ANALYSIS OF MAIZE VALUE CHAIN IN IMO STATE, NIGERIA

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CERTIFICATION

This is to certify that this work "Analysis of **Maize Value Chain in Imo state Nigeria"** was carried out by **NNOROM EMMANUEL IYKE, (Reg. No:20154949538)** in partial fulfilment for the award of the degree of Master of Science (M.Sc.) in Farm Management and Production Economics in the Department of Agricultural Economics, Federal University of Technology, Owerri, Imo state.

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DEDICATION

This work is dedicated to God Almighty for His immense love, strength and wisdom to complete the study.

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ABSTRACT

The study analysed maize value chain in Imo State, Nigeria. The specific objectives were to examine the socio-economic characteristics of maize value chain actors in Imo State; ascertain the value chain map in maize value chain in the area; estimate the net margin and profitability of maize supply, production, processing and marketing in the area; estimate the contributions of the major actors in the maize value chain in the state; evaluate the value added and hence, the determinants of value addition in maize supply, production, processing and marketing in the study area and identify the constraints associated with maize value chain among producers, processors and marketers in the study area. Multistage random sampling technique was adopted in selecting the sample for the study. A Total of 240 respondents were used for the study that is; 60 suppliers, 60 producers, 60 processors and 60 marketers. Well structured questionnaire was used for data collection. Data were analyzed using descriptive and inferential statistical tools such as mean, percentage, frequency distribution, regression models, principal component factor analysis (PCFA), net farm income model and ANOVA. The result shows that majority (53.33%, 53.33% and 78.33%) of the respondents were female suppliers, producers and processors of maize respectively while majority (55%) of the respondents were male marketers of maize. Their mean ages were 57.25, 50.5, 41 and 45.5 years respectively. Majority (85%, 85%, 63.33% and 80%) of maize seed suppliers, producers, processors and marketers were married. The mean household size were 5, 7, 4 and 4 persons for maize seed suppliers, producers, processors and marketers respectively. The mean number of years spent in school were 9.6, 9.1, 9.9 and 12.1 respectively. About 52%, 47% and 67% of maize seed suppliers, processors and marketers had trading as their major occupation, while 71.67% of the producers had farming as their major occupation. The mean years of experience were 9.3, 15.8, 8.8 and 12. Also, 65%, 45%, 20% and 61.67% of maize seed suppliers, producers, processors and marketers respectively were members of one cooperative association or the other, while 35%, 55%, 80% and 38.33% of maize seed suppliers, producers, processors and marketers respectively were not members of any cooperative association. The mean farm size was 1.42 hectares. The value chain map shows that the chain started with the maize seed suppliers and ended with the consumers, and all the actors in the chain interacted more with the retailers and local supermarkets. Maize actors made a net income of ₦13,364.79, ₦113,339.38, ₦505.10 and ₦12,532.38 per ton, indicating that the actors made profit from their investment. Return on investment were estimated as ₦2.049, ₦4.87, ₦0.029 and ₦0.557 to the maize seed suppliers, producers, processors and marketers respectively. Maize seed suppliers, producers, processors and marketers each contributed 1.67% respectively to the market share. The result of multiple regression analysis showed that on the determinants of value addition were age, marital status, household size, association membership, product cost, transportation cost, preservation cost, and output for maize seed supply; gender, farm size, labour cost and output for maize producers; age, product cost and output for maize processing while educational level, association membership, transportation cost, product cost and output for maize marketing. The most important constraints associated with maize value chain amongst suppliers were high cost of maize seed, high cost of hulling maize seed from the cub and high cost of transportation to supply maize seed; amongst producers were lack of high yielding maize variety, lack of good access road to the farm and lack of access to credit; amongst processors were lack of good storage facility for processed maize (LGSF), change in market price of maize seed, lack of good access road, inadequate maize seed and high cost of transportation and amongst marketers were high cost of hired labour, high cost of hulling maize seed from the cob, high cost of transportation. The null hypothesis which states that there is no significant difference in the net margin amongst the various actors in maize value chain in Imo State, Nigeria was rejected. It is therefore recommended that Enterprise differentiation should be encouraged to maximize resource utilization and increased investment in the enterprise choice which in turn increases return on investment

Keywords: Maize, Value Chain, Chain Map, Value Added, PCFA, Share Index

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Maize is one of the most important cereal crops in the world agricultural economy both as food for human consumption, feed for animals, and as an industrial raw material. Maize is produced worldwide on 162 million hectares (Mha) in more than 180 countries, including 125 developing countries with a total production of 844 million tonnes (Mt) (Food and Agriculture Organization Corporate Statistical Database (FAOSTAT), 2012). About two-thirds of the total maize in the developing world is produced in low and lower middle income countries. Hence, maize plays an important role in the livelihoods of millions of poor farmers in the developing world. Often, they are too poor to afford quality seeds and other essential inputs and are exposed to significant production and market risks. Together with rice and wheat, maize provides at least 30 percent of the food calories to more than 4.5 billion people in 94 developing countries (Von Braun *et. al*., 2010). According to an estimate by the International Food Policy Research Institute (IFPRI), the demand for maize in developing countries is expected to be doubled by 2050 (Rosegrant *et. al*., 2008) on account of its varied uses such as in food, feed, food sweeteners, starch, oil, proteins, alcoholic beverages, etc.

Nigeria is currently the tenth largest producer of maize in the world, and the largest maize producer in Africa (International Institute of Tropical Agriculture (IITA), 2012). Maize crop started as a-subsistence crop in Nigeria and has gradually risen to a commercial crop on which many agro-based industries depend on as raw material (Iken and Amusa, 2014).

Imo State is the fourteenth largest producer of maize in Nigeria (USAID, 2005). Maize in Imo State is still under small scale production level cultivated between 1-2 hectares, which is usually scattered over a wide area (Akande, 2009). The smallholder maize farmers in the state can be effectively linked to the markets by improving the value chain management. Value chain describes the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), and delivery to final consumers and disposal after use (Kaplinski & Morris, 2003). A value chain is a sequence of related business activities (functions) from provision of specific inputs for a particular product to primary production, transformation and marketing, up to the final sale of a particular product to the consumer (Gesellschaft fur Technische ZusClmmenarbeit (GTZ) Value Links, 2008). It also includes the set of operators performing different functions, viz. producers, processors, traders and distributors of a particular product linked by a series of business transactions through which the product passes from primary producers to end consumers. Thus, value chain actors, responsible for transmission of materials, information and/or services, share an interest in the end-product because changes in the end-market affect them both collectively and simultaneously.

Each actor along the chain impacts value creation. The actors performing different functions and exerting different levels of clout often have very different perspectives on critical opportunities, bottlenecks and the potential of different interventions. Hence, value chain analysis demands participation of full range of stakeholders (Kaplinsky, 2000). This range includes buyers, processors, producers, input suppliers, and public agencies and associations that impact industry, trade, labour and commercial regulations and practices.

Value chain analysis is increasingly being used because of its focus on identifying opportunities and key constraints within the chain, and its potential to identify market based solutions that promote competitiveness (Donald, 2009). The focus of this study is on maize value chain in Imo State. It seeks to understand the real scenario on the ground to guide local actors come up with strategies for inclusion of smallholder maize farmers into the chain. This will improve linkages between maize farmers and other value chain actors for increased productivity.

1.2 Problem statement

The central challenge in agricultural development is the search for sustainable growth. When agricultural growth is unevenly distributed, there may be little increase in welfare. The process of globalization has not only brought far-reaching impacts on the structure and sourcing of production but also on the nature of market opportunities and competitive pressures for producers around the world (Schmitz, 2005).

In the present day, businesses do not compete with each other individually on the market, but as members of a chain, delivering the goods and services to their consumers in joint collaboration (Noerni, 2012). Participants cooperate in the process of purchasing, production, processing and marketing; their mutual interest being to satisfy consumer demand, as a result all the basic material and parts producers, product assemblers, processing units, wholesalers and retailers become part of a chain, by collaborating with one another.

The Nigerian maize is characterized by seasonality in production and lack of on-farm structure in maize storage. High transaction costs, price inefficiencies and quality losses lead to minimal returns to farmers (Kaguongo *et. al*., 2008). The market is controlled by cartels, which shield producers from receiving any market information. Due to the poor storage condition of maize in Imo State, prices fall during the glut season, hence low net returns to farmers. Transportation of maize to the market is expensive due to poor road infrastructure in the producing areas (Hoeffler, 2005). Packaging of the maize in extended bags of 100 kilograms (kg) has led to exploitation of farmers by traders (Gathumbi, 2009).

Maize in Imo State is still under small-scale production level cultivated between 1-2 hectares, which is usually scattered over a wide area (Akande, 2009). In U.S, in 1900, 38% of Americans were farmers, 100 years later, there were 3% farmers that produced 47% of total world maize production for Americans and the world because of sophisticated mechanization (National Academy of Engineering, 2013). This is in contrast to Nigeria where the farmer is often described as the "hand-hoe farmer" because nearly all of his farm operations are still carried out manually using the inefficient hoe and cutlass (Akande, 2009). It has been reported (Faborode, 2001) that less than 2% of the agricultural production in Imo State is mechanized in the real sense, leaving 98% of the production in the hands of traditional producers. The effect of this dependence on hand tool technology is low output, localization of maize processing by limiting its processing to products such as maize gluten, maize husk, corn meal, starch, pap, livestock feed etc. and the technology cannot transform agriculture (Akande, 2009).

Jraisat (2011) mentioned that conceptually the management of value chain is not particularly fully understood, and many authors have highlighted - the necessity of clear concepts and conceptual frameworks on value chain management (VCM) (Svensson, 2002). Most of the discussions were about supply chain relationships, information and product flow, networks and transactions (Hsu *et. al*., 2008) with limited work done on the linkages, profitability, determinants of profit and constraints of the actors in the chain. This study was designed to bridge the gaps in research.

1.3 Objectives of the study

The broad objective of the study was to analyze maize value chain in Imo State, Nigeria. The specific objectives were to:

i. examine the socio-economic characteristics of maize value chain actors in Imo State;
ii. ascertain the value chain map in maize enterprise in the study area;
iii. estimate the net margin and profitability of maize supply, production, processing and marketing in the area;
iv. estimate the contributions of the major actors in the maize value chain in the state;
v. evaluate the value added and hence, the determinants of value addition in maize supply, production, processing and marketing in the study area;
vi. identify the constraints associated with maize value chain among producers, processors and marketers in the study area;

1.4 Hypotheses of the study

The following hypotheses were tested in the study:

H_1: value added by suppliers is positively and significantly influenced by output, educational level, marital status, marketing experience and is not negatively and significantly influenced by household size, gender, farm size and age of the farmer.

H_2: value added by producers is positively and significantly influenced by output, educational level, marital status, marketing experience and is not negatively and significantly influenced by household size, gender, farm size and age of the farmer.

H_3: value added by processors is positively and significantly influenced by output, educational level, marital status, marketing experience and is not negatively and significantly influenced by household size, gender, farm size and age of the farmer.

H_4: value of processed maize products sold is positively and significantly influenced by output, educational level, marital status, marketing experience and is not negatively and significantly influenced by household size, gender, farm size and age of the farmer.

H_5: There is no significant difference in the net margin of the various actors in maize value chain.

1.5 Justification of the study

The findings of the study and recommendations will help in the implementation of policies that can revitalize maize production and encourage other stakeholder participation on food security initiatives.

The study will also provide information to agricultural extension personnel to identify the constraints of the actors in maize value chain and come up with appropriate capacity building programmes. It will also aid agricultural extension officers and the various value chain actors to examine their own constraints as change agents and come up with appropriate corrective measures to improve maize yields among maize farmers, The findings are hoped to provide information to small scale maize farmers to efficiently produce high maize yields with minimal inputs thereby maximizing profit. The study is also hoped to provide a base for further research on maize value chain issues especially among small-scale farmers.

The research is also hoped to be a reference material in Federal University of Technology Owerri's Library. This will consequently hasten the realization of the MOGs and also vision 2030 in the Sub-Country and the whole nation at large.

