agro-processing industries: Implications for the Extension Services of Gauteng Province. S. Afr. J. Agric. Ext. Vol. 47 No. 4, 2019: 106 - 119 http://dx.doi.org/10.17159/2413-3221/2019/v47n4a530

Mody, A., & Sandri, D. (2012). The eurozone crisis: How banks and sovereigns came to be joined at the hip. Economic Policy, 27(70), 199-230.

Mohod, A. Jain, S. and Powar, A. G. (2010). Energy option for small scale cashew nut processing in India. *Energy Research Journal* 1(1): 47 – 50.

Mordor Intelligence Home Page. Global Sesame Seeds Market-Segmented by Geography-Growth, Trends, and Forescast (2020–2025). Available online: https://www.mordorintellignece.com/industry-reports

Mordor Intelligence. (2021). Cashew nuts market - growth, trends, COVID-19 impact, and forecasts (2021-2026). Retrieved from https://www.mordorintelligence.com/industry-reports/cashew-nuts-market

Mordor Intelligence. (2023). Packaging Industry in Nigeria - Companies, Overview & Analysis.

Morris, J.B. (2002). Food, industrial, nutraceutical, and pharmaceutical uses of Sesame genetic resources. In Trends in News Crops and New Uses; Janick, J., Whipkey, A., Eds.; ASHS Press: Alexandria, Egypt, 2002; pp. 153–156.

Moyo, M., Nyanga, P. H., & Mhaka, E. (2019). The importance of agricultural knowledge and information system in improving smallholder agriculture productivity: A case study of Zimbabwe. Journal of Agricultural Informatics, 10(1), 1-13.

Mshelia, J.S., Sajo. A. and Gungula. D.T. (2012). Sesame Production as Panacea for Poverty Alleviation in Nigeria. Journal of agriculture and veterinary services Vol.4(5). http://www.cenresipub.org.

Muhammed U. 2011. Market Chain Analysis of Teff and Wheat Production in Halaba Special Woreda, Southern Ethiopia. MSc Thesis, Haramaya University, Haramaya, Ethiopia.

Munda, G., Saisana, M., 2011.Methodological Consideration on Regional Sustainability Assessment Based on Multicriteria and Sensitivity Analysis. Regional Studies 45(2), 261-276.

Munyua B, Orr A, Okwadi J. 2013. Open Sesame: A value Chain Analysis of Sesame Marketing in Northern Uganda. International Crops Research Institute for the Semi-Arid Tropics, Socioeconomics Discussion Paper Series 6.

Murgor, P. K (2014), External Environment, firm capabilities strategies responses of large scale manufacturing firms in Kenya, PhD. Thesis, University of Nairobi, Kenya.

Musa, J., Bello, M.S and Beli, S.A, (2020). Profitability Analysis of Sesame (*Sesamum indicum L.*) Production in Dutsin-Ma Local Government Area, Katsina State, Nigeria. *FUDMA Journal of Agriculture and Agricultural Technology ISSN: 2504-9496 Vol. 5 No. 2, December 2019: Pp 47-55*

Mutayoba, V. and Kusiluka, M. A. (2018). *The Linkage among Cashew Nut Processors in Mtwara Region, Tanzania : Volume and Quality* Optimisation *Option*. Mwalimu Nyerere Memorial Academy, Dar es Salaam. 18pp.

Myint, D., Gilani, S. A., Kawase M. and Watanabe K. N. (2020). Sustainable Sesame (*SesamumindicumL.*) Production through Improved Technology: An Overview of Production, Challenges, and Opportunities in Myanmar, http://www.mdpi.com/journal/sustainability.

Nagayets, O. (2005). Small farms: Current status and key trends. Background paper prepared for the Research Workshop on the Future of Small Farms, organised by IFPRI, the Imperial College and the Overseas Development Institute, Wye, UK, 26-29 June.

Nair K.P. 2010. The agronomy and economy of important tree crops of the developing world. New Delhi: Elsevier ©. 2010.

Nair, S. (2020). Why the cashew industry is struggling to stay afloat. The Hindu BusinessLine. Retrieved from https://www.thehindubusinessline.com/economy/agri-business/why-the-cashew-industry-is-struggling-to-stay-afloat/article33144619.ece

National Agency for Food and Drug Administration and Control (NAFDAC). (n.d.). About us. Retrieved February 26, 2023, from https://www.nafdac.gov.ng/about/mission-vision-core-values/

National Beaureu of Statistics April, 2017

National Bureau of Statistics (2011).National Bureau of Statistics, General Household Survey, Annual Socio Economic Report.

National Bureau of Statistics (2022).National Bureau of Statistics, General Household Survey, Annual Socio Economic Report.

National Bureau of Statistics (NBS). 2017. Foreign Trade in Goods Statistics. (Q3 2017).

National Population Commission (2007). Official Gazette: Legal Notice on Publication of the Details of the Breakdown of the National and State Provisional Totals 2006 Census. National Population Commission, Lagos, B175-B198.

National Population Commission (NPC) [Nigeria] and ICF International, "Nigeria Demographic and Health Survey 2013," 2014.

National Population Commission (NPC) [Nigeria], 2006 Census of Population, Vol. 1, Part 2, Report and Tables on the 2006 Population Census of the Federal Republic of Nigeria (Abuja, Nigeria: NPC, 2008).

Nduka, C. and Ikpefan, A. (2016), Agricultural Overtakes manufacturing, oil says CBN. An Article published in The Nation Business Newspaper of Tuesday.

Nedelcovych, M. and Sciferaw, D. (2012). Private Sector Perspectives For Strengthening Agribusiness Value Chains In Africa: Case Studies For, Ethiopia, Ghana, Kenya, And Mali, Partnership To Cut Hunger And Poverty In Africa, Washington, DC.

Negash, M., Riera, O. &Swinnen, J. F. M. (2013). Biodiesel value chains and access to energy in Ethiopia: A synthesis of policies and business prospects. LICOS Working Paper.

NEPAD (2014), "Agriculture in Africa: transformation and outlook", available at: http://www.nepad.org/file-download/download/public/15582

NEPC (2020) https://nepc.gov.ng/importer/nigeria-product/sesame/

NEPC (2021) Cashew nut-Profile https://nepc.gov.ng/blog/market-report/cashew-nuts-profile/

Ngene, U. (2012) Climate change: Any impact on Nigeria? Vanguard News On line Newspaper, 2016 Vanguard Media Limited, Nigeria News Thursday 12 May. Available at: http://www.vanguardngr.com/2012/10/climate-change-any-impact-on-nigeria/

Nicholson, K., Bento, J. and Broermann, S. (2019). *The Role of Governments in Developing Agriculture Value Chains.* African Development Bank, South Africa. 26pp.

Nicolas, D., Valerio, D., Rami, K. and Ruben, S. (2020) Agriculture supply-chain optimization and value creation. © 1996-2023 McKinsey & Company

Nigeria Export Promotion Council (NEPC), (2014). Expanding Nigeria's Exports of Sesame Seeds, Sheanut/Butter Through Improved Capacity Building for the Private and Public Sector. Pp. 1-37.

Nigeria Export Promotion Council (NEPC), (2018).Promising Markets – Sesame Seed.Pp. 1.

Nigeria Export Promotion Council, 2021. Nigeria Cashew Nut Profile. https://nepc.gov.ng/blog/market-report/cashew-nuts-profile/

Nigerian Bureau of Statistics (NBS) 2016.Capital Importation Report Q2 2016. Abuja: Nigerian Bureau of Statistics.

Nigerian Export Promotion Council (2018): Cashew, Accessed 5th August, 2018. Available online: https://nepc.gov.ng/importer/nigeriaproduct/cashew/

Noh, H. J., & Lee, T. H. (2020). The impact of logistics costs on agricultural profitability: Evidence from Korea. Sustainability, 12(7), 3037. https://doi.org/10.3390/su12073037

North, C. D (1990), Institutions, Institutional Change and Economic Performance. Cambridge: Cambridge University Press.

North, C. D (1992), Transaction Costs, Institutions, and Economic Performance. Published by International Centre for Economic Growth Press, 243 Kearny Street, San Francisco, California.

Nwachukwu, C. C., Azubuike, C. O., & Amadi, C. I. (2021). Analysis of road transport infrastructure and agricultural productivity in Nigeria. Journal of Agricultural Extension and Rural Development, 13(2), 24-32.

Nwosu C.1, Adejumo O. A.and Udoha W. N. (2016) Cashew apple utilization in Nigeria: Challenges and prospects. Journal of Stored Products and Postharvest Research Vol. 7(2), pp.29-31, DOI: 10.5897/JSPPR2015.0190 Article Number: CDE4CF457310 ISSN 2141-6567

Obasi, P. C., Nwaiwu, I. U. O., Korie, C. O. and Tim-Ashama, A. (2016).. Evaluation of productivity and profitability of mixed farming enterprises in Imo State, Nigeria. Sky Journal of Agricultural Research Vol. 5(4), pp. 056 - 063, June, 2016 Available online http://www.skyjournals.org/SJAR ISSN 2315-8751 ©2016 Sky Journals

Obi, S.E and Uche, O. (2018) Farmers-Agricultural Development and Rural Poverty Reduction InDekina Local Government Area of Kogi State; An Assessment. FOU Quarterly *Journal of Contemporary Research,* 6 (3): 129-142.

Obianefo C. A., Okafor I. P., Bola-Audu I. and Umebali E. E (2019) "Assessment of the Education Background on Perception of Single Digit Interest Rate among Members of Farmers Cooperative in Anambra State" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-3 Issue-5, August 2019, pp.113-117, https://doi.org/10.31142/ijtsrd25205

Ocheni, S. I. (2015). Impact of fuel price increase on the Nigerian economy. Mediterranean Journal of Social Science, 6 (1), 560-569.

Ochi JE, Sani RM, Idefor FK (2015). Economic analysis of resource use efficiency among small scale cassava farmers in Nasarawa State, Nigeria: Implications for agricultural transformation agenda. *Int. J. Res. Agri. For.* 2 (2):14 – 21.

Odey, F. O., Ushie, E. M., & Ubi, B. E. (2021). Assessment of the contributions of formal sources of agricultural finance to smallholder farmers' agricultural value chain optimization in Nigeria. Journal of Agribusiness and Rural Development, 61(1), 87-96. https://doi.org/10.17306/J.JARD.2021.01341

Odjugo, P., (2005): "An Analysis of Rainfall Pattern in Nigeria," Global Journal of Environmental Science 4(2): 139–45.

Odoemenem, I.U. and Obinne, C.P.O. 2010. Assessing the factors influencing the utilisation of improved cereal crop production technologies by small scale farmers in Nigeria. http://www.indjst.org/archive/vol.3.issue.2/innocent-17.pdf.

OECD (2015a), Participation of Developing Countries in Global Value Chains: Implications for Trade and Trade-Related Policies, OECD Publishing, Paris, http://dx.doi.org/10.1787/5js33lfw0xxn-en.

OECD (2016a), "Using Foreign Factors to Enhance Domestic Export Performance: A Focus on Southeast Asia", by Lopez-Gonzalez, J., OECD Trade Policy Papers, No. 191, OECD Publishing, Paris.

OECD (2017a), "How policies shape global food and agriculture value chains", by Greenville, J., K. Kawasaki and R. Beaujeu, OECD Food, Agriculture and Fisheries Papers, No. 100, OECD Publishing, Paris, http://dx.doi.org/10.1787/aaf0763a-en.

OECD (2017b), "GVCs: Sectoral analysis of developing countries", by Jouanjean, MA., Gourdon, J. and Korinek, J., OECD Trade Policy Papers, OECD Publishing, Paris, forthcoming.

OECD (2018) New technologies and digitalisation are transforming agriculture and offering new opportunities to improve policy. https://www.oecd.org/agriculture/topics/technology-and-digital-agriculture/

OECD (2018a, forthcoming), "Dynamic changes and effects of agro-food GVCs", by Greenville, J., K. Kawasaki and M.A. Jouanjean, *OECD Food, Agriculture and Fisheries Papers*, OECD Publishing, Paris.

OECD (2022) Global value chains and agriculture. https://www.oecd.org/agriculture/topics/global-value-chains-and-agriculture/.

OECD (2022), Consumer price indices (CPIs) Database, https://stats.oecd.org/index.aspx?DataSteCode=PRICES_CPI

OECD and FAO (2016) Agricultural Outlook 2016–2025, Special Focus: Sub- Saharan Africa. OECD/FAO, Paris/Rome. See www.fao.org/3/a-i5778e.pdf.

OECD and FAO (2017) Agricultural Outlook 2017–2026, Special Focus: Southeast Asia. OECD/FAO, Paris/Rome. See www.fao.org/3/a-i7465e.pdf.

OECD. (2017). Agricultural Trade and Transport Costs: Revisiting the Issues. Retrieved from https://www.oecd-ilibrary.org/agriculture-and-food/agricultural-trade-and-transport-costs_9789264279470-en

of Macroeconomic Factors on Business Success. Harvard Business Review, 89(4), 56-63.

Ofolsha, M. D., Kenee, F. B., Bimirew, D. A., Tefera, T. L., & Wedajo, A. S. (2022). The Effect of Social Networks on Smallholder Farmers' Decision to Join Farmer-Base Seed Producer Cooperatives (FBSc): The Case of Hararghe, Oromia, Ethiopia. Sustainability, 14(10), 5838.

Ogbalubi, L.N. and Wokocha, C.C. (2013). Agricultural development and employment generation: The Nigeria experience. *ISOR Journal of Agriculture and Veterinary Science*. **2**(2):60-69.