1.6 Organization of the study

The study is organized into five main chapters. The first chapter provides a brief introduction to the maize value chain in Imo State, Nigeria. Furthermore, with the description of the problem along with the specific objectives and justification of the study. In second chapter, some pertinent reviews are presented in consonance with the study objectives. Third Chapter describes main feature of the study area, sample selection, sources of data and method of data analysis. Based on the knowledge gained from review of literature and primary data, empirical results and discussions are presented in the fourth chapter. Fifth chapter summarizes the whole research work carried out to drive conclusion from the research findings followed by recommendation.

CHAPTER TWO

LITERATURE REVIEW

2.1 Conceptual literature

2.1.1 Value chain

Kaplinsky (2000) describes Value Chain as “full range of activities which are required to bring a product or service passing through the intermediate phases of production to delivery to consumers and final disposal after use". According to Gereffi (1994) the actors of a value chain as well as the input-output, and the territorial structure along with technical structure also define a value chain.

There are different approaches for value chain research. Gereffi *et. al*. (2003) further discusses the Global value chain research as the different ways to examine how global production and distribution systems are integrated and possibilities of firms in developing countries to improve their position in global markets. Although this definition covers most important core of the value chain, additionally it becomes necessary that institutional and other aspects like legal framework need to be considered in the value chain (Schipmann, 2006). A visual representation of different aspects of value chain is represented in figure 1 below

Figure 2.1: Visual representation of different aspects of value chain

Source: Value Chain Adapted from GTZ, 2004a as cited in Schipmann, (2006)

2.1.2. Dimensions in value chain

Value chain analysis forms an important tool to examine structural change. Altogether, it comprises of five dimensions which include the technical structure, the actors in a chain, the territorial, the input output and the governance structure (Gereffi, 1994). The analysis of these structures answers a set of questions like How does the production process work, who participates at which stage, where do the different stages take place, how are they linked, who has which benefits, etc. These answers are required to find the pertinent points of intervention for a successful integration of poor population sections. However, this study focuses on the agricultural sector, therefore, all analyses and examples herein relate to the sector which means different situations might be found in other sectors.

2.1.2.1 Technical structure and actors

From figure 1, technical production process can generally be separated into five stages: input supply, primary production, processing, marketing and consumption. Different actors can be found in each of technical production process with input supply, being the first step in the production process considers everything from the seeds to the technical equipment needed for the production of the concerned product.

Input supply facilitates the primary production of raw materials like grains and vegetables. Actors at this stage can be individual small, middle or big sized smallholders as well as enterprises with own production plants. If the product does not have market in its raw form, processing becomes essential. In this stage transformation of raw materials into processed products takes place. There is huge demand for processed products among consumers in industrialized countries.

Different actors found in this stage depend on the amount and quality of the product, complexity of product and production process (Schipmann, 2006).

The next stage in the process is trade and marketing, transportation and distribution of products to the places of demand forms an important marketing activity. Marketing can be directly done by the producers or processors, but as the amount and quality of the traded goods becomes higher, the requirements for marketing is also higher. In such cases logistic companies, food corporations and supermarket chains are mainly found.

The last stage is consumption of a good. In most cases the consumer is the driving power of the whole process. It is true that even though the consumer does neither participate in the production process nor add value to the product, ·he forms an important part of the chain. Consumer demand is the determining factor for the kind, amount and quality of a product. Trading activities takes place at each stage of the above mentioned process. However, it is assumed that trading activities between these stages takes place as a pure transfer of goods within the production process (Schipmann, 2006)

2.1.2.2 Territorial structure

The territorial structure is understood as the geographic concentration or dispersion of production and marketing" (Stamm, 2004). It gives an overview of the location of the distinct stages of a value chain. Although, in national value chains all stages take place in the same country but in international chains not only the stages, but also the activities within each stage can be widespread around the world.

2.1.3 Governance structure

The concept of governance is central to the global value chain approach which is used to refer to the inter-firm relationships and institutional mechanisms through which non-market coordination of activities in the chain takes place. This coordination is achieved by setting and enforcement of product and process parameters to be met by the actors in which developing country producers typically operate (Humphrey *et. al*., 2001). Governance in the value chain is very often understood as the power to define who and who does not participate in the chain, the setting of rules of inclusion, assisting chain participants to achieve the standards set, and monitoring their performance. (Kaplinsky *et. al*., 2000). An essential property of the chain is its governance structure determining the allocation of resources and gains and their flow within the chain Indeed, the overall mode of governance of a chain refers to the extent of control which the leading segment(s) has on the exchange of information and production activities, and thereby able to shape the functional division of labor along the chain and to set entry barriers through which economic profits may be concentrated in particular segments. These various activities in the chain found within the firms and in the division of labour between firms' are subjected to governance (Gereffi, 1994). In line with this, there is an argument that in a chain, power is exerted when lead firms are able to set and/or enforce the parameters under which others in the chain operate (Roldan *et. al*., 2005)

In 1990s, a framework, called "global commodity chains" was developed by Gereffi *et. al.* (1994) that tied the concept of the value-added chain the global organization of industries directly (Gereffi *et. al*., 1994). "Global commodity chains" highlighted the importance of coordination across firm boundaries as well as the growing importance of new global buyers including retailers and brand marketers in the formation of production and distribution networks which are globally dispersed and organizationally fragmented.

Further, Gereffi (1994) identified two broad categories of governance structures namely, 'producer-driven and 'buyer-driven for global commodity chains. Producer driven chains refers to production systems common in capital- or technology-intensive industries controlled at upstream level while the buyer-driven chains is used to describe production networks controlled by labor-intensive sectors including downstream-located manufacturers, large retailers, brand name merchandisers or trading companies. (Roldan *et. al*., 2005). Furthermore, Buyer-driven chains denote how global buyers use explicit coordination to help in creating a supply-base which is highly competent through which global-scale production and distribution systems could be built without direct ownership. Global buyers (retailers, marketers, and traders) can and do exert a high degree of control over- spatially dispersed value chains even when they did not own production, transport or processing facilities (Gereffi, 1994). This notion of role of global buyers was reinforced by the evidences in horticulture industry (Dolan *et. al*., 2000) and the footwear industry (Schmitz *et. al*., 2000).

Gereffi *et. al*. (2003) identified three variables' which shape internal Global Value Chain governance structures.

1. Complexity of information and knowledge transfer required to sustain a particular transaction particularly with respect to product and process specifications;
2. Codification of information and knowledge; i.e. can it be codified and transmitted efficiently without transaction specific investment between parties.

3. Capabilities of actual and potential suppliers in relation to the requirements of the transaction.

Furthermore, extending this Gereffi *et. al*. (2003) have identified five governance types as market, modular, relational, captive, and hierarchy based on interaction of above mentioned variables. Table 1 shows the simplified representation wherein each factor is characterized with only two values, low or high.

Table 2.1: Governance structures in Value Chain

Governance	**Information Complexity**	**Ability to codify information**	**Supplier capabilities**
Market	Low	High	High
Modular	High	High	High
Relational	High	Low	High
Captive	High	High	Low
Hierarchy	High	Low	Low

Source: Gereffi *et. al*. (2003)

The different forms of governance that establish through the interaction of the different aspects mentioned above are explained in the following

a) Market coordination: In this type, there is no specific relation between the stages of the chain but all the transactions are market coordinated. However, market linkages can persist over time with repeated transactions. The costs of switching to a new partner are found to be low for both parties (Gereffi *et. al*., 2003).

b) Modular value chains: Suppliers in the modular value chains "manufacture products according to the detailed instructions of the purchaser, but maintain full responsibility, e.g. for the process technology employed" (Stamm, 2004). This offer the suppliers with a greater possibility of stronger integration through which reliability, transfer of knowhow and others can be anticipated.
c) Relational value chains: In these chains, a mutual dependence occurs which is regulated through reputation, social and spatial proximity, family and ethnic ties, and the like. Often, the ability to codify the information is low. The exchange of information is accomplished by frequent face-to-face interaction and governed by high levels of explicit coordination, making the costs of switching to new partners high (Gereffi *et. al*., 2003).
d) Captive value chains: This type of chains is found when suppliers are less qualified due to which a great deal of intervention and control on the part of the lead firm is required. Lead firms encourage the build-up of transactional dependence to lock-in suppliers excluding others from reaping the benefits of their efforts. Therefore, the suppliers face significant switching costs and are "captive". Captive suppliers are engaged in simple assembly and are dependent on the lead fir-m for complementary activities such as design, logistics, component purchasing, and process technology upgrading" (Gereffi *et. al*., 2003). Thereby, loose their independence and have a low standing in captive value chains that limit their benefits from integration into it.
e) Hierarchical value chains: In these chains no individual suppliers exist as lead firms are forced to develop and manufacture products in-house as product specifications cannot be codified and highly competent producers are not found (Gereffi *et. al*., 2003).

2.1.3.2 Governance and coordination

Kaplinsky (2000) argues that the term coordination often used describes the non-market relationships that exist between firms in different segments, or between external (e.g., NGOs) and internal parties in the chain Although Roldan *et. al*. (2005) uses the term coordination to describe the exchange of non-market information, capabilities, and activities between two segments of the commodity chain which are not linked through ownership. Also, Coordination is meant to ensure particular product specifications, including performance, processes, and logistics in the chain. It is often seen that Coordination is likely to arise in commodity chains which involves suppliers in developing countries and buyers in industrialized countries, since it forms a suitable way to ensure reliable transactions when there is conditions like high risks, heterogeneous production conditions, technological backwardness, and unstable financial systems that are common characteristic of developing countries Gibbon (2001) describes chain co-ordination as enhancing barriers to entry, more precisely allowing 'driving' agents to incorporate measures that can reduce costs and risks as well as increasing the speed and reliability of supply, bringing in increase of sales. Furthermore, chain co-ordination and upgrading usually occurs when it benefits the chain driver.

A market based governance structure is characterized by many buyers and sellers, and is more characteristic of the 'traditional' coffee Global Value Chain (GVC). This type of GVC has much looser form of co-ordination. In the market based system, the products are standardized which implies that there are low barriers to entry as all the products are essentially being similar to each other, (Jodie *et. al*., 2008).

Dolan *et. al*. (2000) in their study, have shown that some of these categories can be used to analyze interactions at different points in the fresh vegetable chain between

Kenya and' the United Kingdom. The market of the fresh vegetables in Kenya had shown a trend from shifting from market coordination to explicit coordination. This revealed the importance of the competitive strategies of United Kingdom (UK) supermarkets in driving this chance. Until the mid of 1980's the fresh vegetables trade was handled through a series of market relationships. Produce was brought from the traders in wholesale markets or at the farm gate and exported it to the UK, where it was further sold in wholesale markets. However, in the later period supermarket chains in the UK gradually took over the trade and became powerful actors and started exhibiting explicit coordination in the chain. In order to attract the consumers, emphasize was given to quality. This also provided consistent year-round supply and increased the demand for processing of products. They were also forced to keep up the environmental regulations including food safety, pesticide residues and labour standards. In order to go in pace with these goals, supermarkets tried to increase explicit coordination. They used the strategy of buying the produce directly from the UK importers and African exporters by developing closer relationship and renewable annual contracts with the suppliers. There was regular monitoring from supermarkets. Also, Suppliers and buyers worked together on product development, logistics and quality which led to the creation of new value chain relationships and competencies. Over time, relationships between supermarkets and UK importers took new form which showed a recent trend of value chain governance moving in the direction of modularity.

2.1.4 Upgrading in value chains

Stamm (2004) defines upgrading as "the process that enables a firm or any other actor of the chain to take on more value intensive functions in the chain, make itself harder to replace, and thus appropriate a larger share of the generated profits" (Stamm, 2004). Furthermore, upgrading means that individuals, firms or even a whole country improves its original situation through "changes in the nature and mix of activities, both within each linkage in the chain, and in the distribution of intra-chain activities" (Kaplinski *et. al*., 2000), Growing competition in global markets can be met by developing the capacity to innovate more rapidly and effectively than their rivals.

Further, Humphrey *et. al*. (2000) uses this concept of upgrading to understand the three different shifts that firms might undertake in the global chain. Firstly, a firm can upgrade through transformation of inputs into outputs more efficiently by reorganizing the production system or by introducing superior technology which is often referred as Process Upgrading. Secondly, Product upgrading through which a firm can upgrade from moving into more sophisticated product lines. Thirdly, upgrading by value addition referred as Functional Upgrading, in addition, fourth case is added by Kaplinsky *et. al*. (2000) termed as Inter-sectoral upgrading where firm can upgrade by moving out of a chain into new one,

2.1.4.1 Preconditions for upgrading

Upgrading is not only improving their own position but more than a necessity to secure the position within the chain (Schmitz, 2006). Preconditions for upgrading forms the strategic intent of a not only the firm and the policy environment but also the innovation process and investment needs. First and foremost one should be aware that learning processes that are available to the single actors of a chain influence upgrading. "As a result of learning processes/ firms are able to improve their position in the value chain" (Stamm, 2004). While on the other hand Learning is influenced by governance structure of a chain, besides production systems, knowledge systems exist in value chains through which different kinds of know how are transferred between' the single stages of a chain. The organization of information flow and its intensity depends on the interest of the leading party in a chain, which is most times the buyer. It can be assumed that information transferred from a buyer to his suppliers is limited to the amount that favour's the buyer (Humphrey *et. al*., 2002). Other aspects relevant for learning processes are availability and access to-extension services, further education, market information, etc.

2.1.5 Mapping the maize value chain

The main actors in the maize value chain are input providers, farmers, traders/aggregators, processors (mills) and downstream participants in activities such as retail, food manufacturing, brewing, and animal production. The primary actors, along with their position in the value chain, are identified in Figure 1 below. The section that follows offers short descriptions of key actors in the chain.

Inputs: The most important inputs in agricultural value chains are typically land, seeds, fertilizers, agrochemicals (herbicides, fungicides and pesticides), farm equipment, and water and irrigation equipment. Maize is no different. Other services in the pre-production phase include extension services, market information, credit, and certifications for production in niche organic or other high-value markets. Poorly developed inputs markets inhibit the use of fertilizers, drought and disease resistant seeds, and increased mechanization, contributing to low productivity, which is an important problem in many countries across Africa (AGRA, 2013). In general, input supply is typically provided by private sector firms in response to demand from producers in most countries around the world; however, poor access to credit and information together with substandard infrastructure can weaken this demand, and as a result, it is not uncommon for the public sector or international development agencies to otter inputs through a variety of free or subsidized programs, albeit with varying degrees of success (AGRA, 2013; Banful, 2011; Morris *et. al*., 2007).

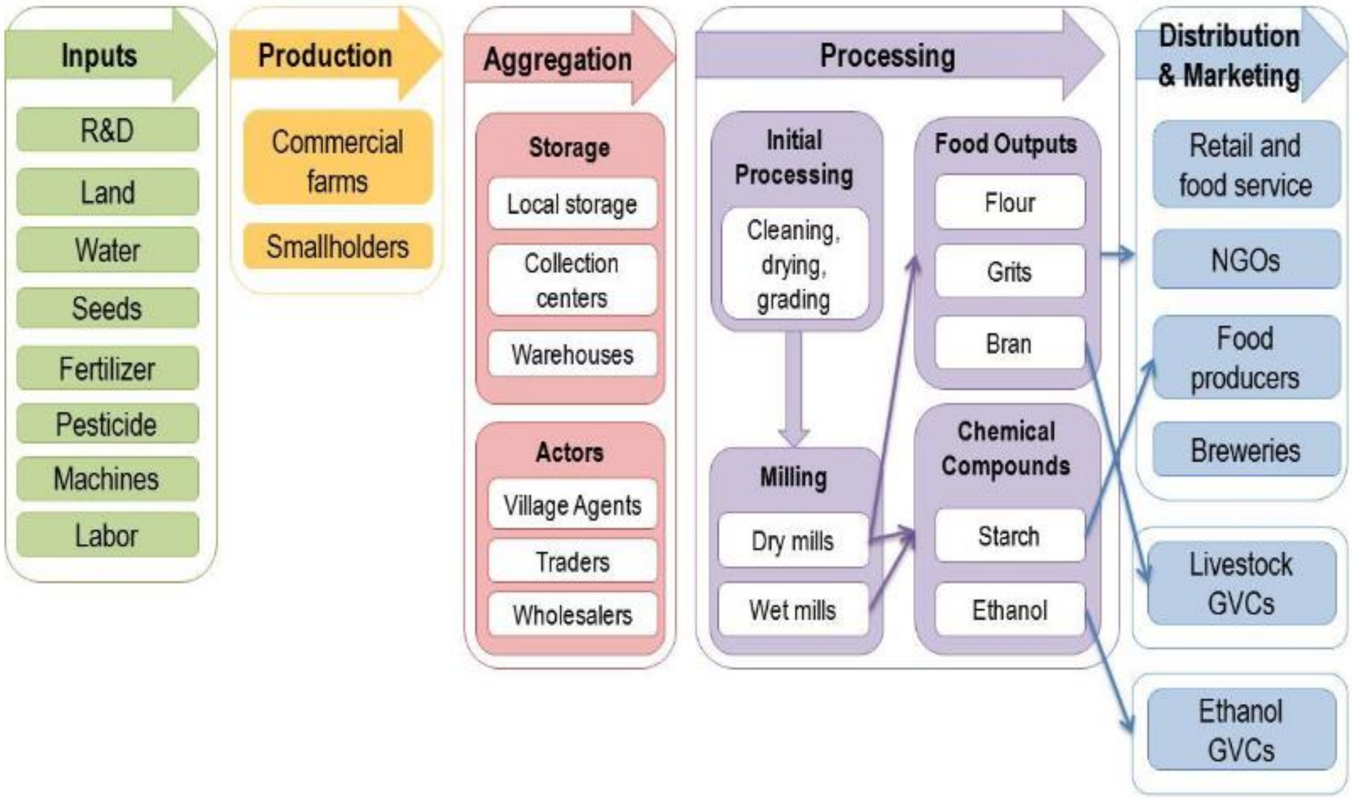


Figure 2.2: The Maize Global Value Chain

Research & Development (R&D) plays an important role in the chain. For the production stage, research tends to focus on how to increase productivity, improve seed varieties, adapt existing varieties to local conditions, and improve disease and drought resiliency of crops. Research requirements also extend to other segments, including extending shelf life of products through processing technologies such as drying maize or fortifying maize flour. New technologies and techniques introduced as a result of this research can drive upgrading and help countries to open up new markets. In many developing countries, R&D in the production stage of the chain is carried out by government funded research centers, while ongoing research regarding shelf life and food processing often takes place either within private firms or universities. Ideally, R&D institutions must be closely linked with other value chain actors to ensure effective and efficient use of resources to support chain development (Hall *et. al*., 2002).

Production: Geographic, environmental, social and political characteristics are important contextual drivers of competitiveness in production. Soil types, rainfall or access to water, temperature variations, as well as land ownership structures significantly affect maize cultivation. For the global industry, cereal crops tend to have lower margins at the production level and success often depends on economies of scale; competitive production of these crops is thus often concentrated in large scale, modern production operations with heavy mechanization and low labor engagement (Murphey *et. al*., 2012).

Aggregation: This segment of the chain is more prominent in markets that do not rely on large-scale modern production. In many developing countries, the major aggregators are producer cooperatives, small- and medium-sized traders, or processors that have vertically integrated into this stage of the chain (da Silva *et. al*., 2009). In informal maize value chains, aggregation occurs through multiple layers of small traders, who sell to small-scale processors or exporters. In both formal and informal chains, some degree of aggregation occurs to achieve economies of scale. Village agents are the traders who generally work most closely with farmers. **Processing:** Cereal products must be processed before being incorporated into a range of end products. Initial tasks include cleaning, drying, and grading. There are two primary milling techniques that follow for maize: dry milling and wet milling. Both processes break down maize into a range of outputs; however, there are also costs and benefits for each. Dry milling, which describes the grinding of the entire kernel in hammer or rolling mills, is less capital intensive and yields a greater array of inexpensive food outputs, including flour. While the maize in wet milling is separated from its nutritional content and therefore not used for direct human consumption, the process produces an increased range of chemical by-products (Pefie-Rosas *et. al*., 2014; Gwirtz & Garcia-Casal, 2014; OHSA, 2014). While dry mills are more common globally because of the dietary benefits and lower investment costs, major companies have recently constructed wet mills in emerging nations to produce a range of food additives.

Overall, the major actors present at this stage include local or household actors, small and medium-sized enterprises, and industrial-scale processors (Gwirtz & Garcia-Casal, 2014; da Silva *et. al*., 2009). The skill and technologies incorporated in these stages can differ considerably according to the scale of operations and access to capital of key actors (UNIDO, 2004, 2009). Different production processes can be used to either extend shelf life or add nutritional content. For example, de-germination enhances preservation and allows maize products to be traded longer distances, while nixtamalization and fortification can increase iron content (Petie-Rosas *et. al*., 2014; Gwirtz & Garcia-Casal, 2014). Most of these processing techniques are employed at the industrial level.

Marketing and Distribution: Maize's end uses can be divided into three primary categories: (1) Human consumption; (2) ethanol for fuel; and (3) animal feed. Prominent outputs of the milling segment that are destined for human consumption are categorized by particle size and include flour, grits, meal, bran and kernels. All can be used for a variety of staple products, including bread, porridges, tortillas, arepas, cornbread, and couscous. Grits or flour are common inputs for breweries. Other food products include corn oil, corn starch and sweeteners among the final products.

The market for ethanol developed rapidly in the last decade, especially in established economies. Table 3 provides a breakdown of the three major categories in the US in the 'time period from 1980-2013. Ethanol's share has surged to the point it has tied animal feed as the largest final use for maize. Globally, the largest share of maize production is used as animal feed; the US, European Union (EU), China, and Brazil account for 70% of the consumption of maize as a food source for animals (Abassian, 2007). Animal feed can be generated from the by-products of ethanol production, although in some locations, bran that is removed from the maize in the early stages of processing is used as food for livestock (Heuze *et. al*., 2015).

Marketing and distribution systems consist of channels that control access of products to the final consumers. For products destined for human consumption, these include supermarkets, kiosks and wholesale markets as well as food service operations such as hotels and restaurants. Marketing channels differ somewhat according to geographic end-markets. These geographic end-markets can be local, regional or global in scope and exhibit differing patterns of market control. For example, in leading US and EU markets, supermarket chains such as Walmart, Tescos and Sainsbury control a significant share of the market (Gereffi *et. al*., 2011), while in some developing countries, a large portion of agricultural products are still sold on informal markets, including in East Africa (Dihel, 2011). Dominant supermarkets typically require adherence to wide ranges of quality and safety standards in order to become an approved' supplier, while smaller chains or informal markets tend to have lower standards and be more easily accessible for less sophisticated production operations (Kaplinsky, 2010).

Supporting Services: Logistics and transportation fulfill key supporting functions, while government regulatory bodies are required to approve the sanitary and phytosanitary (SPS) conditions of outbound products and to ensure food safety and contain the spread of plant and animal diseases domestically. Post-harvest losses as a result of inadequate transportation and storage can account for as much as 30% of production in developing countries, undermining improvements in productivity and reducing incentives for producers to invest in the adoption of new techniques (Fernandez-Stark, 2013). Transportation alternatives often vary depending on the value-to-weight ratio' of the product. High-value, low-weight products such as French beans or blueberries are appropriate fits for air transportation. Cereal products are typically bulk commodities that require large storage facilities and must generally be shipped in large vehicles or by sea.

2.1.6 Concept of value addition

Value addition is a process of changing or transforming a product from its original state to a more valuable state through creating value, innovation or industrial innovation at an advanced stage (Mmasa, 2013). Maize value addition has to do with deliberate activity to change the form of the raw maize seed into a more refined or usable form thereby increasing its value. Value addition is the process of increasing the economic worth or value of a commodity by transforming it to another commodity termed as a value added commodity. Coltrain, (2000) added that the process should contribute to changing the current place, time and form characteristics of the commodity to characteristics more preferred in the market place. The value of the changed commodity is thus referred to as its added value. Other definitions of value added include that of the Bureau of Economic Analysis (BEA) that defines value added as the difference in the value of goods and services produced and the cost of inputs used to produce them. It also describes it as the industry's gross receipts and other incomes, commodities taxes and inventory changes minus expenditure for goods and services purchased from other firms.