Ogundele, O. J., & Ayinde, O. E. (2020). Agricultural credit and financial inclusion in Nigeria: Issues and prospects. Journal of Economics and Sustainable Development, 11(7), 1-8. https://doi.org/10.7176/JESD/11-7-01

Ogundipe, A. A., Ojeaga, P., & Odejimi, D. (2020). COVID-19 and the Nigerian economy: Insights and policy implications. Journal of Public Affairs, 20(4), e2266. https://doi.org/10.1002/pa.2266

Ogunleye, A., Kehinde, A., Mishra, A. and Ogundeji, A. (2021) Impacts of farmers' participation in social capital networks on climate change adaptation strategies adoption in Nigeria. Heliyon. 2021 Dec 17;7(12):e08624. doi: 10.1016/j.heliyon.2021.e08624. PMID: 35005276; PMCID: PMC8715181.

Ogunleye, W., Salau, A., & Olayiwola, K. (2017). Smallholder farmers' access to finance in Nigeria: A review of the literature. Cogent Economics & Finance, 5(1), 1362297. doi: 10.1080/23322039.2017.1362297

Ojimba TP (2017). Cost of Production and Resource – Use Efficiency among Small Scale Cassava Farmers in Igbo Etche Rivers State, Nigeria. Vol.5 (12), pp. 390-400, December 2017 ISSN 2354-4147 DOI: https://doi.org/10.26765/DRJAFS.2017.5701 Article Number: DRJA93325701. Direct Research Journal of Agriculture and Food Science http://directresearchpublisher.org/aboutjournal/drjafs

Ojo, A. (2011).Economic impact of climate change. Available at: http://www.nigeriaworld.com/Abuja, Nigeria. Assessed: 15th May. 2016.

Ojo, I. O. (2020) Economics of Cashew Nut Processing in Ondo State, Nigeria; Evidence from Jof Ideal Family Farms Limited, ZBW – Leibniz Information Centre for Economics, Kiel, Hamburg

Okojie, C., Monye-Emina A., Eghafona, K., Osaghae, G. and Ehiakhamen, J.O. 2010. Institutional environment and access to microfinance by self-employed women in the rural areas of Edo State. NSSP Brief No. 14. Washington. D.C.: International Food Policy Research Institute.

Okuthe, R. (2017) Transforming Nigeria's Agricultural Value Chain: A case study of the Cocoa and Dairy industries. https://www.academia.edu/36939218/Transforming_Nigerias_Agricultural_Value_Chain

Oladimeji, Y. U., Abdulsalam, Z. &Ayandotun, B. W. (2018). Profitability and energy gaps of semi-mechanised and traditional rice production technologies in north central and north western Nigeria. Agricultural Engineering International: CIGR Journal, 20(2): 116-125.

Oladimeji, Y. U., Sidi, A. G., Damisa, M. A. and Yusuf, O. (2014). Value Chain Analysis of Sesame in Bade and Jakusko Local Government Areas of Yobe State, Nigeria *International Journal of Economic Development Research and Investment*, 5(3):1-13.

Olagunju, F.I. & Ajiboye, A. (2010). Agricultural lending decision: a tobit regression analysis. African journal of food, agriculture, nutrition and development, 10(5)[2].

Olagunju, K. O., & Adepoju, A. O. (2018). Agricultural processing, productivity and economic growth nexus in Nigeria. Journal of Agribusiness in Developing and Emerging Economies, 8(2), 156-172. https://doi.org/10.1108/JADEE-05-2017-0054

Olatunji, G. B., Omotesho, O. A., Taye O. E. and Ayinde, K. (2010). Determinants of Inflation in Nigeria: A Co-integration Approach. Contributed Paper presented at the joint 3rd African Association of Agricultural Economics (AAAE) and 48th Agricultural Economists Association of South Africa (AEASA) Conference, Cape Town, South Africa, September 19-23, 2010. 1-13.

Olavarrieta, S., and Friedmann, R. (2008). Market Orientation, Knowledge-Related Resources and Firm Performance. *Journal of Business Research*, *61*(6), 623-630.

Oldekop, J. A., Fontana, L. B., Grugel, J., Roughton, N. *et al*l (2016), 100 key research questions for the post-2015 development agenda. *Development Policy Review*, vol. 34, is. 1, pp. 55–82. https://doi.org/10.1111/dpr.12147.

Oliver C (1991) Strategic responses to institutional processes. AcadManag Rev 16:145–179

Oliver, C. (1997). Sustainable competitive advantage: Combining institutional and resource-based views. *Strategic Management Journal*, 18(9): 697-713.

Olomu M.O., Ekperiwane M.C. and Akinlo T. (2020). Agricultural sector value chain and government policy in Nigeria: issues, challenges and prospects. African Journal of Economic and Management Studies © Emerald Publishing Limited 2040-0705 DOI 10.1108/AJEMS-03-2019-0103. https://www.emerald.com/insight/2040-0705.htm

Olomu, M. O., Ekperiware, M. C., & Akinlo, T. (2020). Agricultural sector value chain and government policy in Nigeria: issues, challenges and prospects. *African Journal of Economic and Management Studies*. Retrieved from Emerald Insight

Olomu, M.O. and Akinlo, T. (2020) Agricultural Sector Value Chain and Government Policy in Nigeria: Issues, Challenges and Prospects. African Journal of Economic andManagement Studies© Emerald Publishing Limited2040-0705DOI 10.1108/AJEMS-03-2019-0103

Omonona, B. T., Adetunji, M. O., Adewumi, M. O., & Akinyemi, O. O. (2018). Analysis of Agricultural Value Chain in Nigeria: Evidence from Rice and Maize Sub-Sectors. Journal of Economics and Sustainable Development, 9(10), 56-72.

Omotesho, O. A., Omonona, B. T., & Lawal, J. O. (2018). Agricultural infrastructure and national food security in Nigeria: a co-integration approach. Cogent Economics & Finance, 6(1), 1467153.

Ongeti, W. J. (2014), Organisational resources, corporate governance and performance of Kenya State owned corporations, University of Nairobi, Kenya.

Opara, S. 2011. Exploring lifeline in small-scale farming. NBF Topics.

Opoku-Ameyaw, K., Oppong, F.K., Amoah, F.M., Osei-Akoto, S. &Swatson, E. (2011*)*. Growth and early yield of cashew intercropped with food crops in northern Ghana*. J. Trop. Agric.,* 49: 53-57.

Ordu A.U., Cooley L. and Goh L. (2021) Digital technology and African smallholder agriculture: implication for public policy. https://www.brookings.edu/articles/digital-technology-and-african-smallholder-agriculture-implications-for-public-policy/

Organisation for Economic Co-operation and Development (OECD). (2017). Agricultural Policy Monitoring and Evaluation 2017. Retrieved from https://doi.org/10.1787/9789264278696-en

Osinubi, I.S. (2020), "The three pillars of institutional theory and IFRS implementation in Nigeria", *Journal of Accounting in Emerging Economies*, Vol. 10 No. 4, pp. 575-599. https://doi.org/10.1108/JAEE-07-2019-0139

Otokiti, S. O. (2005). Methodologies and Mechanics of Computational Systems, New Delhi, Sultan Ghand and Sons Publishers Limited.

Oyekale, A. S., & Akinleye, O. T. (2020). Water scarcity, food insecurity and malnutrition in Nigeria: Challenges and opportunities. Global Food Security, 26, 100419. doi: 10.1016/j.gfs.2020.100419

Ozowa, V.N. 1995. Information needs of small farmers in Africa: The Nigerian example. www.worldbank.org/htm/cgiar/newsletter/june97/9nigeria.html. Accessed on 4th July, 2012.

Parienté, Jeremy Shapiro, Bram Thuysbaert, and Christopher Udry. 2015. “A multifaceted

Patt, Anthony & Suarez, Pablo & Hess, Ulrich. (2010). How do Small-holder Farmers Understand Insurance, and How Much do they Want it? Evidence from Africa.Global Environmental Change. 20. 153-161. 10.1016/j.gloenvcha.2009.10.007.

Pedro, M., Gonzalez-Andujar, J. L. (2019).Evaluation of a decision support system for crop protection in apple orchards.Computers in Industry. Volume 107, May 2019, Pages 99-103. Doi:10.1016/j.compind.02.005.

Peng, M. (2002). Towards an institution-based view of business strategy. *Asia Pacific Journal of Management,* 19(2/3), 251-267.

Peng, M., Sun, S., Pinkham, B., and Chen, H. (2009). The institution-based view as a third leg for a strategy tripod. *Academy of Management Perspectives*, 23(3): 63-81.

Penrose, E. T. (1959). *The Theory of the Growth of the Firm*. Oxford: Basil Blackwell and Mott Ltd.

Pérignon, C., & Smith, D. C. (2010). The level and quality of value-at-risk disclosure by commercial banks. Journal of Banking & Finance, 34(2), 362-377. doi: 10.1016/j.jbankfin.2009.07.013

Perrow, C (2002), Organizing America: wealth, power, and the origins of corporate capitalism. Princeton University Press.

Peteraf, M. (1993). The cornerstones of competitive advantage: A resource-based view. *Strategic Management Journal*, *14*(3), 179–191.

Peteraf, Margaret and Barney, Jay, "Unravelling The Resource-Based Tangle", Managerial and Decision Economics, 2003, Vol. 24, 309-323.

Piacentini, T., Galli, A., Marsala, V. and Miccadei, E. (2018). Analysis of Soil Erosion Induced by Heavy Rainfall: A Case Study from the NE Abruzzo Hills Area in Central Italy. MDPI Water 2018, 10, 1314.

Pietrobelli, C., & Rabellotti, R. (2011). Global value chains meet innovation systems: are there learning opportunities for developing countries? World development, 39(7), 1261-1269.

Piger, J., & Zha, T. (2008). What Does the Yield Curve Tell Us about GDP Growth? Journal of Econometrics, 143(2), 359-375.

Pimentel, D., and Lehman, H. (2014). The perceived effects of pesticides on human health and the environment. In Sustainable Agriculture Reviews 17: Pesticides in Agriculture and the Environment (pp. 1-29). Springer.

PMC. (2022). Response and resilience of agricultural value chain to COVID-19 pandemic in India and Thailand. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9212235/

Poole, N. and Donovan, J. (2014), "Building cooperative capacity: the specialty coffee sector in Nicaragua", Journal of Agribusiness in Developing and Emerging Economies, Vol. 4 No. 2, pp. 133-156.

Porter, M. E. (1980). *Competitive Advantage: Creating and Sustaining Competitive Performance*. New York: Free Press.

Porter, M. E. (1998). Clusters and the new economics of competition. Harvard Business Review, 76(6), 77-90.

Poulton, C and Chinsinga, B (2018).The Political Economy of Agricultural Commercialisation in Africa. Agriculture Policy Research in Africa (APRA) Working Paper 16. Future Agricultures Consortium, Brighton. See bit.ly/2HcHUK7.

Pratiwi, A. and Suzuki, A. (2017) Effects of farmers' social networks on knowledge acquisition: lessons from agricultural training in rural Indonesia. *Economic Structures* **6**, 8 (2017). https://doi.org/10.1186/s40008-017-0069-8

Pretty, J., Benton, T. G., Bharucha, Z. P., Dicks, L. V., Flora, C. B., Godfray, H. C. J., Goulson, D., Hartley, S., Lampkin, N., Morris, C., Pierzynski, G., Prasad, P. V. V., Reganold, J. P., Rockström, J., Smith, P., Thorne, P., Wratten, S. D., and Zhang, F. (2018). Global assessment of agricultural system redesign for sustainable intensification. Nature Sustainability, 1(8), 441-446. https://doi.org/10.1038/s41893-018-0114-0

Pricewaterhouse Coopers Limited PwC (2019).*Unlocking Nigeria's Agricultural Exports*.

PriceWaterhouseCoopers.(PWC) 2016. Economy Alert: Nigeria 2016 Q1 GDP: Economy contracts to -0.36%y/y Nigeria: PWC.

Pro share (2018), Sesame Seeds - A Diamond in the Rough.

Pujahari, D, Dayal, A and Roul, S (2015) Creating Technology-enabled Inclusive Markets: Electronic Trading Platform for Small and Marginal Women Farmers in Bihar, India. Technoserve, Washington D.C. See bit.ly/2VPNh5f.

PwC (2017) Promoting Economic Prosperity: Analysis of the State-Level Business Environment in Nigeria, PwC, Nigeria.

Pwc Report - Understanding the Brazil agribusiness: what are the drivers, the issues and the perspectives (September 2013).

Qiang, C. Z., S. C. Kuek, A. Dymond, and S. Esselaar. 2012. *Mobile Applications for Agriculture and Rural Development*. World Bank.http://go.worldbank.org/YJPDV8U9L0.

Quirino R.L., Garrison T.F. and Kessler M.R. (2014). Matrices from vegetable oils, cashew nut shell liquid, and other relevant systems for biocomposite applications. Green Chem. 2014.

Ragasa, C., and C. Niu. 2017. “The state of agricultural extension and advisory services

Rahman, A., Bhattarai, S., Akbar, D., Thomson, M., Trotter, T. and Timilsina S. (2019). Market Analysis of Sesame Seed. CRICOS:00219C cqu.edu.au/research

Rahman, S., Kabir, H., and Bala, B. K. (2021). The role of storage and transportation facilities in ensuring food security in Bangladesh. Journal of Agricultural Science and Technology, 23(2), 69-82.

Rajchelt-Zublewicz, M., Piwoni-Krzeszowska, E., and Matyja, M. (2019). Tangible and intangible resources and the financial performance of Polish social cooperatives. *PraceNaukoweUniwersytetuEkonomicznego we Wrocławiu*, *63*(5), 173-187. https://doi.org/10.15611/pn.2019.5.14

Ray G, Barney JB &Muhanna WA (2004). Capabilities, business processes, and competitive advantage: Choosing the dependent variable in empirical tests of the resource-based view. Strategic Management Journal. 25: 23-37.

Reardon, T. (2018). The quiet revolution in agrifood value chains in Asia. Global Food Security, 17, 44-53.

Reardon, T., Berdegué, J. A., & Barrett, C. B. (2009). The rise of supermarkets in Africa, Asia, and Latin America. American Journal of Agricultural Economics, 91(5), 1318-1325.