Theoretically, The Agricultural Marketing Resource Centre (AMRC) defines agricultural value added in terms of factors that motivates value addition. It stated that value addition must involve changes in the physical state or form of an agricultural product; changes in the production process that enhances the value of the final product; marketing a product based on his special physical characteristics through physical segregation. It opined that the two important ways of improving (influencing) value added to include;

i. Improving production efficiency there by widening the gap between the gross value of output and the cost of intermediate input, and
ii. Changing the form, function, quantity or other product or process characteristics that increase the margin and cost of intermediate inputs

The concept of improving value addition is intrinsically embedded in the concept of improving technical, allocative and scale efficiencies. Thus, factors that increase the aforementioned will optimize/maximize value addition to agricultural products. Studies have shown that when firms are inefficient in the production of their core product, increasing value addition can be addressed by correction of factors causing inefficiency.

Studies have shown that most of the discussion on value addition in agriculture focus on change in form of agricultural product, changes in production process or change in marketing strategies. The justification/assumption for focusing on value addition is that there are unexploited profits going unclaimed in the manufacture of food, fibre and industrial or other products from raw agricultural output/produce. (Lambert *et. al*., 2006)

Evidence exist that there are economies of scale in food manufacturing (Morrison and Siegel 1998). In many cases it does cost large firms less money per unit to produce a product than small firms. Because of economies of scales in food manufacturing farms are large and there are consequent few buyers of raw agricultural produce. Arising from this, buyers are able to dictate the price of raw agricultural produce. The reasoning/argument therefore is that if farmers can invest in additional processing activities, they could bypass the monopoly power of large agribusiness firms and retain more of the value of the raw agricultural product by selling directly into the wholesale or retail markets.

In terms of theoretical analysis, Dodamani and Kunnal (2007) in a study of value addition to organically produced naturally-coloured cotton under contract farming in Uppinabetageri village of the Dharwad district, Karnataka state India used the simple descriptive statistics, means and percentages were used to generate estimates of value addition at the different stages in the processing of Kapas (Coloured cotton) into cotton garments (shirts). The study found that an additional value of Rs 5,875 was generated through processing kapas into cotton garments (shirts). Its break-up at different levels of processing has been recorded as follows: ginning, Rs 327 (5.57%); spinning, Rs 781 (13.30%); weaving, Rs 1626 (27.68%); and garments manufacturing, Rs 3140 (53.45%).

Wanyama (2013) utilized the Propensity Score Method (PSM) to determine the gendered effect of peanut value addition on household income among 310 randomly selected peanut farmers in Rongo and Ndhiwa districts of Kenya. From the results, farmers were found to undertake only one form of value addition, shelling. Although they appreciated the higher profitability associated with other forms of value addition like processing, inadequate capital to purchase processing equipment was a major constraint. The PSM results suggest that value addition raises household per capita income by Kshs.88 per day. Male headed households recorded higher levels of income compared to female headed households. This study suggests that potential exists in using value addition opportunity in peanut processing to raise farmers' household incomes.

This study intends to utilize the Ordinary Least Square regression analysis to understand the cause and effect relationship between value addition and factors that influence it among cassava processors in the study area.

2.2 Theoretical literature

2.2.1 Value chain theory

The value chain is defined as the full range of activities that firms and workers perform to bring a product from its conception to final use (Gereffi, 2011). It therefore involves understanding all the different stages of manufacturing including intermediary phases under which a product goes through until it becomes a final product ready for consumption.

The concept of value chain rose to prominence in the 1960s and 1970s by analysts charting a path of development for mineral exporting economies (Girvan, 1987). It has its roots in the commodity chain concept and the world system approach which was conceived as a network of labour and production process whose end result is a finished commodity (Gereffi, 2011). The value chain approach is deployed as an intermediate unit of analysis, where the totality of all product chains makes up the industry system. In this sense, the value chain approach enables one to see all the different stages that a product goes through in its manufacturing.

The value chain approach to analysis allows one to understand how industries are organized by examining the structure and dynamics of different actors involved in that particular industry (Gereffi, 2011). Its methodology is mainly based on investigating in an industrial context the connections and linkages within the industry. Theoretically it raises questions of governance and power which are of much significance to the operation of an industry or a sector. There are three basic important components of value chains which are very important in recognizing value chain as an analytical tool, namely: value chains are repositories for rent; effectively functioning value chains involve some degree of governance; and, effective value chains arise from systematic as opposed to point efficiency (Kaplinsky, 1998).

In terms of governance, the value chain framework of analysis argues that there are key actors in the chain. Gereffi *et. al*. (2001) defines governance as a non-market coordination of economic activity within the chain through influence of lead firms along the production chain. For instance, through governance structures, firms can take decisions that may directly or indirectly influence the whole production process. Gereffi *et. al*. (2001) have identified four main features of governance in the value chain analytical framework. First, is the idea that within value chains coordination can take different forms, which can be explained as inter-firm networks, in this case there are relationships that exist among different firms along the chain. There can also be quasi-hierarchical relationships between powerful lead firms and independent but subordinate firms in the chain; this might be a situation where lead firms control an important raw material or intermediate product. Governance can also take the form of vertical integration within firms, some firms can decide to invest along the chain and have enterprises that support one another. The second feature of governance largely shows how the lead firms assume control in the chain. Basically how lead firms derive their power within the value chain stems from two traits namely market power, which is measured in terms of market share and the degree of concentration. The other crucial aspect is the positioning of such firms in the value chain, which enables them to create and appropriate high returns.

Kaplinsky (1998) argues that these two sources of power stems from the barriers to entry that will be in force in that particular chain.

The third characteristic of governance arises due to the need for coordination within the chain. The needs for coordination can be classified into two namely, coordination that arises as more companies are involved in specifying the products that their suppliers have to make, then the more they are likely to create governance structures in order to coordinate supplier activities (Gereffi *et. al*., 2001). The other component concerns how these companies are exposed to risks as a result of supplier failures, it then implies that the more that firms are exposed to supplier failure the more they will intervene to coordinate and monitor supply chain. Last governance as already highlighted earlier, involves the ability of one firm to influence the activities of other firms in the chain, this position is attained through, lead firms defining the products to be produced by suppliers and specification of processes and standards used in the production process. Gereffi *et. al*. (2001) further argue that chains also vary with respect to how strongly governance is exercised, that is how governance is concentrated in the hands of a one firm and the number of lead firms that exercise governance over other chain members. This brings another aspect that is of the importance of in the governance of value chain which is power asymmetry. The form of governance in the chain changes as an industry evolves and matures and also governance patterns also varies from one stage to another within the same chain (Dolan and Humphrey, 2004).

The second element consist the issue relating to barriers to entry and rent in the value chain. Kaplinsky (2010) argues that economic rent emanates from a situation of differential productivity of factors and barriers to entry which basically reflects scarcity. Economic rent is mostly dynamic in nature and can be eroded by the forces of competition. In the case of producer rent, it is transferred into consumer surplus through the process of competition. Competition allows for innovation and new ways of organizing production and as it increases within the chain, then it might lead to improved efficiency and reduction of barriers to entry and economic rent.

The final analytical element of the value chain framework is the systemic efficiency that becomes inherent in analyzing a sector as one chooses such an approach. It therefore moves the focus of attention from point to the whole system. In this process it enables one to understand the different stages that a product has to pass through and weaknesses associated with each stage. This in turn will give a good reflection to analysts and policy makers on the possible policy intervention and identifying the particular stage to target. Such an approach will result in proper decisions being made and will ensure success of the whole sector in the long run.

2.2.2 Hecksher-Ohlin theory

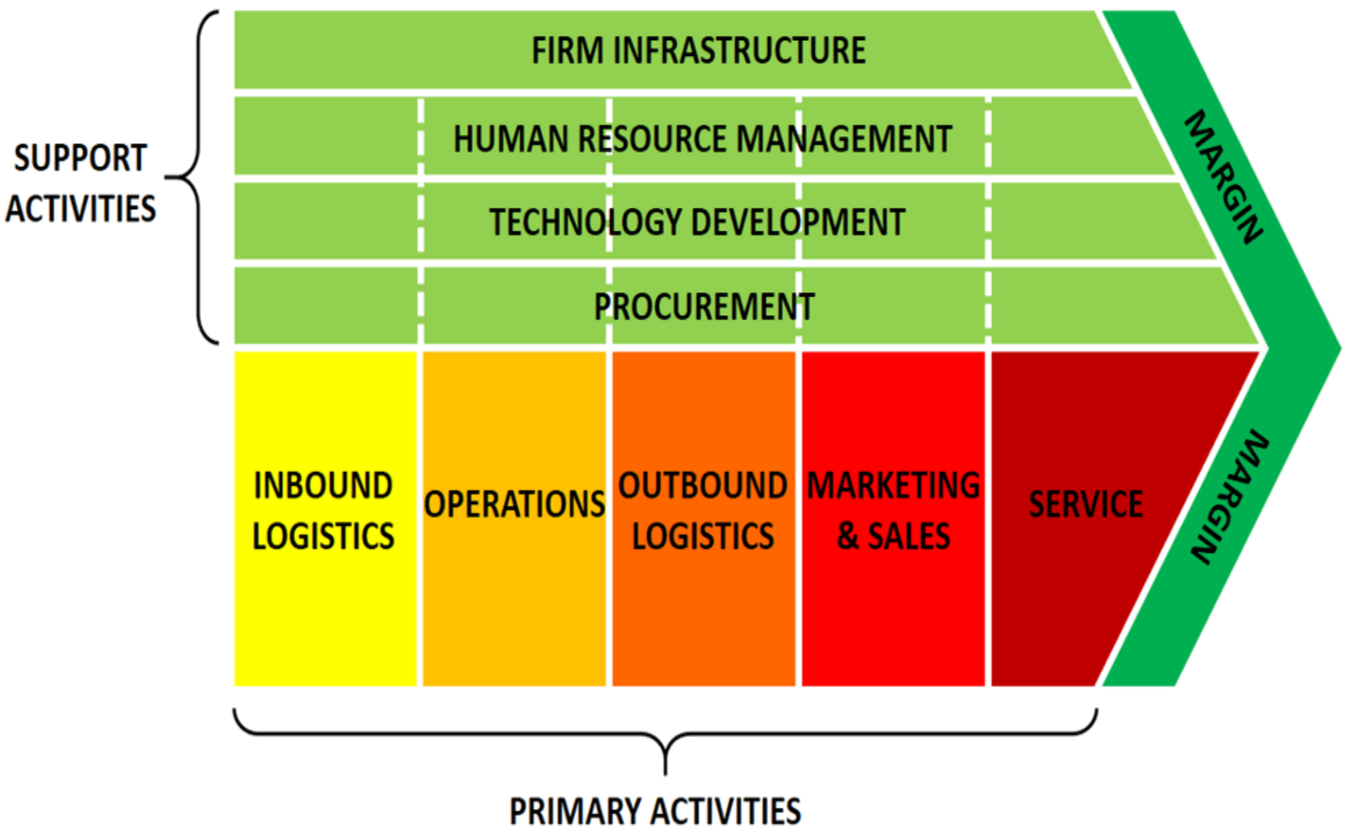
The Hecksher-Ohlin theory of comparative advantage based on factor endowments is at the core of neoclassical trade theory. This theory came as a refinement of David Ricardo's comparative advantage theory (Todaro, 2007). The theory explains patterns of trade between countries in terms of their relative endowments of the two factors of production, labour and capital (Sodersten, 1984). Following this theory, countries that are rich in capital will produce and export capital-intensive goods while those richly endowed with labour will concentrate in the production of labour-intensive goods. There are substantial gains from trade in this world as trade allows specialization in products intensive in the country's abundant factor.

The theory is however based on a number of assumptions. The key assumptions are that there' are two factors of production, no transport cost, perfect ·competition, and homogenous production function of the first degree. Production functions are such that the two commodities produced show different factor intensities and that production functions are different between commodities but the same for both countries (Sodersten, 1984). While these assumptions are made to enable the theory to work they are subject to much criticism due to the limitations they impose and lack of realism around assumptions like the existence of perfect competition' and even same production functions existing in both countries.

Todaro (2007) stresses that this theory enables us to describe analytically the impact of economic growth and trade on trade patterns and structure of national economies respectively. There are two main conclusions that come from this theory. First is that it promotes free trade with all countries as a result they also gain from trade and that world output increases as a result of trade among countries. The second conclusion is that under free trade price ratios will tend to equalize factor prices across trading countries. Put in another way, the theory suggests that prices of factors of production will be tile same as countries engage in free trade. Under this theory any trade protection reduces welfare as it introduces a distortion meaning that consumers pay more for imports, which affects the exchange rate and reduces trade (and the benefits from exchange and specialization).

2.2.3 Porter's theory of competitive advantage

Porter (1985) analyzed the value chain as an effort to understand the behaviour of costs and the existing/potential sources of differentiation, arriving at the Porter's value chain analysis (VCA) the value chain analysis rotates around: design, produce and market, delivering products, and support firms product. Thereafter Porter's Theory of Competitive Advantage, which focuses upon individual industries, emerged to extent VCA and related it to performance (Porter, 1990).The Porter's theory of competitive Advantage contributes to understanding the competitive advantage. This theory encourages individual industries to build up to the economy as a whole, since the firms are the ones competing in the markets (Kohler, 2006). These firms should have an understanding the way firms create and sustain competitive advantage. Porter's theory of Competitive Advantage distinguishes between; primary activities (Grant, 1991) and support activities (Porter, 1985). The primary activities include; inbound logistics, operations, outbound logistics, marketing and sales service in the core value chain creating direct value. The support activities are, procurement, technology development, human resource management, firm infrastructure supporting the value creation in the core value chain (Porter, 1985).



Source: Competitive advantage study (Porter, 1985)

Figure 2.3: Porters value chain

The theory formulates the general strategies for the value chain of cost leadership and differentiation to reach competitive advantage (Porter, 1985). These cross-value chain strategies established a principle that competitive advantage can be reached only by managing the entire value chain as a whole including all involved functions (Salvatore, 2002). Competitive advantage is necessary to satisfy customers by fulfilling customers request (Wang *et. al*., 2011). Michael Porter considers the competitiveness as a function of four major determinants: factor conditions; demand conditions; related and supporting industries, firm strategy, structure, and rivalry. The competitive advantage leads to explaining the role played by the vale chain on economic environment and thereby promoting firms' ability to compete in a particular industry. The Porter's theory of Competitive Advantage when applied in value chain, simply advocate for use of appropriate value chain strategy and having prudent practices to enhance the financial performance (Porter, 1990). The production of goods and services should be for those that can be produced at a lower opportunity cost (Salvatore, 2002). The Competitive advantage theory suggest that firm should go for policies that create high quality products to be sold at high prices (Wang *et. al*., 2011).

2.2.4 Resource-based view (RBV) theory

The Resource-Based View (RBV) Theory, which is on the overall performance of a firm (Ray *et. al*., 2004), examines the impact of organization resources and capabilities on competitive advantage that. The theory expresses that these resources and capabilities should be directed to ensuring overall firm performance since those not conditioned into sustaining activities and business processes negatively impact on an organizational performance (Ray *et. al*., 2004).

The study of RBV by (Baltacioglu *et. al*., 2007) suggest that the resources and capabilities should be organized effectively and operated efficiently at optimal level to improve the firm performance. This occurs when the resources and capabilities are directed towards sustaining value chain practices, demand management, on the main functions, assists in managing and balancing customer demand by keeping updated demand information, customer relationship management maintains and develops long-term customer relationships by developing information continuously and understanding what customers want, leadership due to optimal contracting and supplier relationship management. In addition to these various components such as coordination, cooperation, commitment, information sharing and feedback are equally important. Therefore, both RBV and competitive advantage theories will glue the five dimensions in service value practices with financial performance in this proposed conceptual framework (Baltacioglu *et. al*., 2007).

2.3 Empirical literature

2.3.1 Maize production in Nigeria

Nigeria is the 10th largest producer of maize in the world, and the largest maize producer in Africa, followed by South Africa (IITA, 2012; USAID 2012). While maize is grown in the entirety' of the country (both yellow and white varieties), the North Central region is the main producing area as shown in Figure 3, below. Seventy percent of farmers are smallholders, with an average of 5ha area of cultivated land accounting for 90 percent of total farm input (NAIP, 2010). Maize in Nigeria is usually intercropped, with yam, cassava, guinea corn, rice, cowpea, groundnut, and soybeans. Maize was, on average, the 5th most produced agricultural commodity in the period of 2005- 2010, became the 3rd most produced crop (by quantity) in the country within the period between 2009 and 2010, after cassava and yams. Most of the production aims to the domestic market, since a negligible part of the production is formally exported (FAOSTAT, 2012). However, informal trade does occur with neighbouring countries, although detailed volumes are not available.

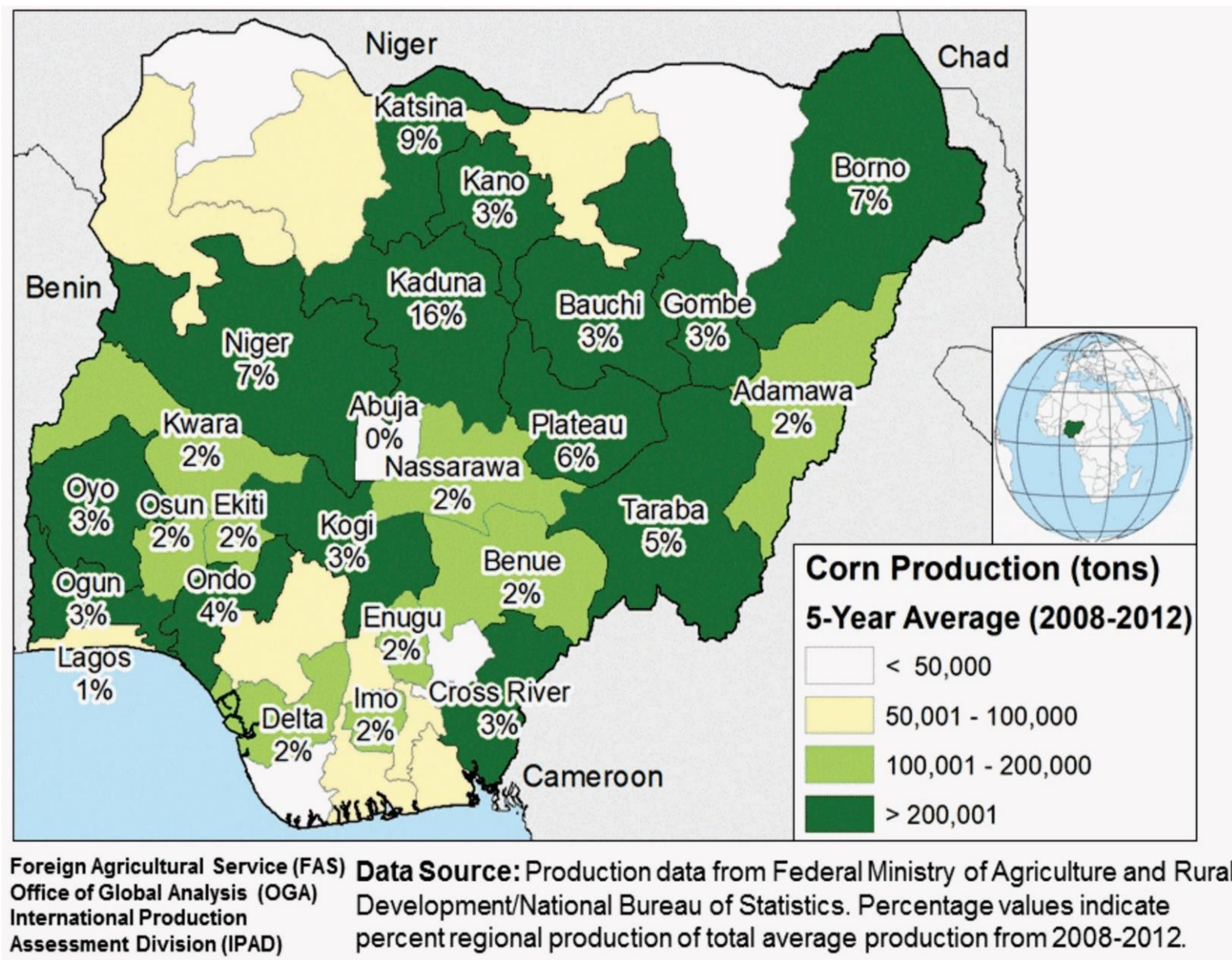


Figure 2.4: Maize Production at State Level, 2008-2012

Source: United States Agency for International Development (USAID), 2012

As shown in Figure 2.5, based on information from the Nigerian National Bureau of Statistics (2005/2006), Kaduna is the main producing state.

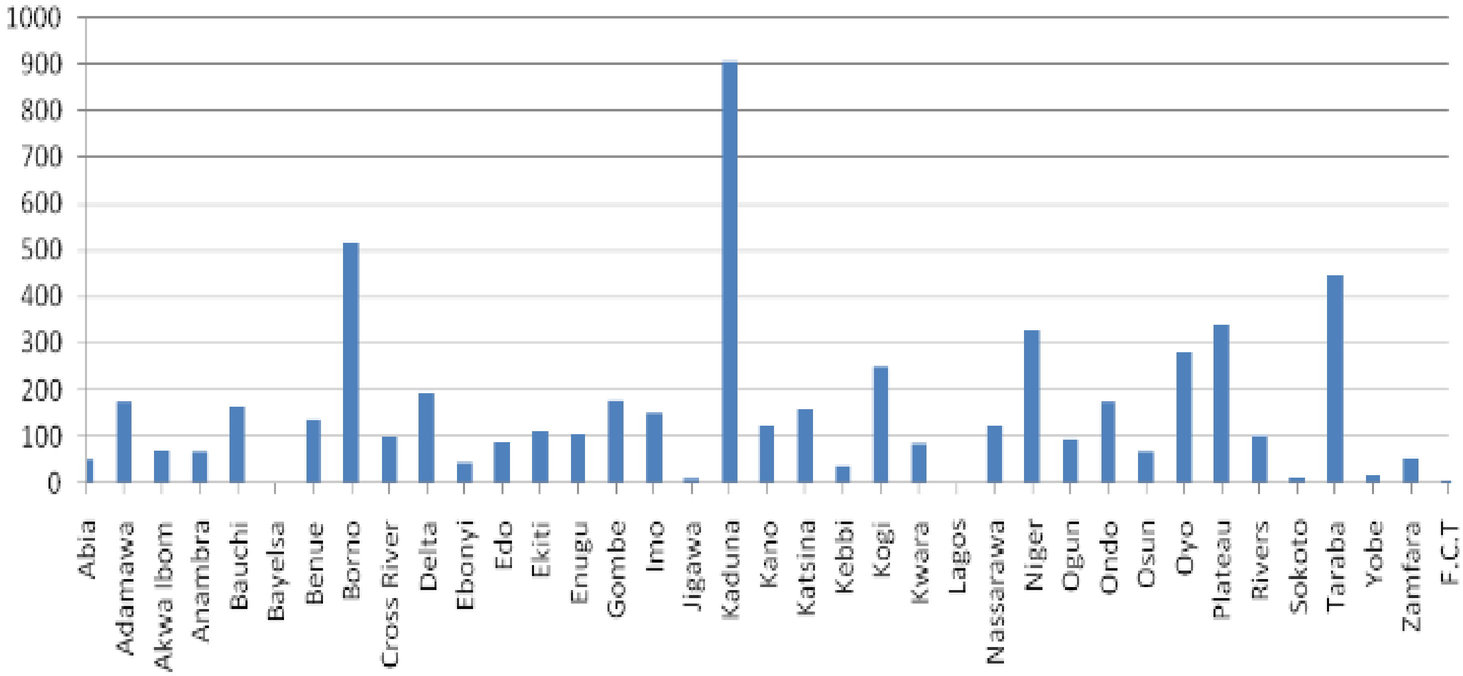


Figure 2.5: Maize production by State ('000 Mt), 2005/2006

Source: Ministry of Agriculture (MOA) Nigeria, 2012

Ecological zones of production include mangrove swamp, deep water, irrigated lowland, rain fed lowland, and rain fed upland (WARDA, 2008). Although the Guinea Savannah zone provides the' best ecological condition for maize cultivation, maize is also grown in the Forest zone, the Derived Savannah zone and the Southern Savannah (USAID, 2010).

Examining production, yields and area harvested trends for the past two decades, there is an overall alignment between production and area harvested until 2000. Indeed, from 2000, the area harvested remained lower than 1990 (about 5millions hectares in 1990 and between 3 and 4 millions from 1998 to 2010) while the production increased drastically at an average rate of 5.52% per year between 2000 and 2010. This might indicate an improvement in production technology, since yields are increasing as well. (FAOSTAT, 2012).