Reardon, T., Gulati, A. (2008).The Rise of Supermarkets and Their Development Implications: International Experience Relevant for India, International Food Policy Research Institute, Retrieved from <http:// www.ifpri.org/pubs/pubs.htm#dp>[4 February 2015].

RehimaMusema. 2006. Analysis of Red Pepper Marketing: The Case of Alaba and Siltie in SNNPRS of Ethiopia. MSc Thesis, Haramaya University, Haramaya, Ethiopia.

Research and Markets. (2022). Global cashew nut market - growth, trends, and forecasts (2020-2025). Retrieved from https://www.researchandmarkets.com/reports/5201375/global-cashew-nut-market-growth-trends-and?utm_source=GNOM&utm_medium=PressRelease&utm_code=hxwcbr&utm_campaign=1662129+-+Global+Cashew+Nut+Market+Report+2020-2025%3a+Consumption+in+Developed+Countries+Driving+Market+%2b+Profiles+of+Major+Players&utm_exec=chdo54prd

Rich K. M., Baker D., Negassa A., and Ross R. B. (2009). Concepts, __applications, and extensions of value chain analysis to livestock systems in developing countries. Contributed Paper prepared for presentation at the International Association of Agricultural Economists Conference, Beijing, China, August 16-22, 2009.

Rodger, N. (2014). Agricultural Value Chain: A Game Changer for Small Holders. https://www.devex.com/news/agricultural-value-chains-a-game-changer-for small-holders-83981.

Romer, C. D., & Romer, D. H. (2014). The macroeconomic effects of tax changes: estimates based on a new measure of fiscal shocks. American Economic Review, 104(3), 763-801.

Rosenzweig, C., Elliott, J., Deryng, D., Ruane, A. C., Müller, C., Arneth, A., Boote, K. J., Folberth, C., Glotter, M., Khabarov, N., Neumann, K., Piontek, F., Pugh, T. A. M., Schmid, E., Stehfest, E., Yang, H., and Jones, J. W. (2019). Assessing agricultural risks of climate change in the 21st century in a global gridded crop model intercomparison. Proceedings of the National Academy of Sciences, 116(9), 3513-3518.

Rota, A. and Sperandini, S. (2010). Value chains, linking producers to the markets, International Fund for Agricultural Development, IFAD, Rome, Retrieved from <http:// www.ifad.org/lrkm/index.htm>[6 November 2015].

Rousseau, K., Gautier, D. and Wardell, D.A. (2015), "Coping with the upheavals of globalisation in the Shea value chain: the maintenance and relevance of upstream Shea nut supply chain organisation in western Burkina Faso", World Development, Vol. 66, February, pp. 413-427.

Ruben, R., Kuyvenhoven, A., & de Groot, H. L. F. (2001). Sustainable cocoa production: Constraints and opportunities in a dynamic cocoa market. NJAS-Wageningen Journal of Life Sciences, 49(2), 183-202.

Salavou, H., and G. Avlonitis (2008). 'Product Innovativeness and Performance: A Focus on SMEs'. *Management Decision*, 46(7): 969–85.

Samuel E. Jonah, Baba G. Shettima, Abba S. S. Umar, Enan Timothy (2020). Analysis of Profitability of Sesame Production in Yobe State, Nigeria. American Journal of Economics ISSN 2520-0453 (online) Vol.4, Issue 2, pp 46 - 69, 2020

Sands, R. & Wescott, P. (2011). Impact of Higher Energy Prices on Agriculture and Rural Economies. Economic Research Service/ ERR- 123. Economic Research Service/USDA.

Santovito, S., Silvestri, R., Lamonaca, E. and Contò, F. (2016). 'Producers Organisation and Digital Technologies for Farms' Competitiveness. In E. Horská, Z. Kapsdofferová, and M. Hallová (eds), *International Scientific Days 2016. The Agri-Food Value Chain: Challenges for Natural Resources Management and Society*. Nitra-Chrenová: Slovak University of Agriculture in Nitra.

Sarpong, P.K. 2011. An Assessment of the Contribution of Cashew Production to Local Economic Development, A Case Study of the Brong Ahafo Region

Savic, B., Petrovic, M. & Vasiljevic, Z. (2020). The impact of transportation costs on economic performances in crop production. Ekonomika Poljoprivrede. 67. 683-697. 10.5937/ekoPolj2003683S.

Schejtman, Alexander, and Julio Berdegué 2004."Rural Territorial Development." Rimisp–

Schmitz, H. (2004). "Dynamics, Innovation and Development" Elsinore, Denmark, June 14-16, 2004 Theme: 'Local Upgrading In Global Chains': recent findings paper to be presented at the druid summer conference 2004.

Schoemaker, P., Heaton, S., and Teece, D. (2018). Innovation, dynamic capabilities, and leadership. *California Management Review*, *61*(1), 15-42.

Scoppola, M. (2022). Agriculture, food and global value chains: issues, methods and challenges. *Bio-based and Applied Economics*.

Scott W (1987) Unpacking institutional arguments. In: PowellW, Di Maggio P (eds) The New Institutionalism in Organisational Analysis. University of Chicago Press, Chicago, pp 164–182

Seville, D, Buxton, A and Vorley, B (2011). Under What Conditions are Value Chains Effective Tools for Pro-poor Development? IIED/Sustainable Food Lab, London/ Harland. See pubs.iied.org/16029IIED.

Shah, P. and Yadav, P. (2014), Cultural Environment and International Business. International Journal of Research in Management and Business Studies, vol. 1, is. 2, pp. 36–37.

Shahin, A. And Janatyan, N. (2011) Estimation of Customer Dissatisfaction Based on Service Quality Gap by Correlation and Regression Analysis in Travel Agency. International Journal of Business Management, 6, 99-108.

Shaw, A., Dolan, C., & Collins, R. (2019). Sustainable agricultural value chains in India: Opportunities and challenges for inclusive growth. World Development, 123, 104617.

Siedlecki, S.L. (2020) Understanding Descriptive Research Designs and Methods. Clinical nurse specialist CNS 34(1):8-12 DOI: 10.1097/NUR.0000000000000493

Simchi-Levi, D., Kaminsky, P., & Simchi-Levi, E. (2017). Designing and managing the supply chain: concepts, strategies, and case studies. McGraw Hill Education.

Simon D., Alex, B., Charlie, D., and Philip G., (2016).Climate value at risk' of global financial assets. Journal of Nature Climate Change, 6(4): 34- 42. Available at: www.nature.com/natureclimatechange

Singh, R. K., Singh, A. K., and Singh, V. (2020). Post-harvest management of fruits and vegetables. Springer.

Singh, V., Sankhwar, S. and Pandey D. (2015).'The Role of Information Communication Technology (ICT) in Agriculture'.*Global Journal of Multidisciplinary Studies*, 3(4).

Slywotzky A J and Morrison D J (1997), The Profit Zone, Wiley, New York.

Smith, J. (2018). Smallholder Farmers and Global Value Chains: Opportunities and Challenges. *Journal of Agricultural Economics*, 69(1), 35-65.

Smith, J. (2018). The Role of Networking in Agricultural Value Chains. Journal of Agricultural Economi

Smith, P. (2018). Intangible resources and their impact on the agricultural value chain. Journal of Agricultural Economics, 69(2), 435-452.

Smith, S. J., and Davenport, F. (2019). Water use in agriculture. In S. A. Elias (Ed.), Encyclopedia of the World's Biomes (pp. 388-399). Elsevier.

Sotonye, A., (2015): Cashew nuts export contributes N50 billion to the Nigerian economyNCAN. Reported in online Vanguard Newspaper, Thursday November 9, 2015 @http://www.vanguardngr.com/2015/08/cashewnut-export-contributes-n50bn-to-economy-ncan/

Spore, A. (2012). Making the connection: The rise of agricultural value chains.The magazine for agricultural and rural development in ACP countries. Technical Centre for Agricultural and Rural Cooperation CTA, Waganingen, the Netherlands. 3-7.

Standard Organisation of Nigeria (SON). (n.d.). About us. Retrieved February 26, 2023, from https://son.gov.ng/about-us/

Staritz, C. (2012), Value Chains for Development: Potentials and Limitations of Global Value Chain Approaches in Donor Interventions, Austrian Research Foundation for International *Statistics* 97(3): 567-73.

Stark, K., Bamber, P., and Gereffi., G. (2011). The Fruit and Vegetables Global Value Chain: Economic Upgrading and Workforce Development, Center on Globalisation, Governance and Competitiveness, Duke University.

Stepien, M., Legowik-Swiacik, S., Skibinska, W., &Turek, I. (2016). Identification and Measurement of Logistic Cost Parameters in the Company. *Transportation Research Procedia, 16*, 490-497.

Stevens, C. J., Quinton, J. N., Bailey, A. P., Deasy, C., Silgram, M., Jackson, B., & Stevens, D. (2018). The role of agricultural waste management in enhancing sustainable development goals.

Stoian, D., Donovan, J., Fisk, J. and Muldoon, M. (2012), "Value chain development for rural poverty reduction: a reality check and a warning", Enterprise Development and Microfinance, Vol. 23 No. 1, pp. 54-69.

Sturgeon, T. (2008). From Commodity Chains to Value Chains: Interdisciplinary Theory Building in an Age of Globalisation. Working Paper Series, MIT-IPC-08-001, available: https://ipc.mit.edu/sites/default/files/documents/08-001.pdf

Suchman M (1995) Managing legitimacy: Strategic and institutional approaches. AcadManag Rev 20(3):571–610

Swinnen, J. F. M. &Vandeplas, A. (2011). Rich consumers and poor producers: quality and rent distribution in global value chains. *Journal of Globalisation and Development* 2(2): 1-30.Swinnen, J. F. M., Vandeplas, A. &Maertens, M. (2011), Liberalization, Endogenous Institutions, and Growth: A Comparative Analysis of Agricultural Reforms in Africa, Asia, and Europe, *World Bank Economic Review* 24(3):412-445.

Swinnen, Johan. 2018. "Inclusive Value Chains to Accelerate Poverty Reduction in Africa."

Tahir, A. D., Alkali, H. M and Saleh, R. A. (2021). Analysis of Costs and Returns of Sesame Production in Hong Local Government Area, Adamawa State, Nigeria. Journal of

Agricultural Economics, Environment and Social Science 7(2): 186-193: August, 2021 http://www.jaeess.com.ng ISSN: 2476 – 8423

Tanzania." Working paper, Department of Economics, UC Santa Cruz.

Techno Serve. "COVID-19 and the Cashew Industry in Benin". 6 May 2020.

Teece, D.J., Pisano, G., &Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal, 18*(7), 509–533.

Tewodros T. 2014. Analysis of Chickpea Value Chain and Determinants of Market Options Choice in Selected Districts of Southern Ethiopia. School of Environment, Gender and Development Studies, College of Agriculture, Hawassa University, Ethiopia. *Journal of Agricultural Science*; 6(10): 1916-9752.

Thindisa, L. and Urban, B., 2018. Human-social capital and market access factors influencing agro-processing participation by small-scale agripreneurs: The moderating effects of transaction costs. *Acta Commercii*, 18(1):1-10.

Thomas K.A and Eforuoku F (2020) Rural Transport and Marketing of Agricultural Produce in Oyo State, Nigeria International Journal of Agriculture and Earth Science E-ISSN 2489-0081 P-ISSN 2695-1894, Vol. 6 No. 2 2020 www.iiardpub.org

Thowa, A. and Priyadarshib, S. (2013). Aid for Trade: an opportunity to increase fruit and vegetable supply, Bull. World Health Organ., Vol. 91, pp. 57–63 | doi:10.2471/BLT.12.106955.

Tiamiyu S.A., Ibrahim M.A. and Shaahu A. (2015). Profitability of Sesame Production and Marketing in Nigeria. Advanced Journal of Agricultural Research, 1(006), 089 – 093.

Tijani, A.A. AyanwaleA.O.S.andBaruwa O.I. (2010). Profitability and constraints of Tomato Production Under Tropical Conditions. International Journal of Vegetable Science. Vol. 16, 2010-Issue 2

Tisdale, S. L., Nelson, W. L., and Beaton, J. D. (2019). Soil fertility and fertilizers: An introduction to nutrient management. CRC Press.

Tobin, D., Glenna, L. and Devaux, A. (2016), "Pro-poor?Inclusion and exclusion in native potato value chains in the central highlands of Peru", Journal of Rural Studies, Vol. 46, August, pp. 71-80.

Toungos M.D. (2020). Maximising The Potentials Of Beni Seed Sesame (*Sesamum indicum L*) Production In Adamawa State, Nigeria. *International Journal of Innovative Agriculture & Biology Research 8(2):12-20, April-June, 2020*. ISSN: 2354- 2934. www.seahipaj.org

Trade and Development Board, "Assessing the Impact of Public-Private Partnerships on Trade and Development in Developing Countries - Public-Private Partnerships for Enhancing SME Participation in Global Value Chains" UNCTAD, Geneva, March 2013.

Trienekens, J.H. (2011) Agricultural Value Chains in Developing Countries A Framework for Analysis. International Food and Agribusiness Management Review / Volume 14, Issue 2, 2011

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

Trigde. Intelligence cashew Nigeria. Seoul: Trigde;© 2020 (cited 2020 Nov 20). Available from https://www.trigde.com/inteligence/cashew-nut/NG

Truelove, R.N., Lellyett, S.C., Issaka, A.I., Huda, S. (2023). Agricultural Value Chains in Developing Economies: A Theoretical Framework. In: Narula, S.A., Raj, S.P. (eds) Sustainable Food Value Chain Development. Springer, Singapore. https://doi.org/10.1007/978-981-19-6454-1_6

Tunde, A.M and Adeniyi, E.E (2012) "Impact of road transport on Agricultural Development: A Nigerian Example" Ethiopian Journal of Environmental Studies and Management EJESM, Vol. 5 No. 3, pp.232-238. Available: https://www.ajol.info/index.php/ejesm/article/viewFile/77955/68350 [Accessed 15th May, 2017].