2.3.2 Consumption/utilization of maize in Nigeria

Introduced in Nigeria in the 16th century, maize is the fourth most consumed cereal during the past two decades, below sorghum, millet and rice (FAOSTAT, 2012). Being among the primary food staples, maize consumption is widespread across the country and among households of different wealth. It is widely used in the preparation of traditional foods. Main local dishes include pap, tuwo, gwate, and donkunu, with the cereal cooked, roasted, fried, ground, pounded or crushed form (Abdulrahaman *et. al*, 2006). Following a peak in 1994 (35 Kg/year), per capita consumption of maize in Nigeria underwent an overall decrease throughout the 1990s, reaching a negative peak in 2000 (17 Kg/year) with a positive growth rate between 2001 and 2007 (aside from 2006, when the per capita consumption declined by 0.4 percent), (FAOSTAT, 2012). Although maize is not the most consumed cereal in terms of quantity, the Nigeria Food Consumption and Nutrition Survey, conducted by IITA in 2003, based on the survey of 6480 households across federal states, shows that maize is the most frequently consumed food staple in Nigeria. About 20 percent of the surveyed households consume maize both as flour or green. Frequency of maize consumption is followed by cassava (16.5 percent), rice (11.9 percent) and cowpea grain (11.8 percent) (Table 2.2). Consumption over four times a week like maize could indicate that the foods were consumed almost every day. It reflects the food most preferred by households or those that were available and affordable.

Table 2.2: Frequency of consumption of staple food crops at the national level

	0 Week	1-2 Weeks	3-4 Weeks	Over 4 Weeks	Overall Percentage
Maize	0.68	6.15	6.35	6.95	20.1
Cassava	0.63	6.85	4.61	4.45	16.5
Rice	0.52	5.89	5.26	3.24	14.9
Cowpea grain	0.31	4.31	4.45	2.77·	11.8
Groundnut	0.18	4.07	3.58	3.31	11.1
Yam	0.45	4.92	3.29	1.72	10.4
Sorghum	0.08	1.22	2.19	3.12	6.6
Plantain	0.63	3.45	1.29	0.55	5.9
Soybean	0.25	1.48	0.47	0.35	2.6

Source: International Institute of Tropical Agriculture (IITA) on Nigeria Food Consumption and Nutrition Survey, 2003

Most of the national production aims at human consumption. However, industrial uses (such as the brewery and feed industry) have been developing in the past decade: the percentage of total maize production used for feed has grown from 13 to 18 percent of total production (USDA, 2005-2010). A specific driver of the feed industry is the development of the poultry sector, as poultry feed represents 95-98 percent of the total feed produced in the country between 2005 and 2010 (USDA, 2005-10). The development of the poultry industry is one of the priorities of Nigeria's agri-business strategy and is in line with the imposition of bans on maize exports to ensure maize supplies to the poultry and feed industries.

According to IITA, maize demand in the country is estimated to increase 3.2 percent per year due a perspective growth of urbanization and population. UTA estimates that approximately 60 percent of maize produced in the country is used for industrial end uses for both for human (flour, beer, malt drinks, cornflakes, starch, dextrose, syrup) and animal consumption, mainly poultry (UNIDO, 2010).

In terms of maize types, yellow maize is mostly used for feed and human consumption while white maize for human consumption only. IITA estimates that yellow maize production will likely increase considerably as compared to white maize in the coming years, due to the development of the feed sector (particularly poultry) (Hartwich, 2010). However, maize contribution to total feed production is small, and ranges between 11 percent in 2006 and 18 percent in 2010, given the high cost of maize as compared to other feeds. Maize grain is primarily used in layer and broiler feed ratios (Hartwich, 2010).

2.3.3 Marketing and trading of maize in Nigeria

Nigeria presents a combination of growing domestic demand (for both human consumption and feed) together with a ban on maize imports (between 2005 and 2008) and exports at different moments in time (2009 and 2010, with no comprehensive information on the previous years). Trade data for maize other than seed have significant gaps, especially on the export side, for which trade flows are not available in the main databases (UNCOMTRADE and GTA, FAOSTAT). FAOSTAT was the only source providing some information on export flows for maize, although it includes seed in the computation. Despite the inclusion of seed, FAOSTAT exports figures were initially used as a proxy to capture trends in net maize trade for the country (2005-2010). Even with the inclusion of seed, formal exports only account for a maximum of 0.20 percent of production (in 2007), and formal imports account for a maximum of 0.3 percent of production (in 2005).

Table 2.3: Maize production (including seeds), import and export of Nigeria (2004- 2010)

	2004	2005	2006	2007	2008	2009	2010
Production ('000 tonne)	5,567	5,957	7,100	6,724	7,525	7,339	7,306
Imports ('000 tonne)	0.05	17,668	9,612	0.687	0.049	0.049	n/a
Formal exports ('000 tonne)	0	2,226	3,666	10,416	1,023	1,023	n/a
Formal export as a % of production	0.00%	0.00%	0.10%	0.20%	0.00%	0.00%	n/a
Formal imports as % of production	0.00%	0.30%	0.14%	0.01%	0.00%	0.00%	n/a

N/A = data not available. Source: FAOSTAT, 2012

GTA records have been selected for the analysis of disaggregated import flows, since total import figures match those recorded by FAOSTAT (although in more detail) and UNCOMTRADE information presented data gaps. Although GTA data only cover years 2007 to 2010, they provide quantities and value of imports to Nigeria disaggregated by partner countries. However, information on GTA is not comprehensive nor confirmed, since GTA published a specific disclaimer for its Nigeria data, calling for users' caution.

Nonetheless, it is to be noted that the inclusion of comprehensive data on informal trade flows (both imports and exports figures), which is currently unavailable, is likely to provide information on neighbouring countries (currently not included) as relevant trade partners. Besides tariff barriers on maize, Nigeria has a list of prohibited imports which make smuggling a widespread phenomenon in the country

(Meagher, 2003). Although detailed data is unknown, it is noted that although Nigeria imports an average of 30 to 40 percent of its grain imports from the ECOWAS block, only a negligible percentage of the country's cereal demand is actually met by formal imports (Inter-reseaux, 2010). USDA estimates informal cross-border exports ranging from 200,000 tonnes in 2005/2006 and 2010, and 100 000 tonnes for the other years under review, indicating Niger, Chad and Sudan as main destinations (USDA 2006-2010). Thus, although formally Nigeria is maize importing country, there are import and export flows which are not captured in official data, and their estimate is currently not confirmed.

Within Nigeria, Lagos and Kano represent the two main centers where goods are marketed due to their proximity to the two most active borders for informal trade between Nigeria and Benin and between Nigeria and Niger, as well as due to the proximity between Lagos and the ports of Lome and Cotonou. Conversely, according to FAO special report (based on CILSS/FAO/FEWSNET/SIMA/WFP Joint Market Assessment Mission), maize prices in Jibia, Illela and Mai Adua markets (in Northern Nigeria, at the border with Niger), along with prices in Malanville (in Benin, at the border with Niger) have a strong influence on maize prices in Niger (FAO, 2008).

Informal cross border trade flows of maize between Nigeria and its neighbouring countries are particularly intense in the Kano-Katsina-Maradi region at the border with Niger (Figure 2.6). This corridor is characterized by flows of both local products and re-exports from other countries. The importance of this corridor between Niger and Nigeria has historical roots and relates to the complementarities of the two cropping systems. Niger used to import significant volumes of cereals including millet, maize and sorghum from Nigeria to mitigate its structural production deficit.

Additionally, studies undertaken by OECD stresses the new patterns of informal cross border trade in the West Africa region which are not only confined to border areas, but have extended to the whole national territory of countries (Sahel and West Africa club, OECD, 2006). Nigeria plays significant role with its flows of petrol, grain and fertilizer, which penetrate the northern and western part of Niger, being re-exported to Mali, Burkina Faso and Ghana (Meagher, 2003).

Figure 2.6: Informal Trade hubs, Northern Nigeria

Source: Sahel and West Africa club/OECD, joint mission report "Food security and cross border trade in Kano, Katsina, Maradi", (2006) The informal exports to the Francophone countries are attributed to the informal exchange rate between the Naira and the CFA France which made Nigerian goods cheaper than the ones produced in Francophone countries. Re-allocation and smuggling of subsidized fertilizers and other subsidized inputs from Nigeria can be a constraint for those development initiatives aimed at increasing agricultural productivity in Nigeria (Meagher, 2003). The significant volumes of maize and inputs traded informally between Niger and Nigeria imply the involvement, not only of small, but also large traders which take indirect advantage of the non-tariff measures (such as bribes) and road blocks which impact more heavily on the low profit margins of the smaller traders (Sahel and West Africa club, OECD, 2006).

Wholesale price data are currently available for the Northern region only, Kano market. A descending trend is observed in the first half of tile observed period with a maximum price of 56,333 Naira/tonne in 2005 and a minimum of 29,754 Naira/tonne in 2007. With a rise of maize prices comparable to 2005 level in 2008 (59,083 Naira/tonne in 2008), the trend has been descending ever since, with a yearly average of 55,833 Naira/tonne in 2009 and 49,833 in 2010 (GIEWS, 2012).

2.3.4 Demographic characteristics of small-scale farmers and maize production

Socio-economic conditions of farmers are the most cited factors influencing technology adoption. The variables most commonly included in this category are age, education, household size, landholding size, livestock ownership and other-factors that indicate the wealth status of farmers. Farmers with bigger land holding size are assumed to have the ability to purchase improved technologies and the capacity to bear risk if the technology fails (Feder *et. al*., 1985). This was confirmed in the case of fertilizer by Nkonya *et. al*. (1997) Studies undertaken have shown that access to resources and services (information, credit) vary by gender of household head who makes key decisions. It was hypothesized that the variable could positively or negatively influence the adoption of fertilizer and soil erosion information technologies in Tanzania, Hassan *et. al*. (1998) in Kenya and Yohannes *et. al*. (1990) in Ethiopia whereas; farm size did not matter in Nepal (Shakaya and Flinn, 1985).

The role of education in technology adoption has been extensively discussed in the literature. Education enhances the allocative ability of decision makers by enabling them to think critically and use information sources efficiently. Producers with more education should be aware of more sources of information, and more efficient in evaluating and interpreting information about innovations than those with less education (Wozniak, 1984). Education was found to positively affect adoption of improved maize varieties in West shoa, Ethiopia (Alene *et. al*., 2000) and Tanzania (Nkonya *et. al*., 1997). For widespread adoption of improved varieties and chemical fertilizer by farmers, extension educators need to understand the factors affecting technology adoption (Abebaw& Belay, 2001). Adoption of technology is influenced by physical, socioeconomic and mental factors including agro-ecological conditions, age of farmer, family size, education of farmer, how-to-knowledge, source of information, and farmer's attitudes towards the technology (Neupane *et. al*., 2002; Rogers, 2003). Young farmers are more likely to adopt a new technology because they have had more schooling and are more open to attitude change than older farmers (International Maize and Wheat Improvement Center [CIMMYT], 1993; Visser & Krosnick, 1998). Education is expected to enhance decision making and the adoption of agricultural technologies. Knowledge influences adoption. Farmers who have adequate knowledge of technology use are more likely to adopt it (Abebaw and Belay, 2001; Rogers, 2003).

On the other hand, farm size, level of formal education of the head of the farm family, number of instructional contacts the farmer had with extension agents, ratio of credit to total cost of production, degree of farm enterprise commercialization, membership of farmers' associations, knowledge of fertilizer use and application as well as ratio of non-farm to total annual income of farmers had positive signs, implying direct effect on the probability of adoption and intensity of use of fertilizer by the farmers. Specifically, these imply that a unit increase in the farm size, level of formal education of the head of the farm family, number of instructional contacts the farmer had with extension agents, ratio of credit to total cost of production, decree of farm enterprise commercialization and ratio of nonfarm to total annual income of farmers would bring about increased adoption and intensity of use of fertilizer among the farmers.

Also, membership of farmer’s association brings about increased awareness on the part of the farmers regarding existing and new farming technologies. With increased awareness of the availability of improved farm inputs coupled with information on their applicability, the level of adoption and intensity of use of fertilizer would increase. These views have also been expressed by Chukwuji *et. al*. (2006).