Tunde-Akintunde, T.Y., Oke, M.O. and Akintunde, B.O. (2012).*Sesame Seed: Oilseeds.* Dr.Uduak G. Akpan (Ed.). ISBN: 978-953-51-0665-4, InTech, Available from: http://www.intechopen.com/books/oilseeds/sesameseed (accessed May, 2013).

Ukpe, U.H., Nwalem, P.M., Dzever, D.D. (2023). Economics of Sesame Marketing in Nigeria. In: Odularu, G.O.A. (eds) Agricultural Transformation in Africa. Advances in African Economic, Social and Political Development. Springer, Cham. https://doi.org/10.1007/978-3-031-19527-3_3

UNCTAD. (2019). World investment report 2019: Special economic zones. United Nations Conference on Trade and Development. Retrieved from https://unctad.org/system/files/official-document/wir2019_en.pdf

UNDP (2014) Growing inclusive agri-food value chains benefitting African famers and SMEs

UNDP. (2013). Inclusive Agricultural Value Chain Development: A Guideline. Retrieved from https://www.undp.org/content/dam/undp/library/Enterprise%20Development/Inclusi ve_Agricultural_Value_Chain_Development_A_Guideline.pdfUNDP. (2013). Inclusive Agricultural Value Chain Development: A Guideline. Retrieved from https://www.undp.org/content/dam/undp/library/Enterprise%20Development/Inclusive_Agricultural_Value_Chain_Development_A_Guideline.pdf

UNESAP (2009). *Achieving the millennium development goals in an era of global uncertainty. Asia-Pacific regional report*. Economic and Social Commission for Asia and the Pacific, Bangkok.

UNIDO (United Nations Industrial Development Organisation): *Pro- Poor Value Chain Development. 25 Guiding Questions for Designing Agroindustry Projects*.UNIDO; 2011.

UNIDO, CBN, BOI (2010). Working Paper. November 2010. Unleashing Agricultural Development in Nigeria through Value Chain Financing.United Nations Industrial Development Organisation (UNIDO). Vienna, Australia.

United Nations (2021) Frontier Technology Issues: Frontier technologies for smallholder farmers: addressing information asymmetries and deficiencies.https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/publication/FTI_Nov2021.pdf

United Nations Conference on Trade and Development (UNCTAD). (2019). Review of maritime transport 2019. Retrieved from https://unctad.org/system/files/official-document/rmt2019_en.pdf

United Nations Conference on Trade and Development. (2021). Cashew sector: An overview. Retrieved from https://unctad.org/en/pages/newsdetails.aspx?OriginalVersionID=2140

United Nations Industrial Development Organisation(UNIDO). 2009. Agro-value chain analysis anddevelopment: the UNIDO approach. A Staff

WorkingPaper.https://www.unido.org/sites/default/files/2010-02/Agro_value_chain_analysis_and_development_0.pdf

United Nations Industrial Development Organization (UNIDO). (2019). Renewable energy in agro-industries. Retrieved from https://www.unido.org/sites/default/files/2019-06/REAP_Agro-Industries%20brochure_web.pdf

United States Agency for International Development (USAID). (2019). Nigeria climate risk profile. Retrieved from https://www.climatelinks.org/sites/default/files/asset/document/2019_USAID_Nigeria%20Climate%20Risk%20Profile.pdf

United States Agency for International Development (USAID)-Nigeria. *Industry Action Plan Nigerian Cashews*. NW Washington DC: Chemonics International Inc., 2002.

University of Pennsylvania. (2018). How do rising transportation costs affect firm behavior? Retrieved from https://publicpolicy.wharton.upenn.edu/live/news/2212-how-do-rising-transportation-costs-affect-firm

UNSD (2017). UNdata. Available online at: http://data.un.org/Data.aspx?d=FAOandf=itemCode%3A289

Usman, S. B., Ogunjobi, A. A., Adebayo, A. A., & Adekunle, J. A. (2020). An assessment of the Sesame (Sesamum Indicum L.) Seed Industry in Nigeria: Challenges and Opportunities. Journal of Agriculture and Biology, 20(1), 1-6. https://doi.org/10.5455/jagb.20200404030125

Utami, H. & Alamanos, E. (2023) Resource-Based Theory: A review. In S. Papagiannidis (Ed), TheoryHub Book. Available at https://open.ncl.ac.uk / ISBN: 9781739604400

Uwagboe, E. O., Adeogun, S. O. and Odebode, S. O. (2010) Constraints of farmers in cashew production: a case study of Orire L.G.A. of Oyo State, Nigeria. ISSN : 1990 6145 http://www.arpnjournals.com/jabs/rese... Asian Research Publishing Network - ARPN

Vagneron, I., Faure, G., & Moustier, P. (2009). The diversity of quality schemes in agro-food systems: Implication for governance and innovation. Food Policy, 34(1), 1-13. doi: 10.1016/j.foodpol.2008.09.001

Vaidya, B., & Donthu, N. (2021). Logistics and production cost: An empirical study of the US agricultural sector. International Journal of Production Economics, 240, 107944. https://doi.org/10.1016/j.ijpe.2021.107944

Van den Broeck, Goedele, Johan Swinnen, and MietMaertens. 2016. “Global Value Chains, Large-Scale Farming, and Poverty: Long-Term Effects in Senegal.” Licos discussion papers series, Leuven University.

Vandemoortele, T. &Deconinck, K. (2014). When are private standards more stringent than public standards? *American Journal of Agricultural Economics*, forthcoming.

Vandemoortele, T., Rozelle, S., Swinnen, J. F. M. & Xiang, T. (2012). Quality and Inclusion of Producers in Value Chains: A Theoretical Note. *Review of Development Economics* 16(1): 122-136.

Venkataram, B. (2019) Issues and challenges faced by cashew processing enterprises – A study in Udupi district. Journal of Emerging Technologies and Innovative Research (JETIR) www.jetir.org Volume 6, Issue 5, ISSN-2349-516

Volpe, R., Roeger, E. and Leibtag, E. (2013) How Transportation Costs Affect Fresh Fruit and Vegetable Prices. Economic Research Service www.ers.usda.gov

Vorley, B and Lançon, F (2016). Food Consumption, Urbanisation and Rural Transformation: The trade Dimensions. IIED, London. See pubs.iied.org/10767IIED.

Vorley, B, Cotula, L and Chan, M K (2012b). Tipping the Balance: Policies to Shape Agricultural Investments and Markets in Favour of Small-Scale Farmers. Oxford, Oxfam. See bit.ly/2MbdHdg.

Vorley, B, Del Pozo-Vergnes, E and Barnett, A (2012a). Small Producer Agency in the Globalised Market: Making Choices in a Changing World. IIED, London. See pubs.iied.org/16521IIED.

Wagner, J. (2014). The role of business in fostering economic growth and innovation. Journal of Business and Leadership: Research, Practice, and Teaching, 1(1), 21-29.

Wagner, S., Neshat, N., 2010. Assesing the vulnerability of supply chains using graph theory.

Walter. D and Lancaster .G (2000). Implementing value strategy through value chain.Management Decision. vol. 38, Iss3 pp.166-178

Wang, Y., & Feng, Y. (2019). Supply chain management and financial performance in China & manufacturing industry: A moderated mediation model of business process agility and environmental uncertainty. Sustainability, 11(3), 751.

Webber C. M. and Labaste Patrick (2010). Building Competitiveness in Africa's Agriculture. A guide to value chain Concepts and applications. World Bank. http://www.technoserve.org/assets/documents/building-comp.pdf Accessed in June 2010.

Wernerfelt, B. A. (1984). Resource-based view of the firm. *Strategic Management Journal*, (5), 17-180.

WFP. “West and central Africa - WFP Regional Bureau Dakar Markets Update during COVID-19 pandemic” April 2020b

Widyarini M. 2012: Rice value chain : A Structuration Theory Approach. Perjanjian No: III / LPPM/2011-03/71-P

Williams, S. (2019). Institutional Theory in Agriculture: An Overview. *Agricultural Economics Review*, 74(4), 567-585.

Williamson, E. O (1998), Transaction Cost Economics: How it works; Where it is headed**. De Economist, 146 (1) 23-58.

Wolfgang, B. and Muluken, E. (2016).Contributing to a better understanding of the value chain framework in developing countries. Invited Poster Presented At The 5th International Conference Of The African Association Of Agricultural Economists, September 23-26, 2016. Addis Ababa, Ethiopia.

Wooldridge, J.M. 2010. *Econometric Analysis of Cross Section and Panel Data, 2nd Edition*. Cambridge, MA: MIT Press.

Word Bank, 2019. https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=NG.

World Bank (2020). The role of macro level actors in the agricultural value chain. World Bank Group. https://www.worldbank.org/en/topic/agriculture/brief/macro-level-actors-in-agricultural-value-chain.

World Bank (2020). The role of meso level actors in the agricultural value chain. World Bank Group. https://www.worldbank.org/en/topic/agriculture/brief/meso-level-actors-agricultural-value-chain.

World Bank (2020). Understanding the micro level of value chain actors in the agricultural sector. World Bank Group. https://www.worldbank.org/en/topic/agriculture/brief/micro-level-value-chain-actors-agricultural-sector.

World Bank group "Investing in Women along Agribusiness Value Chains", International Finance Corporation Washington, 2016.www.ifc.org.

World Bank Group (2021) Nigeria: Ensuring Water, Sanitation and Hygiene for All. https://www.worldbank.org/en/news/feature/2021/05/26/nigeria-ensuring-water-sanitation-and-hygiene-for-all

World Bank, "BUILDING Social Capital Socio-Economic Intensification, Agriculture for Impact, 2018.

World Bank, https://www.worldbank.org/en/topic/financialsector/brief/agriculture-finance.

World Bank. (2016). Connecting to Compete 2016: Trade Logistics in the Global Economy. Retrieved from https://openknowledge.worldbank.org/handle/10986/23758

World Bank. (2016). Connecting to Compete: Trade Logistics in the Global Economy. Retrieved from https://openknowledge.worldbank.org/handle/10986/23720

World Bank. (2016). Enabling the Business of Agriculture 2017. Retrieved from https://openknowledge.worldbank.org/handle/10986/25030

World Bank. (2016). World Bank LSMS- Integrated Surveys on Agriculture General Household Survey Panel 2015/2016. https://microdata.worldbank.org/index.php/catalog/2734.

World Bank. (2017). Agricultural Value Chain Finance. Retrieved from https://www.worldbank.org/en/topic/agriculture/brief/agricultural-value-chain-finance

World Bank. (2017). Agriculture in Africa – Telling facts from myths. Washington DC: World Bank.

World Bank. (2017). Agriculture in Africa: Telling facts from myths. Retrieved from https://openknowledge.worldbank.org/bitstream/handle/10986/28523/9781464810025.pdf

World Bank. (2018). Cashew and sesame value chains in Tanzania. World Bank Group. Retrieved from https://openknowledge.worldbank.org/handle/10986/29708

World Bank. (2018). Enabling the Business of Agriculture. Washington, DC: World Bank Group.

World Bank. (2019). Agriculture storage and transportation in India: market assessment and recommendations. World Bank Group.

World Bank. (2021). Nigeria: Overview. https://www.worldbank.org/en/country/nigeria/overview

World Bank. (2022). Transport infrastructure. Retrieved from https://www.worldbank.org/en/topic/transport/brief/transport-infrastructure

World Bank. 2007. *World Development Report 2008, Agriculture for Development*. Washington, DC. http://hdl.handle.net/10986/5990

World Bank. 2016. *Linking farmers to markets through productive alliances*. Washington D.C.

World Economic Forum (WEF). 2017. *The Africa competitiveness report 2017: addressing Africa's demographic dividend*. Accessed 9 Sept 2019.http://www3.weforum.org/docs/WEF_ACR_2017.pdf

World Food Programme (WFP). “Update on the impact of Covid-19 on food and nutrition security in West and Central Africa”, 17 April 2020a.

World Intellectual Property Organization. (2021). Intellectual property and agriculture. Retrieved from https://www.wipo.int/ip-outreach/en/ipday/2021/agriculture.html

World population prospect 2019; Data booklet https://population.un.org/wpp/Publications/Files/WPP2019_DataBooklet.pdf.

Wubshet C. 2010. Value Chain Analysis of Fairtrade Coffee: The Case of Bedeno Woreda Primary Coffee Cooperatives, East Hararghe Zone, Ethiopia. MSc Thesis, Haramaya University, Haramaya, Ethiopia.

Xiang, T., Huang, J., Kancs, D., Rozelle, S. &Swinnen, J. F. M. (2012). Food Standards and Welfare: General Equilibrium Effects. Journal of Agricultural Economics 63(2): 223-244

Yakubu S. (2002) Economic Analysis of Groundnut Production in Azare Municipal, Katagum L.G.A of Bauchi State. An unpublished B. Tech. Project of Agricultural Economics and Extension Programme ATBU Bauchi. Pp. 62.

Yang, Q., and Ma, Y. (2019). The impact of economic crises on non-essential consumption: Evidence from China. Journal of Retailing and Consumer Services, 48, 131-137. doi: 10.1016/j.jretconser.2019.01.006

Yinka, A. A. and Abiodun O. O. (2017). "Linkage Between Rural Non-Farm Income and Agricultural Productivity in Nigeria: A Tobit-Two-Stage Least Square Regression Approach," Journal of Developing Areas, Tennessee State University, College of Business, vol. 51(3), pages 317-333, July-Sept.

Zavale, H., Monroy, L. (2014). Analysis of price incentives and disincentives for cashew nuts in the Republic of Mozambique, 2005–2013, FAO, Technical notes series, MAFAP, Rome. Retrieved from < http://www.fao.org/in-action/mafap>[6 November 2015].

Zbinden, S. and Lee, D. R. (2005). Paying for Environmental Services: An Analysis of Participation in Costa Rica's PSA Program. *World Development*, 33:255-272.