Cultivation of large farm sizes makes it more economical for farmers to apply fertilizers. Also, the larger the size of farm cultivated and therefore output produced, the more commercialized the farm would be. Increased level of education of farmers and contacts with extension agents lead to increased knowledge of input uses and their application because ignorant of the uses and abuses of inputs in crop production could discourage farmers from using them. These' findings are in line with tile reports of Daramola and Aturamu(2000) who noted that contacts with extension agents as well as acquisition of formal education exposes the farmers to the availability and technical-know-how of innovations and increases their desirability for acquiring them. The high and positive effect of off farm incomes on the adoption indices of the farmers is an indication that they need improved financial bases in order to adopt better farming technologies. Also gender issues in agricultural production and technology adoption have been investigated for a long time.

Most of such studies show mixed evidence regarding the different roles men and women play in technology adoption. Doss and Morris (2001) in their study on factors influencing improved maize technology adoption in Ghana, and Overfield and Fleming (2001) studying coffee production in Papua New Guinea show insignificant effects of gender on adoption.

2.3.5 Value addition in maize

Madevu (2006) studied the nature and magnitude of competition between supermarkets, green grocers and hawkers in the fresh produce markets of South Africa and ways of improving the value chain. He used the value chain analysis method and found that the value chain can be improved in four ways: processes, product, functional and chain upgrading. He also found that low income areas were dominated by informal traders while the supermarkets dominated the high income areas. He recommended empirical testing of the effect of value addition on profitability, sales and competitiveness for further study.

Brewin *et. al*. (2009), examined the adoption of product and process innovations in the Canadian food processing industry using multivariate probit model. Their findings suggest that firms that conduct both process and product innovations in-house at-e better able to enjoy complementarities that arise in the discovery process. They also found that firms were more likely to innovate in response to keeping pace with competitors.

Roheim *et. al*, (2007) analyzed the value of brands and other value addition activities meant to target specific segments in the frozen fish market. They used purchased retail point scanner data of 687 frozen fish products, collected weekly over three years (2002-2005). The sales data included quantities sold and prices by brand, package size, and product promotions. The data was analyzed using hedonic pricing model and results appeared to indicate that consumers preferred "natural" fish that was less processed and less value added, and they were ready to pay a premium for that. This is to be expected in markets where health and well ness concern override other factors influencing demand. The other observation is that traceability is gaining more value among dealers because quality of their products has a direct impact on their reputation.

Karantininis *et. al*. (2008) investigated what determines innovation in the agro-food industry. They used the number of products launched (zero inflated Poisson model) and investments in innovation as a percentage of sales (heckman sample selection model) as proxies for innovation activity of the firm. They noted that number of products launched is a misleading indicator as it is heavily influenced by product proliferation and not innovation. They concluded that organization, stage in the value chain and market power are important to innovation, and that Who1esalers and retailers tend to have a larger number of new products (Model 1), whereas manufacturing firms tend to invest more in research and development.

Mitcheels and Gow (2008) used a structural equation model for beef producers to explore the importance of a producer's market orientation on their subjective performance within agricultural commodity markets. They found that market oriented firms are highly innovative and achieve superior performance.

Punjabi (2007) observed that it has become clear worldwide that the most rapid growth in agriculture has been occurring on the part of post-production activities. This is being driven by growth of middle income consumers even in low income countries and their demands for better quality value added products. Absence of agro-industry and agribusiness resulting in low levels of value addition of agricultural commodities has been one of the main causes of stagnation in rural incomes. A substantial agribusiness sector generating a high outflow of value added commodities is always correlated with high agricultural GDP and high rural incomes.

Mapiye *et. al*. (2007) analyzed the potential for value addition of Nguni cattle products in the communal areas of South Africa. They concluded that development and research programmes aimed at reintroducing the Nguni breed in the rural areas should take a holistic and participatory approach in agro-processing and value-addition of Nguni cattle products. Increased value addition can be achieved by provision of appropriate incentives for the establishment of agro-processing industries in the rural areas and promotion of partnerships between communal farmers and agribusiness.

McEachern and Schroeder (2004) observed that superior knowledge of customers' perceptions of value is recognized as a crucial success factor in today's competitive market place. Despite this, the voice of the consumer is often poorly integrated in the value chain. Few studies have assessed value created for consumers. The study evaluated the main attitudes driving consumer purchases of fresh meat bearing value based labels. Market potential for further differentiation was also examined.

Ward *et. al* (2008) found that, across all beef products sampled, the location of the retail outlet significantly influenced variation in product prices. The product name or cut significantly influenced beef retail price. Special and other brands were priced higher than unbranded or generic beef.

2.3.6 Market share

Market share is the proportion of an entire market's sales that is taken by a specific organization. It is represented as a percentage of the market, and is useful for gaining a general sense of a firm's size in comparison to its competitors. Owning a large percentage of market share is a strong indicator of the success of a business, especially if that share is increasing over time. The market share percentages of all major competitors in a market are commonly calculated and compared, to determine the relative success of each business (Bragg, 2020). To calculate market share, divide the firm's sales by the sales of the entire market for the indicated measurement period. The formula is: Company sales ÷ Entire market sales = Market share

A large market share can give a business price leadership in the market, where competitors are more likely to follow the price points established by the company. This situation most commonly arises when the business is the low-cost leader in the industry. However, a business that offers goods at a low price point may not be the most financially successful one in the industry. A smaller business might reap more profits by occupying a more profitable niche within the market.

If a business attains quite a large market share, it may be subject to anti-competition laws such as Federal Competition and Consumer Protection act 2019 (Isiadinso and Omoju, 2019), the Act aims at promoting a competitive market and protecting consumer rights in Nigeria. Prior to the enactment of the Act, there was no single piece of legislation regulating competition in Nigeria. Thus provisions of laws regulating competition were found in various legislation such as the ISA; the

Nigerian Communications Act 2003; the Electric Power Sector Reform Act 2005 amongst other laws. However, the new Act applies to all businesses in Nigeria and supersedes all laws on competition and consumer protection, except the Constitution of the Federal Republic of Nigeria 1999. The Act prohibits unfair business practices or abuse of dominant market position by any company, as well as any agreement to restrain competition such as agreements for price fixing, price rigging, collusive tendering etc. To regulate and facilitate competition, the President may from time to time, by order published in the Federal Gazette, declare that prices for goods and services specified in the order shall be controlled in accordance with the provisions of the Act. In addition, the Act mandates the Commission to administer the provisions of the Act as well as set up the Competition and Consumer Protection Tribunal to adjudicate over conducts prohibited by the Act and exercise jurisdiction in accordance with the Act. Under these laws, the government may not allow it to complete proposed acquisitions on the grounds that they may result in an excessively high market share and therefore a decline in competition in the marketplace.

2.3.7 Constraints to maize production

The increasing demand for maize and its global advance implies that by 2023, maize will account for the greatest share (34%) of the total crop area harvested (OECD-FAO, 2014). This poses particular challenges to the global capacity to sustainably supply the volumes of maize needed particularly in low- and middle-income countries. Indeed, rising demand has often expanded the maize area in these countries and brought new land into cultivation instead of sustainable intensification and increasing yields. Crop area thereby often expands into more marginal lands with potential threats to crop diversity, forests, and erodible hill slopes (Neumann *et. al*., 2010). Across the developing world, maize production systems are increasingly diverse and present a gradient of extensive to more intensive systems, with varying implications and concerns in relation to soil erosion, soil fertility loss, land degradation (acidification and salinity), reliance on fossil fuel-derived energy for synthesis of nitrogen fertilizers and pesticides (UN Foresight, 2011), and rural transformation (e.g., competition for or lack of rural labor OECD-FAO, 2014), all often aggravated by climate change induced by global warming.

Climate change poses significant risks to future crop productivity as temperatures rise, rainfall patterns become more variable and pest and disease pressures increase (Heisey and Rubenstein, 2015). Climate change affects the poorest populations most in terms of food security. The number of malnourished children in sub-Saharan Africa is expected to increase as the severity of climate change increases. Asia is also vulnerable to progressive climate change (Ignaciuk, 2014). Climate change models have suggested that average maize yields are likely to fall between 5% and 33% by 2050, depending on the severity of climate change (Nelson and Rosegrant, 2010), with the largest decrease in productivity occurring in the least developed countries (Ignaciuk, 2014). As a result of climate change, maize prices could increase by Lip to 30% (Ignaciuk, 2014).

Set against this backdrop, tile future may look daunting. However, there are viable solutions that can be deployed to meet these significant challenges. While there are fewer opportunities for land expansion, there are significant avenues for improved germplasm and sustainable intensification to raise and stabilize yields and to close yield gaps (Foley *et. al*., 2011). Sustainable intensification means simultaneously raising yields, increasing the efficiency with which inputs are used and reducing the negative environmental effects of food production. Improved agricultural technology is seen as an essential strategy for increasing agricultural productivity, achieving food self-sufficiency and alleviating poverty and food insecurity among farmers (UN Foresight, 2011).

2.4 Analytical literature

2.4.1 Multiple regression analysis (ordinary least square)

According to Wooldridge (2005), multiple regression analysis is a type of analysis that is used to describe estimation of/and inference in the multiple linear regression model. It is an econometric method used to study relationship involving a dependent variable and many independent variables. When the relationship is between one dependent and one independent, it is called simple regression. Multiple regression techniques can be applied to a set of data set in which the independent variables are correlated with one another and with the independent to varying degrees (Barbara and Linda, 2013). Most regression models are multiple regression models because few phenomenons can be explained by only one variable (GuJarati, 2004).

Functional Forms

The model of an ordinary least square multiple regression analysis is implicitly stated thus:

$Y = f\ (X_1, X_2, X_3, X_n, e)$

According to Miller and Franklin, (2002), this can be performed on four (4) different functional forms which are linear, semi-log, double log and the exponential. In their general forms, these functional forms are specified as follows.

The linear form

$Y = b_0 + b_1X_1 + b_2X_2 + ... + b_nX_n + e$

The double log form

$\text{Log } Y = b_0 + b_1\ln X_1 + b_2\ln X_2 + ... + b_n\ln X_n + e$

The semi-log form

$Y = b_0 + b_1\ln X_1 + b_2\ln X_2 + ... + b_n\ln X_n + e$

The exponential form

$\ln Y = b_0 + b_1X_1 + b_2X_2 + ... + b_nX_n + e$

Where

Y = dependent Variable (e.g. value added by the various actors)

b_0 = Intercept

b_i = Coefficients of Xi

Ln = Natural logarithm

X_i = Independent Variable (socio-economic characteristics of the actors)

e = error term

2.4.2 Net returns

The costs and return of fruits and vegetables marketing were estimated using the Net Income technique. Net income is a measure of profitability and is determined based on information derived from a business or farm operations income statement (Kantrovich, 2011). The net farm income is expressed as:

NI = TR-TC

TC = TVC+ TFC

Where,

NI = Net income (₦)

TR = Total Revenue (₦)

TVC = Total variable cost (₦)

TFC = Total fixed cost (₦)

2.4.3 Net margin model

According to Tomek and Robinson, (1990); Mendoza *et. al*. (1995)

$$\text{TGMM} = \frac{\text{Consumers Price} - \text{Producer's Price}}{\text{Retail Price}} \text{X } 100$$

$$\text{TMp} = \frac{\text{Price paid by consumer} - \text{gross margin}}{\text{Price paid by the consumer}} \text{X } 100$$

$$\text{NMM} = \frac{\text{Gross margin} - \text{operational costs}}{\text{Price paid by the consumer}} \text{X } 100$$

Where:

TGMM = Total Gross Marketing Margin

GMp = Gross Margin of Producers

NM = Net Margin

2.4.4 One-way ANOVA

The statistical methodology for comparing the means of several populations is called analysis of variance, or simply ANOVA. One-way ANOVA consists of the analysis of only one way of data classification. For example, the comparison of the means of cost growth of the three types of delivery systems.