Zhang, N. (2017). Relationship between intangible assets and financial performance of listed telecommunication firms in China, based on empirical analysis. *African Journal of Business Management*, *11*(24), 751-757. https://doi.org/10.5897/AJBM2017.8429

Zhou, N. and Guillén, M. F. (2015), From home country to home base: A dynamic approach to the liability of foreignness. Strategic Management Journal, vol. 36, pp. 907–917. https://doi.org/10.1002/smj.2242.

APPENDICES

Appendix I: Two stage least square regression results

First-stage regressions

Number of obs = 283

F(6, 276) = 92.83

Prob > F = 0.0000

R-squared = 0.6687

Adj R-squared = 0.6614

Root MSE = 0.2457

Logwealth_dol~s	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Logage	-.3272703	.1626872	-2.01	0.045	-.6475356	-.0070049
Logedu	.1322063	.0748557	1.77	0.078	-.0151543	.2795669
Loghousehold	-.003862	.0675331	-0.06	0.954	-.1368074	.1290834
Logincome	.201844	.0459131	4.40	0.000	.1114597	.2922283
logSC	1.408039	.0824968	17.07	0.000	1.245636	1.570441
logproductivity	-.0164147	.0226035	-0.73	0.468	-.0609119	.0280824
_cons	1.883709	.3066333	6.14	0.000	1.280072	2.487347

Instrumental variables (2SLS) regression

Source SS df MS Number of obs = 283

F(5, 277) = 3.46

Model 4.32968174 5 .865936347 Prob > F = 0.0047

Residual 295.971072 277 1.06848762 R-squared = 0.0144

Adj R-squared = -0.0034

Total 300.300754 282 1.06489629 Root MSE = 1.0337

logprofit_dollars	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Logwealth_dollars	-.5460994	.2360584	-2.31	0.021	-1.010796	-.0814031
Logage	-2.084218	.6953379	-3.00	0.003	-3.453035	-.7153997
Logedu	-.5608604	.3148073	-1.78	0.076	-1.180579	.0588583
Loghousehold	.2730271	.2836498	0.96	0.337	-.285356	.8314102
Logincome	.1644947	.211638	0.78	0.438	-.2521285	.5811179
_cons	7.407544	1.30777	5.66	0.000	4.833114	9.981973

First-stage regressions

Number of obs = 283
F(9, 273) = 63.32
Prob > F = 0.0000
R-squared = 0.6761
Adj R-squared = 0.6654
Root MSE = 0.2442

Logwealth_dollars	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
logfarmsize	-.038228	.0396063	-0.97	0.335	-.1162007	.0397446
logyield	-.0590238	.0586429	-1.01	0.315	-.1744736	.056426
Logplantation_age	-.1436296	.0687539	-2.09	0.038	-.2789849	-.0082744
Logage	-.2556094	.1677023	-1.52	0.129	-.5857635	.0745447
Logedu	.122971	.0751796	1.64	0.103	-.0250344	.2709764
Loghousehold	-.0010656	.0673966	-0.02	0.987	-.1337487	.1316175
Logincome	.2091298	.0466353	4.48	0.000	.1173192	.3009404
logSC	1.418147	.0831081	17.06	0.000	1.254533	1.581761
logproductivity	.0024521	.0283019	0.09	0.931	-.0532657	.0581699
_cons	2.103908	.3527507	5.96	0.000	1.40945	2.798365

Instrumental variables (2SLS) regression

Source	SS	df	MS	
				Number of obs = 283
				F(8, 274) = 14.32
Model	80.7103015	8	10.0887877	Prob > F = 0.0000
Residual	219.590452	274	.801425009	R-squared = 0.2688
				Adj R-squared = 0.2474
Total	300.300754	282	1.06489629	Root MSE = .89522

logprofit_dollars	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Logwealth_dollars	-.4121803	.2083489	-1.98	0.049	-.8223484	-.0020123
logfarmsize	.917935	.1166292	7.87	0.000	.6883318	1.147538
logyield	1.026702	.2133684	4.81	0.000	.6066518	1.446751
Logplantation_age	.1288446	.255255	0.50	0.614	-.3736657	.6313549
Logage	-1.476273	.6211589	-2.38	0.018	-2.699123	-.2534222
Logedu	-.3581082	.2765428	-1.29	0.196	-.9025269	.1863105
Loghousehold	.1933858	.2458426	0.79	0.432	-.2905946	.6773662
Logincome	-.003232	.1863572	-0.02	0.986	-.3701059	.3636419
_cons	2.55425	1.320979	1.93	0.054	-.0463082	5.154807

Instrumented: Logwealth_dollars
Instruments: logfarmsizelogyieldLogplantation_ageLogageLogeduLoghousehold LogincomelogSClogproductivity
First-stage regressions

Number of obs = 283
F(16, 266) = 36.37
Prob > F = 0.0000
R-squared = 0.6863
Adj R-squared = 0.6674
Root MSE = 0.2435

Logwealth_dollars	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
LogETF	-.3729713	.1352433	-2.76	0.006	-.6392548	-.1066878
logppi	.1232657	.2506411	0.49	0.623	-.3702271	.6167585
logcpi	.0284741	.1568088	0.18	0.856	-.2802703	.3372184
logtax	.1252643	.192738	0.65	0.516	-.2542219	.5047506
loginterest	-.0464164	.1568837	-0.30	0.768	-.3553082	.2624753
logexchange	.1149677	.291536	0.39	0.694	-.4590441	.6889795
loginflation	-.1013264	.2955337	-0.34	0.732	-.6832092	.4805564
logfarmsize	-.023218	.0402987	-0.58	0.565	-.1025629	.056127
logyield	-.0677714	.0589355	-1.15	0.251	-.1838108	.0482681
Logplantation_age	-.1371067	.0715932	-1.92	0.057	-.278068	.0038547
Logage	-.2709847	.1693447	-1.60	0.111	-.6044112	.0624418
Logedu	.1221639	.0752016	1.62	0.105	-.0259022	.2702301
Loghousehold	.008268	.0679525	0.12	0.903	-.1255251	.1420612
Logincome	.2222275	.047512	4.68	0.000	.1286801	.315775
logSC	1.385654	.0841014	16.48	0.000	1.220065	1.551243
logproductivity	-.0181506	.0296304	-0.61	0.541	-.0764905	.0401893
_cons	2.303136	.5993946	3.84	0.000	1.122975	3.483298

Instrumental variables (2SLS) regression

Source	SS	df	MS
Model	86.5810043	15	5.77206695
Residual	213.71975	267	.8004485
Total	300.300754	282	1.06489629

Number of obs = 283
F(15, 267) = 8.27
Prob > F = 0.0000
R-squared = 0.2883
Adj R-squared = 0.2483
Root MSE = .89468

----

logprofit_dollars	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
Logwealth_dollars	-.4690786	.2140623	-2.19	0.029	-.8905434	-.0476137
LogETF	-1.104015	.4876272	-2.26	0.024	-2.064099	-.1439316
logppi	-.0418686	.9193656	-0.05	0.964	-1.851997	1.76826
logcpi	.2338325	.5756712	0.41	0.685	-.8996	1.367265
logtax	-.3778933	.7110683	-0.53	0.596	-1.777908	1.022121
loginterest	.7253156	.5770035	1.26	0.210	-.4107401	1.861371
logexchange	.6306139	1.072705	0.59	0.557	-1.481423	2.74265
loginflation	-.1781392	1.08592	-0.16	0.870	-2.316196	1.959917
logfarmsize	.886963	.1182899	7.50	0.000	.6540633	1.119863
logyield	.9967611	.214986	4.64	0.000	.5734777	1.420045
Logplantation_age	.1629251	.2658854	0.61	0.541	-.3605735	.6864238
Logage	-1.486519	.6289686	-2.36	0.019	-2.724888	-.2481497
Logedu	-.3003221	.2779964	-1.08	0.281	-.847666	.2470218
Loghousehold	.245575	.249272	0.99	0.325	-.2452138	.7363638
Logincome	.0004178	.1922389	0.00	0.998	-.3780792	.3789148
_cons	2.912518	2.15367	1.35	0.177	-1.327818	7.152854

Instrumented: Logwealth_dollars

Instruments: LogETFlogppilogcpilogtaxloginterestlogexchangeloginflation logfarmsizelogyieldLogplantation_ageLogageLogeduLoghousehold LogincomelogSClogproductivity

First-stage regressions

Number of obs = 283

F(18, 264) = 33.11

Prob > F = 0.0000

R-squared = 0.6930

Adj R-squared = 0.6721

Root MSE = 0.2418

Logwealth_dollars	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
log_strategy	.1032005	.0591797	1.74	0.082	-.0133237	.2197248
log_constraints	.2373493	.144467	1.64	0.102	-.0471049	.5218034
LogETF	-.460238	.1391407	-3.31	0.001	-.7342047	-.1862713
logppi	.1631286	.2494174	0.65	0.514	-.3279719	.6542291
logcpi	.0175739	.1559383	0.11	0.910	-.2894671	.3246149
logtax	.1498251	.1923051	0.78	0.437	-.2288218	.528472
loginterest	-.0238775	.1569855	-0.15	0.879	-.3329804	.2852254
logexchange	.1326852	.2895712	0.46	0.647	-.4374778	.7028483
loginflation	-.184383	.2956394	-0.62	0.533	-.7664942	.3977281
logfarmsize	-.0125387	.0403523	-0.31	0.756	-.0919921	.0669146

```
logyield| -.0547517 .0587788 -0.93 0.352 -.1704865 .0609832
Logplantation_age| -.1407738 .071137 -1.98 0.049 -.2808419 -.0007057
Logage| -.2110798 .1700739 -1.24 0.216 -.5459538 .1237941
Logedu | .1101068 .0748384 1.47 0.142 -.0372492 .2574629
Loghousehold | -.004422 .0680944 -0.06 0.948 -.1384992 .1296552
Logincome | .2085681 .0478558 4.36 0.000 .1143405 .3027957
logSC | 1.397996 .0836955 16.70 0.000 1.233201 1.562792
logproductivity| -.0182457 .0295363 -0.62 0.537 -.0764023 .039911
        _cons | 1.894464 .6340901 2.99 0.003 .6459461 3.142981
------------------------------------------------------------------------------
Instrumental variables (2SLS) regression


    Source |      SS       df       MS        Number of obs  =      283
-------------+------------------------------    F( 17,   265)  =     7.43
     Model |  89.146838    17  5.24393164      Prob > F       =   0.0000
  Residual |  211.153916   265  .79680723      R-squared      =   0.2969
-------------+------------------------------    Adj R-squared  =   0.2518
     Total |  300.300754   282  1.06489629      Root MSE       =   .89264
------------------------------------------------------------------------------
logprofit_dollars |     Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------------+-----------------------------------------------------------
Logwealth_dollars| -.4494083 .2121264 -2.12 0.035 -.8670758 -.0317407
log_strategy | .1562833 .2181262 0.72 0.474 -.2731977 .5857644
log_constraints | .7231253 .5326142 1.36 0.176 -.3255687 1.771819
LogETF| -1.278831 .5071202 -2.52 0.012 -2.277328 -.2803331
logppi | .0468545 .9203862 0.05 0.959 -1.765346 1.859055
logcpi | .2211953 .5750917 0.38 0.701 -.9111351 1.353526
logtax| -.2955901 .7136164 -0.41 0.679 -1.700669 1.109489
loginterest | .7448611 .5799185 1.28 0.200 -.396973 1.886695
logexchange | .672629 1.070917 0.63 0.530 -1.43596 2.781218
loginflation| -.3452866 1.092603 -0.32 0.752 -2.496574 1.806001
logfarmsize | .9024612 .1202301 7.51 0.000 .6657333 1.139189
logyield | 1.024577 .2157386 4.75 0.000 .5997968 1.449356
Logplantation_age | .1609028 .2654792 0.61 0.545 -.361814 .6836197
Logage| -1.333798 .6324929 -2.11 0.036 -2.579149 -.0884474
Logedu| -.3288384 .2774304 -1.19 0.237 -.8750866 .2174099
Loghousehold | .2040689 .2504259 0.81 0.416 -.2890089 .6971466
Logincome| -.0241053 .1928835 -0.12 0.901 -.4038845 .3556739
        _cons | 1.684848 2.304029 0.73 0.465 -2.851686 6.221381
------------------------------------------------------------------------------
Instrumented:  Logwealth_dollars
Instruments:
log_strategylog_constraintsLogETFlogppilogcpilogtaxloginterestlogexchangeloginflationlogf
```

armsizelogyieldLogplantation_ageLogageLogeduLoghouseholdLogincomelogSClogproductivity

. ivregress 2sls logprofitlogagelogeduloghouseholdlogincomelogexp (logwealth = logproductivitylogSC), first small

First-stage regressions

Number of obs = 168

F(7, 160) = 68.35

Prob > F = 0.0000

R-squared = 0.7494

Adj R-squared = 0.7384

Root MSE = 0.2575

logwealth	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]	
logage	-.2756323	.2165411	-1.27	0.205	-.7032797	.1520152
logedu	-.2716477	.0894919	-3.04	0.003	-.4483853	-.09491
loghousehold	-.0504507	.1397951	-0.36	0.719	-.3265323	.2256309
logincome	.2789892	.0709932	3.93	0.000	.1387847	.4191938
logexp	.0298321	.0702491	0.42	0.672	-.108903	.1685672
logproductivity	.1400624	.0654426	2.14	0.034	.0108197	.2693052
logSC	2.202034	.1220592	18.04	0.000	1.960979	2.443089
_cons	2.952462	.3577309	8.25	0.000	2.245978	3.658945

Instrumental variables (2SLS) regression

Source SS df MS Number of obs = 168

F(6, 161) = 2.11

Model 9.81824469 6 1.63637411 Prob > F = 0.0554

Residual 170.6102 161 1.05969068 R-squared = 0.0544

Adj R-squared = 0.0192

Total 180.428445 167 1.08040985 Root MSE = 1.0294

logprofit	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]	
logwealth	-.1845091	.2209475	-0.84	0.405	-.620838	.2518198
logage	.1972351	.869108	0.23	0.821	-1.519087	1.913557
logedu	-.4142104	.3485671	-1.19	0.236	-1.102563	.2741427
loghousehold	-1.091388	.5549419	-1.97	0.051	-2.187292	.0045154
logincome	.5254947	.3092283	1.70	0.091	-.0851719	1.136161
logexp	.6995108	.2785979	2.51	0.013	.1493335	1.249688
_cons	3.057334	1.457716	2.10	0.038	.1786236	5.936044

Instrumented: logwealth

Instruments: logagelogeduloghouseholdlogincomelogexplogproductivitylogSC

. ivregress 2sls logprofitloglandsizelogyieldlogagelogeduloghouseholdlogincomelogexp (logwealth = logproductivitylogSC), first small

First-stage regressions

Number of obs = 168

F(9, 158) = 66.53

Prob > F = 0.0000

R-squared = 0.7912
Adj R-squared = 0.7793
Root MSE = 0.2365
logwealth Coef. Std. Err. t P>t [95% Conf. Interval]
loglandsize 3.576551 1.412293 2.53 0.012 .7871418 6.365959
logyield -3.254977 1.40577 -2.32 0.022 -6.031504 -.4784514
logage -.1905798 .1995366 -0.96 0.341 -.584683 .2035233
logedu -.1318207 .0899341 -1.47 0.145 -.3094488 .0458075
loghousehold -.0714803 .1284591 -0.56 0.579 -.3251988 .1822383
logincome .2155837 .0662901 3.25 0.001 .0846546 .3465128
logexp -.0049661 .0649024 -0.08 0.939 -.1331543 .1232221
logproductivity -.0010085 .0651285 -0.02 0.988 -.1296433 .1276262
logSC 2.382825 .1173426 20.31 0.000 2.151062 2.614588
_cons 2.880665 .3301877 8.72 0.000 2.228514 3.532816
Instrumental variables (2SLS) regression
Source SS df MS Number of obs = 168
F(8, 159) = 5.26
Model 36.7608887 8 4.59511109 Prob > F = 0.0000
Residual 143.667556 159 .903569535 R-squared = 0.2037
Adj R-squared = 0.1637
Total 180.428445 167 1.08040985 Root MSE = .95056
logprofit Coef. Std. Err. t P>t [95% Conf. Interval]
logwealth -.0918522 .1974888 -0.47 0.642 -.4818918 .2981874
loglandsize 22.62776 5.606559 4.04 0.000 11.55483 33.7007
logyield -21.85202 5.598738 -3.90 0.000 -32.90951 -10.79453
logage .4399504 .8030564 0.55 0.585 -1.146083 2.025984
logedu -.0515447 .3626158 -0.14 0.887 -.7677096 .6646202
loghousehold -1.023652 .5127959 -2.00 0.048 -2.036422 -.0108816
logincome .3966593 .2827379 1.40 0.163 -.1617469 .9550656
logexp .5037679 .2594302 1.94 0.054 -.0086057 1.016141
_cons 2.432715 1.366263 1.78 0.077 -.26565 5.13108
Instrumented: logwealth
Instruments: loglandsizelogyieldlogagelogeduloghouseholdlogincome logexplogproductivitylogSC

. ivregress 2sls logprofitlogETFloginflationlogexchangeloginterestlogtaxlogcpilogppiloglandsizelogyieldlogagelogeduloghouseholdlogincomelogexp (logwealth = logproductivitylogSC), first small
First-stage regressions
Number of obs = 168
F(16, 151) = 38.88
Prob > F = 0.0000
R-squared = 0.8047
Adj R-squared = 0.7840

Root MSE = 0.2340
logwealth Coef. Std. Err. t P>t [95% Conf. Interval]
logETF -.0425165 .4977596 -0.09 0.932 -1.025989 .9409564
loginflation 1.883874 .7386397 2.55 0.012 .4244707 3.343278
logexchange -.174007 .5966067 -0.29 0.771 -1.352782 1.004768
loginterest .2716578 .5832726 0.47 0.642 -.8807715 1.424087
logtax -.8215639 .3867468 -2.12 0.035 -1.585698 -.05743
logcpi .0729415 .2304687 0.32 0.752 -.3824184 .5283014
logppi -.4283619 .3025122 -1.42 0.159 -1.026065 .1693413
loglandsize 4.383991 1.463398 3.00 0.003 1.492612 7.27537
logyield -4.093617 1.459473 -2.80 0.006 -6.977243 -1.209992
logage -.1804804 .2019337 -0.89 0.373 -.5794607 .2184999
logedu -.1090785 .0909775 -1.20 0.232 -.2888319 .0706748
loghousehold -.0312118 .1283746 -0.24 0.808 -.2848542 .2224307
logincome .1747416 .0698032 2.50 0.013 .0368245 .3126588
logexp -.0101676 .0670446 -0.15 0.880 -.1426342 .1222991
logproductivity -.0262611 .0652467 -0.40 0.688 -.1551754 .1026533
logSC 2.434246 .1205462 20.19 0.000 2.196071 2.672421
_cons 1.88645 1.548376 1.22 0.225 -1.172829 4.945729
Instrumental variables (2SLS) regression
Source SS df MS Number of obs = 168
F(15, 152) = 3.09
Model 41.5868465 15 2.77245643 Prob > F = 0.0002
Residual 138.841598 152 .913431568 R-squared = 0.2305
Adj R-squared = 0.1546
Total 180.428445 167 1.08040985 Root MSE = .95574
logprofit Coef. Std. Err. t P>t [95% Conf. Interval]
logwealth -.0683825 .2020574 -0.34 0.736 -.4675861 .3308211
logETF .2757632 2.0234 0.14 0.892 -3.721857 4.273383
loginflation 5.971595 2.97863 2.00 0.047 .0867328 11.85646
logexchange 2.285769 2.438966 0.94 0.350 -2.532882 7.10442
loginterest -.914226 2.377225 -0.38 0.701 -5.610895 3.782443
logtax -1.545167 1.577184 -0.98 0.329 -4.6612 1.570866
logcpi -.4394464 .941298 -0.47 0.641 -2.299163 1.42027
logppi -1.207384 1.232356 -0.98 0.329 -3.642142 1.227375
loglandsize 24.92214 5.921394 4.21 0.000 13.22328 36.62101
logyield -24.1823 5.920585 -4.08 0.000 -35.87956 -12.48503
logage .6360393 .8253921 0.77 0.442 -.9946829 2.266761
logedu .0695674 .3723838 0.19 0.852 -.6661491 .8052838
loghousehold -.9805094 .5221311 -1.88 0.062 -2.012081 .0510618
logincome .2575945 .2964309 0.87 0.386 -.3280623 .8432513
logexp .5025815 .2726061 1.84 0.067 -.0360047 1.041168
_cons -3.749541 6.333261 -0.59 0.555 -16.26213 8.763044
Instrumented: logwealth

Instruments:
logETFloginflationlogexchangeloginterestlogtaxlogcpilogppiloglandsizelogyieldlogagelogeduloghouseholdlogincomelogexplogproductivitylogSC
. ivregress 2sls logprofitlogstartegylogconstraintslogETFloginflationlogexchangeloginterestlogtaxlogcpilogppiloglandsizelogyieldlogagelogeduloghouseholdlogincomelogexp (logwealth = logproductivitylogSC), first small

First-stage regressions
Number of obs = 168
F(18, 149) = 36.66
Prob > F = 0.0000
R-squared = 0.8158
Adj R-squared = 0.7935
Root MSE = 0.2287

logwealth	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]	
logstartegy	-1.170442	.4250936	-2.75	0.007	-2.010433	-.3304516
logconstraints	.3590566	.2059352	1.74	0.083	-.047874	.7659872
logETF	.4914004	.6077456	0.81	0.420	-.7095129	1.692314
loginflation	1.989862	.7234417	2.75	0.007	.5603317	3.419392
logexchange	-.2324349	.5875382	-0.40	0.693	-1.393418	.9285483
loginterest	.6684399	.5909169	1.13	0.260	-.4992196	1.836099
logtax	-.8916149	.3793124	-2.35	0.020	-1.641141	-.1420886
logcpi	.0164185	.2262597	0.07	0.942	-.4306737	.4635107
logppi	-.4799602	.2977759	-1.61	0.109	-1.068369	.1084489
loglandsize	3.815479	1.444848	2.64	0.009	.9604399	6.670519
logyield	-3.618527	1.436677	-2.52	0.013	-6.457419	-.7796347
logage	-.1394727	.1988545	-0.70	0.484	-.5324117	.2534664
logedu	-.1131169	.088956	-1.27	0.205	-.2888951	.0626613
loghousehold	.0057979	.1261729	0.05	0.963	-.2435215	.2551172
logincome	.1561473	.0685407	2.28	0.024	.02071	.2915847
logexp	-.0221726	.0660186	-0.34	0.737	-.1526263	.1082811
logproductivity	-.034126	.0650186	-0.52	0.600	-.1626036	.0943517
logSC	2.371295	.1357002	17.47	0.000	2.10315	2.639441
_cons	2.086704	1.526996	1.37	0.174	-.9306611	5.104069

Instrumental variables (2SLS) regression
Source SS df MS Number of obs = 168
F(17, 150) = 2.76
Model 41.0035137 17 2.41197139 Prob > F = 0.0005
Residual 139.424931 150 .92949954 R-squared = 0.2273
Adj R-squared = 0.1397
Total 180.428445 167 1.08040985 Root MSE = .96411

logprofit	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]	
logwealth	-.2024484	.2385347	-0.85	0.397	-.6737704	.2688735

logstartegy -.3708953 1.801316 -0.21 0.837 -3.930126 3.188335
logconstraints .9968048 .8944858 1.11 0.267 -.7706144 2.764224
logETF -.4759082 2.527636 -0.19 0.851 -5.470278 4.518462
loginflation 6.135018 3.012554 2.04 0.043 .1824972 12.08754
logexchange 2.473366 2.475669 1.00 0.319 -2.418322 7.365055
loginterest -.2224048 2.492926 -0.09 0.929 -5.148191 4.703381
logtax -1.608915 1.597318 -1.01 0.315 -4.765064 1.547235
logcpi -.5175922 .9534731 -0.54 0.588 -2.401565 1.366381
logppi -1.181885 1.248757 -0.95 0.345 -3.64931 1.28554
loglandsize 24.48061 6.004392 4.08 0.000 12.6165 36.34473
logyield -23.86192 5.991303 -3.98 0.000 -35.70017 -12.02367
logage .5566283 .840391 0.66 0.509 -1.103905 2.217161
logedu .0602458 .3759205 0.16 0.873 -.6825375 .8030291
loghousehold -.9560703 .5302864 -1.80 0.073 -2.003866 .0917254
logincome .2826062 .3000308 0.94 0.348 -.3102262 .8754387
logexp .4592371 .2775117 1.65 0.100 -.0890999 1.007574
_cons -4.076603 6.425475 -0.63 0.527 -16.77273 8.619527

Instrumented: logwealth
Instruments:
logstartegylogconstraintslogETFloginflationlogexchangeloginterestlogtaxlogcpilogppilogland sizelogyieldlogagelogeduloghouseholdlogincomelogexplogproductivitylogSC

Appendix II: Ordinary least Square regression results

Source SS df MS Number of obs = 283
F(5, 277) = 10.29
Model 25.3335048 5 5.06670095 Prob > F = 0.0000
Residual 136.451463 277 .492604559 R-squared = 0.1566
Adj R-squared = 0.1414
Total 161.784968 282 .573705559 Root MSE = .70186

logTC Coef. Std. Err. t P>t [95% Conf. Interval]
Logage .0777025 .641264 0.12 0.904 -1.184667 1.340072
Logedu 1.02089 .2052207 4.97 0.000 .6169 1.424881
Loghousehold .2542702 .190958 1.33 0.184 -.121643 .6301835
loginc .3457169 .1267292 2.73 0.007 .0962422 .5951917
Logexp -.0327342 .301884 -0.11 0.914 -.6270125 .561544
_cons 1.261227 .7896754 1.60 0.111 -.2933005 2.815754

Source SS df MS Number of obs = 283
F(11, 271) = 18.48
Model 69.3351896 11 6.30319906 Prob > F = 0.0000

Residual 92.4497781 271 .341143093 R-squared = 0.4286
Adj R-squared = 0.4054
Total 161.784968 282 .573705559 Root MSE = .58407

logTC Coef. Std. Err. t P>t [95% Conf. Interval]
logseeds .2274607 .0590188 3.85 0.000 .1112671 .3436543
logimplements -.3352103 .1340637 -2.50 0.013 -.599149 -.0712715
logfertilizers -.0763603 .0567809 -1.34 0.180 -.1881482 .0354275
loglabour .0210744 .046535 0.45 0.651 -.0705417 .1126906
loglands -.1546961 .0848871 -1.82 0.070 -.3218181 .0124259
logchemical .1426264 .0684003 2.09 0.038 .0079628 .27729
Logage .8920314 .5474941 1.63 0.104 -.185851 1.969914
Logedu .7290343 .175441 4.16 0.000 .3836336 1.074435
Loghousehold .2183894 .1602511 1.36 0.174 -.097106 .5338848
loginc .2041166 .1116672 1.83 0.069 -.015729 .4239621
Logexp -.3052235 .2544978 -1.20 0.231 -.8062676 .1958207
_cons 1.119876 .6635452 1.69 0.093 -.1864824 2.426235

Source SS df MS Number of obs = 283
F(13, 269) = 31.35
Model 97.4537083 13 7.4964391 Prob > F = 0.0000
Residual 64.3312594 269 .239149663 R-squared = 0.6024
Adj R-squared = 0.5831
Total 161.784968 282 .573705559 Root MSE = .48903

logTC Coef. Std. Err. t P>t [95% Conf. Interval]
loginbound .4285918 .0717789 5.97 0.000 .2872719 .5699117
logoutbound .2663614 .0266834 9.98 0.000 .2138265 .3188963
logseeds .1295907 .0504493 2.57 0.011 .030265 .2289164
logimplements -.1751012 .1132343 -1.55 0.123 -.3980395 .047837
logfertilizers -.1210226 .0477752 -2.53 0.012 -.2150836 -.0269617
loglabour .0292571 .0389801 0.75 0.454 -.0474877 .1060019
loglands -.0735658 .0715214 -1.03 0.305 -.2143788 .0672471
logchemical .0179809 .0584699 0.31 0.759 -.0971359 .1330977
Logage .4896017 .4654377 1.05 0.294 -.4267622 1.405966
Logedu .4707887 .1496171 3.15 0.002 .1762192 .7653582
Loghousehold .0033139 .1359636 0.02 0.981 -.2643742 .271002
loginc .1149332 .0942019 1.22 0.224 -.0705336 .3004
Logexp .0682192 .2170488 0.31 0.754 -.3591113 .4955496
_cons 1.335702 .5617832 2.38 0.018 .2296508 2.441753

Source SS df MS Number of obs = 283
F(14, 268) = 29.18
Model 97.6908039 14 6.97791456 Prob > F = 0.0000

Residual 64.0941638 268 .239157328 R-squared = 0.6038
Adj R-squared = 0.5831
Total 161.784968 282 .573705559 Root MSE = .48904

logTC Coef. Std. Err. t P>t [95% Conf. Interval]
LogETF .2690563 .2702237 1.00 0.320 -.2629749 .8010876
loginbound .4343347 .0720114 6.03 0.000 .2925546 .5761147
logoutbound .2614728 .0271318 9.64 0.000 .2080542 .3148913
logseeds .1277744 .0504831 2.53 0.012 .0283806 .2271683
logimplements -.1770495 .1132531 -1.56 0.119 -.4000284 .0459294
logfertilizers -.1164432 .0479969 -2.43 0.016 -.2109421 -.0219443
loglabour .0217474 .0397036 0.55 0.584 -.0564233 .0999182
loglands -.0672477 .0718035 -0.94 0.350 -.2086184 .0741231
logchemical .0171561 .0584767 0.29 0.769 -.0979761 .1322882
Logage .4733148 .4657325 1.02 0.310 -.443645 1.390275
Logedu .4630909 .1498191 3.09 0.002 .1681187 .7580631
Loghousehold .0015395 .1359775 0.01 0.991 -.2661804 .2692594
loginc .1099002 .0943389 1.16 0.245 -.0758395 .2956399
Logexp .0682059 .2170523 0.31 0.754 -.3591385 .4955504
_cons 1.012793 .6486811 1.56 0.120 -.2643658 2.289953

```
     Source |       SS       df       MS              Number of obs =     168
-------------+------------------------------           F(5, 162)     =    4.37
      Model |  4.88772496     5  .977544991           Prob > F      =  0.0009
   Residual |  36.2716789   162  .223899252           R-squared     =  0.1188
-------------+------------------------------           Adj R-squared =  0.0916
      Total |  41.1594038   167  .246463496           Root MSE      =  .47318
------------------------------------------------------------------------------
logTC |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
logage| -.1899574   .3972886   -0.48   0.633   -.9744894   .5945746
logedu |  .1863488   .1587778    1.17   0.242   -.1271923   .4998899
loghousehold |  -.020301   .253917   -0.08   0.936   -.5217148   .4811129
logincome |  .5097125   .1205079    4.23   0.000    .2717438   .7476813
logexp| -.0713855   .1273783   -0.56   0.576   -.3229215   .1801504
      _cons |  3.443805   .6435797    5.35   0.000    2.172918   4.714692
------------------------------------------------------------------------------
     Source |       SS       df       MS              Number of obs =     168
-------------+------------------------------           F(11, 156)    =   13.66
      Model |  20.1915455    11  1.83559504           Prob > F      =  0.0000
   Residual |  20.9678583   156  .134409348           R-squared     =  0.4906
-------------+------------------------------           Adj R-squared =  0.4546
      Total |  41.1594038   167  .246463496           Root MSE      =  .36662
------------------------------------------------------------------------------
logTC |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
```

logseed	.4449166	.2200949	2.02	0.045	.0101659	.8796673
logimplements	.3217995	.5902525	0.55	0.586	-.844119	1.487718
logferti	-.5889909	.2556288	-2.30	0.023	-1.093931	-.0840505
loglabour	-.3455652	.1504749	-2.30	0.023	-.6427965	-.0483339
logland	-.1318918	.2248851	-0.59	0.558	-.5761045	.312321
logchemical	-.1481163	.2109783	-0.70	0.484	-.564859	.2686264
logage	-.2707883	.3106809	-0.87	0.385	-.8844724	.3428959
logedu	.1209063	.1362914	0.89	0.376	-.1483083	.3901209
loghousehold	-.152673	.2048669	-0.75	0.457	-.557344	.251998
logincome	.4534726	.0942774	4.81	0.000	.2672476	.6396976
logexp	-.1121428	.100234	-1.12	0.265	-.3101337	.0858481
_cons	4.003703	.5112702	7.83	0.000	2.993797	5.013608

Source	SS	df	MS		
				Number of obs =	168
				F(13, 154) =	11.57
Model	20.3373288	13	1.5644099	Prob > F =	0.0000
Residual	20.8220751	154	.13520828	R-squared =	0.4941
				Adj R-squared =	0.4514
Total	41.1594038	167	.246463496	Root MSE =	.36771

logTC	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
loginbound	.0426601	.0410851	1.04	0.301	-.038503	.1238232
logoutbound	-.0170215	.0508899	-0.33	0.738	-.1175538	.0835109
logseed	.4365367	.2215987	1.97	0.051	-.0012289	.8743022
logimplements	.345066	.5928751	0.58	0.561	-.8261516	1.516284
logferti	-.5903832	.2588923	-2.28	0.024	-1.101822	-.0789445
loglabour	-.3463479	.1512427	-2.29	0.023	-.645126	-.0475698
logland	-.1542209	.2266737	-0.68	0.497	-.602012	.2935703
logchemical	-.1571185	.2126155	-0.74	0.461	-.5771378	.2629008
logage	-.2400486	.3130167	-0.77	0.444	-.8584094	.3783122
logedu	.1399983	.1379362	1.01	0.312	-.1324931	.4124896
loghousehold	-.1706927	.2080362	-0.82	0.413	-.5816658	.2402803
logincome	.4642165	.0952146	4.88	0.000	.2761213	.6523117
logexp	-.1202907	.1008835	-1.19	0.235	-.3195848	.0790034
_cons	3.934091	.5171529	7.61	0.000	2.912462	4.955721

Source	SS	df	MS		
				Number of obs =	168
				F(14, 153) =	12.04
Model	21.5787254	14	1.54133753	Prob > F =	0.0000
Residual	19.5806784	153	.12797829	R-squared =	0.5243
				Adj R-squared =	0.4807
Total	41.1594038	167	.246463496	Root MSE =	.35774

logTC	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
logETF	2.374572	.7624269	3.11	0.002	.8683288	3.880815
loginbound	.0885898	.0426052	2.08	0.039	.0044195	.1727602
logoutbound	-.0416965	.0501405	-0.83	0.407	-.1407535	.0573605
logseed	.4291625	.2156055	1.99	0.048	.0032143	.8551106
logimplements	.3021159	.5769707	0.52	0.601	-.8377418	1.441974
logferti	-.5640776	.2520169	-2.24	0.027	-1.06196	-.0661954
loglabour	-.353901	.1471634	-2.40	0.017	-.6446356	-.0631664
logland	-.1337455	.2206279	-0.61	0.545	-.5696159	.3021249
logchemical	-.1332897	.2069942	-0.64	0.521	-.5422255	.2756461
logage	-.1884763	.3049826	-0.62	0.538	-.7909971	.4140444
logedu	.1481451	.1342231	1.10	0.271	-.1170248	.413315
loghousehold	-.1876505	.2024709	-0.93	0.355	-.58765	.2123489
logincome	.3996875	.0949227	4.21	0.000	.2121592	.5872158
logexp	-.0939666	.0985124	-0.95	0.342	-.2885868	.1006536
_cons	.5937245	1.184675	0.50	0.617	-1.746707	2.934156

Appendix III: First-stage regression summary statistics, endogeneity and overidentification test for

Tests of endogeneity
Ho: variables are exogenous
Durbin (score) chi2(1) = 15.7288 (p = 0.0001)
Wu-Hausman F(1,264) = 15.5363 (p = 0.0001)

Tests of overidentifying restrictions:
Sargan chi2(1) = 62.3276 (p = 0.0000)
Basmann chi2(1) = 74.5652 (p = 0.0000)

First-stage regression summary statistics

Variable	R-sq.	Adjusted R-sq.	Partial R-sq.	F(2,264)	Prob > F
Logwealth_~s	0.6931	0.6722	0.5387	154.119	0.0000

Shea's partial R-squared

Variable	Shea's Partial R-sq.	Shea's Adj. Partial R-sq.
Logwealth_~s	0.5387	0.5091

Minimum eigenvalue statistic = 154.119

Critical Values # of endogenous regressors: 1
Ho: Instruments are weak # of excluded instruments: 2

	5%	10%	20%	30%
2SLS relative bias	(not available)			

	10%	15%	20%	25%
2SLS Size of nominal 5% Wald test	19.93	11.59	8.75	7.25
LIML Size of nominal 5% Wald test	8.68	5.33	4.42	3.92

Tests of overidentifying restrictions:
Sargan chi2(1) = 30.4999 (p = 0.0000)
Basmann chi2(1) = 33.0508 (p = 0.0000)

Tests of endogeneity
Ho: variables are exogenous
Durbin (score) chi2(1) = 14.3607 (p = 0.0002)
Wu-Hausman F(1,149) = 13.9271 (p = 0.0003)

First-stage regression summary statistics

Variable	R-sq.	Adjusted R-sq.	Partial R-sq.	F(2,149)	Prob > F
logwealth	0.8158	0.7935	0.6769	156.1	0.0000

Shea's partial R-squared

Variable	Shea's Partial R-sq.	Shea's Adj. Partial R-sq.
logwealth	0.6769	0.6403

Minimum eigenvalue statistic = 156.1

Critical Values # of endogenous regressors: 1
Ho: Instruments are weak # of excluded instruments: 2

Appendix IV: Survey questionnaire

QUESTIONNAIRE

General information	
Name of farmer:	**Mobile number:**
Geopolical zone:	**State:**
Date:	**Questionnaire number:**

This study is undertaken to analyse **the agricultural value chain *optimisation* in a turbulent economy w case study of smallholder farmers in Nigeria** using three geopolitical zones of southwest, north east and no central Nigeria.

The purpose of administering this questionnaire is strictly for academic research. The information provided v assist in broadening the knowledge and understanding of the importance of agricultural value chain towards tra for economic growth and development of African countries. Please, your honest and confidential responses this survey will be much appreciated and treated with utmost confidentiality.

SECTION ONE: PERSONAL PROFILE						
1. Please indicate your level of education, gender, marital status, age, household size and source of farmland						
Level of Education		*Gender*		*Marital status*		source of farmlan
No formal education	☐	Male	☐	Single	☐	Self-owned
Adult literacy	☐	Female	☐	Married	☐	Inherited
Primary education	☐			Divorced	☐	Lease/borrowed
Secondary education	☐			Separated	☐	
Tertiary	☐			Widowed	☐	
Age						
Household size						
What's your average monthly income?						

Production characteristics						
3. Which type of crop enterprise are you into?	Cashew	☐	sesame	☐		
4. Other crop enterprise: 1=maize, 2= cassava, 3= yam, 4= vegetables, 5= cocoa, 6= rice, 7= potatoes, 7= fibre crops						
What is the total size of your land in ha?						
What size of the land is under cashew/sesame cultivation?						
Have you ever used agricultural inputs (fertilizer, chemicals, improved seeds etc.) for the production of vegetables?	Yes	☐	No	☐		
If yes, Please indicate which input is used, source, and the cost?						

Inputs type	Source of input: Govt=1, Local market=2, Research=3, Cooperatives=4, NGO=5, Fellow farmers=6	How? Purchase=1, Gift=2, Credit=3, Exchange= Others=5
Land		
Improved Seed		
Fertilizers		
Labour		
Pesticides/Herbicides		
Fuel		
Farm implements		

Do you always get inputs in the quantities that you need at the right time?	Yes	☐	No	☐		
Have you encountered problems in accessing these inputs	Yes	☐	No	☐		
If yes, what are the problems? (*Multiple responses are possible) Unavailability=1, shortage of supply=2, Costly=3, Remoteness of input selling site=4, others=5						
What is the yield of RCN/sesame per ha						
Marketing characteristics						
Do you market raw cashew nut/sesame seeds?	Yes	☐	No	☐		
To whom did you sell your raw cashew nut/sesame seeds?	1. Wholesalers, 2. Retailers (rural), 3. Consumers, 4. Collectors, 5.Institutions (hotels, Universities, etc) 6. Processers, 7. Brokers, 8. Produce buyers, 9. Others (specify					
Where did you sell your raw cashew nuts/sesame seeds	1. Local markets, 2. Zonal markets, 3. Export markets					
Do you buy RCN/sesame seeds?	Yes	☐	No	☐		
Whom did you buy from?	1. Farmers , 2. Rural collectors, 3. Produce buyers, 4. Dealers					
Quantities bought in metric tons__________________________________						
Cost per unit tons_________________________________						
How do you transport your RCN/sesame seeds?	1. Truck, 2.Car, 3. Motorcycle					
In deciding to whom to sell, what factors do you consider? (Multiple responses are possible)	1. Transport availability 2. Price 3. Fairness of scaling (Weighi 3. Closeness in distance 5. Others (specify) ______________					
Who sets the market price?	1. Rural Collectors 2. Consumers 3. Wholesalers 4. Retailers, Processors, 6. [ ] Brokers, 7. Produce buyers, 8. Others (speci _________					
Do your RCN/sesame seeds have preferred qualities by buyers?	Yes	☐	No	☐		
Do you get marketing information	Yes	☐	No	☐		
From whom did you get the information	1. fellow farmers, 2. Radio/television, 3. Cooperatives, 4. Mark					
What type of information did you get?	1.Price information 2.Market place information 3. Buye information 4. Other (specify) ________					
Did you face difficulty in finding buyers when you wanted to sell RCN/sesame seeds?	Yes	☐	No	☐		

If your answer to the question above yes, what are the reasons?	1.Inaccessibility of market 2.Lack of market information 3. L price offered 4. Others (specify) ____________					
Processing and packaging characteristics						
Do you process your RCN/sesame seeds	Yes	☐	No	☐		
Which processing activities do you engaged in your unit?	1. Shelling, 2. Cutting, 3. Peeling, 4. Grading, 5. Packing Steaming, 7. Roasting, 8. CNSL extraction, 9. Destining, Dehulling					
Which method do you used in processing?	Modern	☐	Traditional	☐		
4. Ownership of processing machine	Owned	☐	Hired	☐		
5.Is the harvested cashew/sesame seed enough for processing?	Yes	☐	No	☐		
6. Do you buy raw cashew nuts/sesame seeds?	Yes	☐	No	☐		
8. If yes, where do you buy from?						
11. Quantity of shelled cashew nut/sesame seed in kg:						
12. Processing capacity size in metric tons:						
13. Number of labour engaged in processing and packaging:						
12. Did you experience any processing loss?	Yes	☐	No	☐		
To whom did you sell your processed cashew/sesame seeds? Wholesalers=1, Retailers=2, Consumers=3, Offtakers=5, Institutions=5, Brokers=6, Others=7						
Where did you sell your processed cashew/sesame seeds? Export markets=1, Local markets=2						
Did you face difficulty in finding buyers?	Yes	☐	No	☐		
How do you transport your processed cashew/sesame seeds	1. Truck, 2.Car, 3. Motorcycle, 4. Others					
Do you package you cashew/sesame seeds after processing	Yes	☐	No	☐		
Do you buy processed cashew/sesame seeds	Yes	☐	No	☐		
What quantity of kernel/sesame seeds do you buy in Kg						
Number of labour engages in packaging						
What materials do you used for packaging	1. Polythene bag 2. Can/Tin 3. Plastic					

	4. Paper bag 5. Bottles					
Do you encounter any difficulty in getting packaging materials?	Yes	☐	No	☐		
If yes, what are the difficulties	1. Unavailability 2. Expensive 3. Lack of nearby market 4. Poor quality materials					
Where do you sell your packaged product?	1. Local market 2. Export market					
How do you transport your packaged product	1. Van 2. Cooing van 3. Car 4. Motorcycle 5. Truck					

Household wealth

Household physical assets

	Do you own this? 1=Yes 0=No	Quantity	Price	Value as at January 2021			
Vehicle							
Motorcycle							
Bicycle							
Television							
Radio							
Electric fan							
Pressing iron							
Fridge/refrigerator/freezer							
Mobile phone							
Solar gadget							
Gas cylinder							
Cooking gas burner							
Kerosene stove							

Household financial assets

Kindly indicate the amount of monthly total household earnings from the following

Agricultural production				
Self-employed work				
Salaried employment				
Casual wage work				
Pension				
Others (Specify)				
Total				

Access to capital and support services							
Do you have access to capital and support services?	Yes	☐	No	☐			
If yes, how much did you take?							
If yes, kindly indicate the purpose of accessing the funding support							
To purchase fertilizer	☐						
To rent in land to extend production	☐						
To purchase seed/seedlings	☐						
To purchase Motor pump/irrigation equipment	☐						
Agricultural production	☐						
Processing	☐						
To boost agricultural marketing	☐						
Kindly indicate the source of capital and support services							
Bank	☐						
Ownfund	☐						
Finance companies	☐						
Rotating savings and credit association	☐						
Family and friends	☐						
Cooperative society	☐						

Extension contact										
Did you have extension contact?	Yes	☐	No	☐		☐		☐		☐
If No, what are the reasons for no extension contacts (Multiple responses are possible) No service provider nearby=1, Possessed the required										

information=2, Availability of contact farmer/processor=3, Do not have time to get the service=4, Others=5										
If yes, how often do you get extension contact?	Weekly	☐	Bi-weekly☐☐	☐	Monthly	☐	Bi-monthly	☐	Yearly	☐

SECTION TWO: Economic turbulence variables

To what extent do you agree that the following economic turbulence factors impact agricultural value chain *optimisation*? (1= Strongly Disagree, 2 = Disagree, 3 = Uncertain, 4 = Agree, 5 = Strongly Agree)

	1	2	3	4	5		
Inflation	☐	☐	☐	☐	☐		
Exchange rate	☐	☐	☐	☐	☐		
Taxation	☐	☐	☐	☐	☐		
Gross domestic product	☐	☐	☐	☐	☐		
Consumer price index	☐	☐	☐	☐	☐		
Unemployment	☐	☐	☐	☐	☐		
Producer price index	☐	☐	☐	☐	☐		
Loan	☐	☐	☐	☐	☐		

To what extent do you agree that the following statements on inflation rate impact agricultural value ch *optimisation*? (1= Strongly Disagree, 2 = Disagree, 3 = Uncertain, 4 = Agree, 5 = Strongly Agree)

Statement	1	2	3	4	5		
Inflation rate has changed in the last 12 months by more than 3%	☐	☐	☐	☐	☐		
Rises in inflation rate has caused the cost of production to increased by more than 3%	☐	☐	☐	☐	☐		
Increase in prices would make differences in the value chain *optimisation* of cashew/sesame	☐	☐	☐	☐	☐		
The rate of inflation does not influence the cost of inputs	☐	☐	☐	☐	☐		
Rate of inflation has caused significant reduction in the value chain *optimisation* of cashew/sesame	☐	☐	☐	☐	☐		

To what extent do you agree that the following statements on exchange rate impact agricultural value ch *optimisation*? (1= Strongly Disagree, 2 = Disagree, 3 = Uncertain, 4 = Agree, 5 = Strongly Agree)

Statement	1	2	3	4	5		

Losses were incurred as a result of variation in exchange rate	☐	☐	☐	☐	☐		
Production cost increased as a result of soaring in exchange rate.	☐	☐	☐	☐	☐		
Increase in cost of inputs engendered by rise in exchange rate reduced the value chain *optimisation*.	☐	☐	☐	☐	☐		
Fluctuation in exchange rate impacted the total output in Naira of cashew/sesame enterprise .	☐	☐	☐	☐	☐		
Variation in exchange brought about the instability in the cost of transportation.	☐	☐	☐	☐	☐		
To what extent do you agree that the following statements on interest rate impact agricultural value ch *optimisation*? (1= Strongly Disagree, 2 = Disagree, 3 = Uncertain, 4 = Agree, 5 = Strongly Agree)							
Statement	1	2	3	4	5		
High interest rate results in high cost of production	☐	☐	☐	☐	☐		
Variation in interest rate impacted the value chain *optimisation* of cashew/sesame production	☐	☐	☐	☐	☐		
High interest rate prevent farmers from accessing loans from credit sources	☐	☐	☐	☐	☐		
Interest in bank loans and savings have increased over the last 12 months	☐	☐	☐	☐	☐		
A rise in interest rate will make the prices of inputs rise slowly in the short term	☐	☐	☐	☐	☐		
The current interest rate has no effect on the value chain *optimisation* of cashew/sesame	☐	☐	☐	☐	☐		
To what extent do you agree that the following statements on taxation impact agricultural value ch *optimisation*? (1= Strongly Disagree, 2 = Disagree, 3 = Uncertain, 4 = Agree, 5 = Strongly Agree)							
Statement	1	2	3	4	5		
I know the effect of taxation on the cashew/sesame production	☐	☐	☐	☐	☐		
I know the government provides assistance to reduce the burden of taxation on farmers	☐	☐	☐	☐	☐		

I still use the same amount of inputs despite the price increase by taxation	☐	☐	☐	☐	☐		
Taxation resulted in increase in the cost of production due to high cost of transportation and input price	☐	☐	☐	☐	☐		
Taxation lowers the value chain *optimisation* of cashew/sesame enterprise	☐	☐	☐	☐	☐		
Increase in taxation will result in higher value chain *optimisation*	☐	☐	☐	☐	☐		
To what extent do you agree that the following statements on consumer price index impact agricultural value chain *optimisation*? (1= Strongly Disagree, 2 = Disagree, 3 = Uncertain, 4 = Agree, 5 = Strongly Agree)							
Statement	1	2	3	4	5		
Local prices of cashew/sesame are higher than international prices	☐	☐	☐	☐	☐		
Farmers rarely received the information on new prices	☐	☐	☐	☐	☐		
Input prices are felt more than the output prices	☐	☐	☐	☐	☐		
Price changes influenced the value chain *optimisation* of cashew/sesame enterprise	☐	☐	☐	☐	☐		
Comparative cost advantage due to changes in price of inputs has effects on value chain *optimisation*	☐	☐	☐	☐	☐		
Climatic factors are key factors in the weak response of farmers to higher crop prices	☐	☐	☐	☐	☐		
To what extent do you agree that the following statements on producer price index impact agricultural value chain *optimisation*? (1= Strongly Disagree, 2 = Disagree, 3 = Uncertain, 4 = Agree, 5 = Strongly Agree)							
Statement	1	2	3	4	5		
Prices received for produce at farm gate are low during last season	☐	☐	☐	☐	☐		
Prices received for produce at farm gate are high during last season	☐	☐	☐	☐	☐		
There is high value chain *optimisation* last season due to high producers' price	☐	☐	☐	☐	☐		

There is low value chain *optimisation* last season due to low producers' price	☐	☐	☐	☐	☐		
Producers' price varies from season to season	☐	☐	☐	☐	☐		

SECTION THREE: Cost benefit structure of value chain

I. Cost benefit structure of primary production activities

Please indicate the estimated cost incurred on farming operation last season

Primary production cost components	Quantity	Unit price	Total	
Fertilizer application				
Insecticides/Pesticides/Herbicides application				
Planting				
Land clearing				
Plantation maintenance e.g. weeding and irrigation				
Harvesting				
Transportation of inputs				
Loading and offloading				

II. Cost benefit structure of marketing of raw produce

Please indicate the estimated cost incurred on marketing of raw produce last season

Marketing variable cost components	Quantity	Unit price	Total	
Transportation of harvested produce to the market				
Marketing materials e.g. jute bags, sacks				
Loading and offloading				
Labour packing				
Lost during transportation				
Rents				
Taxes and levies				
Selling price of RCN/sesame seeds				
Marketing fixed cost components	**Quantity**	**Unit price**	**Total**	
Weighing scale				
Depreciation on structure				
Depreciation on tables, chairs, bowl e.t.c.				

III. Cost benefit structure of processing and packaging							
Please indicate the variable cost incurred on processing and packaging last season							
Variable cost components	**Quantity**	**Unit price**	**Total**				
Raw cashew nut/sesame seed							
Transportation of raw cashew nut/sesame seeds							
Loading and offloading							
Firewood							
Frying							
Labour (temporary)							
Frying pan hiring							
Electricity							
Processing machine hiring							
Fuel							
Packaging material							
Packaging cost							
Transportation of finished products from RCN/sesame seeds							
Kindly indicate the fixed cost incurred on processing last season							
Fixed cost components	**Quantity**	**Unit price**	**Amount**				
Boiler							
Permanent labour wages							
Land							
Building/Structure/Warehouse							
Oven							
Nut cracker							
Steamer/Thermasal							
Sesame sieve							
Generator							
Weighing scale							
Kindly indicate the revenue generated from processing and packaging last season							
Revenue component	**Quantity**	**Unit price**	**Total**				
Cashew nut shell liquid							
Whole kernel							
Broken kernel							
Shell							
Clean Sesame seed							
Dehulled sesame seed							
Sesame seed hulls							

SECTION FOUR: Strategies to overcome the institutional challenges of macroeconomic factors

Kindly indicate the strategies to overcome the institutional challenges of macroeconomics on scale of 1 to 5

	1	2	3	4	5		
Government support for easy access to inputs							
Increase in free trade							
Encourage private to invest on the processing and packaging							
Flexible interest rate							
Flexible exchange rate							
Increase credibility and market linkages of cashew and sesame value chain actors							
Control unlicensed traders							
Strengthen credits service providers institutions and improve storage facility							

SECTION FIVE: Institutional constraints to the *optimisation* of value chain by smallholder farmers

Kindly rate the severity of the constraints to value chain *optimisation* on a scale of 1=not severe to 3=severe

	1	2	3				
Lack of Investment	☐	☐	☐				
Non-inclusion of vulnerable groups	☐	☐	☐				
Missing linkages between farms and markets	☐	☐	☐				
High cost of transportation	☐	☐	☐				
Land Tenure system	☐	☐	☐				
Limited market for produced product	☐	☐	☐				
Lack of power coupled with high cost of processing equipment	☐	☐	☐				
Inadequate research	☐	☐	☐				

Appendix V: Stakeholders' key informant interview unstructured questionnaire

The agricultural value chain *optimisation* in a turbulent economy with case study of smallholder farmers in Nigeria

Key Informant Interview

Date ________________________

Name of interviewee ___________________________

1. What are the inputs used in cashew/sesame farming?
2. Does input cost has any effect on the total cost of production and why?
3. Do you incure costs on transportation of inputs and produce and at what stage of the value chain? Can you give the estimated cost?
4. What is the most important constraining economic factors affecting cashew/sesame production?
5. Does the economic crisis have effect on cashew/sesame seeds production and marketing?
6. What are the effects of inflation on cashew/sesame seeds farming enterprise?
7. What are the impacts of exchange rate on cashew/sesame seeds farming?
8. What are the effects of these factors on total cost of production and value chain *optimisation* of cashew/sesame seeds?
9. What are the causes of economic turbulent in your opinion
10. What are the possible solutions to correct these problems?
11. What are the major challenges of the cashew/sesame seeds sectors?
12. How profitable is cashew/sesame seed production?