According to Moore and McCabe (2003), "ANOVA tests the null hypothesis that the population means are all equal. The alternative is that they are not all equal. This alternative could be true because all of the means are different or simply because one of them differs from the rest." Summarizing, ANOVA tests the two following hypotheses based on an F statistic:

H_O: $\mu_1 = \mu_2 = \mu_3 = ... = \mu_n$

H_a: $\mu_1 \neq \mu_2 \neq \mu_3 \neq ... \neq \mu_n$

Side-by-side boxplots are a good preliminary way of visualizing the results of ANOVA tests. In case the plots overlap each other, it is more likely that there will be failure to reject Ho. However, if there is small within-group variation and there is no overlap of the quartiles as shown on the boxplots, the difference among centers is more likely to be significant, and there would be enough evidence to reject the null hypothesis and conclude the alternative one.

One of the requirements of the test is to assume that the standard deviations of the populations are equal. In ANOVA, a "pooled" standard deviation is used. As a rule of thumb, it is possible to assume that the standard deviations of the populations are equal every time that the following sampling standard deviation relationship is satisfied:

$$\frac{\text{Largest S}}{\text{Smallest S}} < 2.0$$

This rule is used in this study. Another requirement of the test is related to the normality of the population. According to Moore and McCabe (2003), " ... the central limit theorem allow us to use normal probability calculations to answer question about sample means from many observations even when the population distribution is not normal." As a sample size guideline, the following points can be considered:

a. Small Sample Size (N <15) → Need population to be normally distributed
b. Medium Sample Size (15 < N < 40) → Some skewness in the distribution of the population is OK
c. Large Sample Size (N ≥ 40) → Strong skewness in the distribution of the population is OK

The sampling distributions of this study will be tested for normality whenever necessary to validate the results obtained.

2.4.5 Factor analysis

Factor analysis has a considerable utility in reducing numerous variables down to a few factors. The variables that are correlated with one another but largely independent of other subsets of variables combined into factors. According to Barbara and Linda (2013), the specific goal of factor analysis is to summarize patterns of correlation among observed variables, to reduce a large number of observed variables to a smaller number of factors, to provide an operational definition for an underlying process by using observed variables, or to test a theory about the nature of the underlying process. Exploratory factor analysis using principal component model with iteration and varimax rotation will be employed to evaluate constraints militating against maize production in the area. The model is given by:

$X = \lambda f + e$

Where:

X = the vector of n observable variables

F = the vector of m unobservable variables

λ = the loading matrix of the order nfm

e = the error vector of n

CHAPTER THREE

METHODOLOGY

3.1 Study Area

This study was carried out in Imo state. Imo state is located in the south eastern geographical area of Nigeria. It has a total landmass of 5430 square kilometres and a population of 4,060,816 people and a population density of 725 square kilometres (National Population Commission (NPC), 2020). It is bounded in the East by Abia state, North by Anambra state, South and South West by Rivers state. It is basically an agrarian state and lies within the tropical rainforest ecological zone. It is located between latitudes $5^0$40' and $8^0$35' north of the equator and longitudes $6^0$25' and $9^0$40' east of the meridian.

The study area experiences two major climatic season, the rainy season (March-October) and a four month dry season usually between November and February. The people are Igbo and share socio-cultural characteristics with most Igbo communities in Nigeria. The major food crops grown are cassava, maize, yam, cocoyam, melon and different varieties of vegetables. The major economic activities include; farming, trading, food processing, craft making etc. Administratively, Imo state is divided into 27 local government areas and three agricultural zones namely; Owerri, Orlu and Okigwe zone.

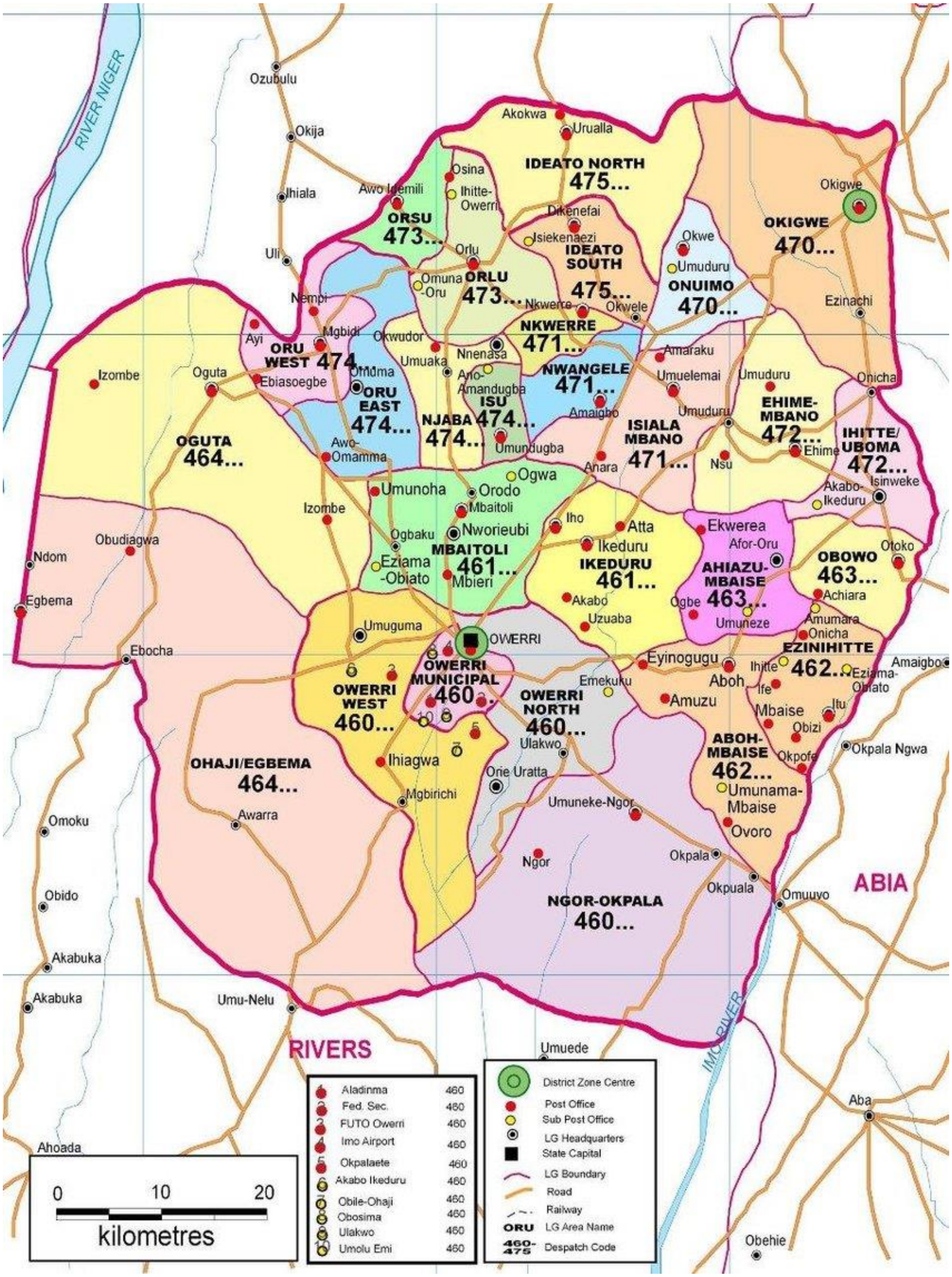


Fig. 3.1 Map of Imo State showing all the 21 Local Government Areas.

3.2 Sample Selection

Multistage sampling technique was adopted in selecting the sample for the study. There are three (3) Agricultural Zones in Imo State, which are Okigwe Agricultural Zone, Orlu Agricultural Zone and Owerri Agricultural Zone. In the first stage, two (2) Local Government Areas were randomly selected from each Agricultural Zone; making a total of six (6) Local Government Areas. In the second stage, two (2) communities were randomly selected from each of the six (6) LGAs to make a total of 12 communities.

In the third stage, five (5) villages were randomly selected from each of the 12 communities earlier selected to give a total of 60 villages used for this study. In the fourth stage, a total population of 600 active maize farmers were compiled with the help of extension agents and community leaders which served as sampling frame for this study. Taro Yamane formulae was adopted to determine sample size for the study (Yamane, 1973), as follows:

$$n = \frac{N}{1 + N(e)^2}$$

Where

n = sample size

N = sample frame (population of study)

e = allowable error

$$n = \frac{600}{1 + 600(0.05)^2}$$

$$n = 240$$

In the fifth stage, the sample was divided into 4 strata which are (that is; the four chain actors) seed suppliers, producers, processors and marketers. In the sixth stage, random sampling technique was then used to select 4 maize chain actors from each village which gave a total of 240 respondents were used for the study that is; 60 suppliers, 60 producers, 60 processors and 60 marketers.

3.3 Method of Data Collection

Both primary and secondary sources of data were used for this study. The major-instrument that was used for primary data collection was the questionnaire. The questionnaire was structured in the form as to meet the solution to the stated objectives of the study. Data were collected on socio-economic characteristics of the respondents (i.e. sex, gender, age, marital status, household size, farming experience, education level and association membership), total revenue, fixed cost, variable cost and maize value chain constraints.

In all, 240 questionnaires were administered to maize value chain actors in the state. The secondary information was collected through review of related literature such as textbooks, journals, bulletins, seminar, and conference papers amongst others.

3.4 Method of Data Analyses

Data were analyzed using descriptive and inferential statistical tools such as mean, percentage, frequency distribution, regression models, principal component factor analysis (PCFA), net farm income model and ANOVA.

Objective (i), which is to describe the socio-economic characteristics of maize value chain actors in Imo State was achieved using descriptive statistics such as mean, percentages and frequency distribution.

Objective (ii) which is to ascertain the main actors in maize value chain in the area was achieved using value chain map.

Objective (iii) which is to estimate the net margin and profitability of maize seed suppliers, producers, processors and marketers in the area was achieved using net income and profitability index model. The net income is expressed as:

NI_i = TR-TC …………………………….(1)

TC_i = TVC+ TFC …………………………..(2)

Where,

NI = Net income (₦/ton)

TR = Total Revenue (₦/ton)

TVC = Total variable cost (₦/ton)

TFC = Total fixed cost (₦/ton)

The net income model will be used for further measure of profitability of maize in the study area. The Profitability index model is expressed as:

$$PI = \frac{NI}{TC}$$

Where

PI= Profitability Index

NI= Net Income

TC= Total cost

Decision Rule:

PI > 1 = Enterprise is profitable

PI < 1 = Enterprise less is profitable

Objective (iv) which is to estimate the contributions of the major actors in the maize value chain in the state was achieved using the market share-ratio given as follows:

$$Market\ Share_i = \frac{Average\ profit\ per\ ton}{total\ profit\ per\ ton} X\ 100\%$$

Objective (v) which is to evaluate the main determinants of value addition of maize producers, processors and marketers in the study area was analyzed using multiple regression analysis. The model is implicitly stated as;

$Y_i = f(X_1,X_2,X_3,X_4,X_5X_6, , ,X_n) +e$

Where

i = 1,2,3 for producers, processors and marketers

Y_i = Value added (Naira)

X_1 = Gender (dummy) 1= male, 0= female

X_2 = Age (years)

X_3 = Marital Status (dummy) 1 = single, 0 = married

X_4= Household Size (persons)

X_5 = Educational Level (years spent in school)

X_6 = Farming Experience (years of farming)

X_7 = Farm Size (hectares)

X_8 = price of maize (₦)

X_9 = Association membership (dummy) Yes = 1, No = 0

X_{10} = Preservation cost (₦)

X_{11} = Output (₦)

X_{12} = Transport cost (₦)

X_{13} = Labour cost (₦)

X_{14} = Processing cost (₦)

e = random error

a priori expectation

output, educational level, marital status and experience were expected to be positive

household size, gender, farm size and age were expected to be negative.

Objective vi which is to identify the constraints associated with maize value chain among producers, processors and marketers in the study area was achieved using principal component factor analysis (PCFA).

The principal component analysis(PCA) explains the constraints associated with maize value chain among suppliers. The PCA enables summarization of total variance to few uncorrelated variables and visualize them in multi-dimensional space. In order to assess whether factor analysis is appropriate for the variables, Bartlett's test of sphericity was carried out. The Bartlett's test of sphericity compares the correlation matrix with a matrix of zero correlations (technically called the identity matrix, which consist of all zeros except the 1's along the diagonal) (Williams *et. al*., 2012). As the study received probability value of less than 0.05 for Bartlett's test of sphericity, it was concluded that the observed correlations are significant and valid factor analysis can be performed with the data. In order to confirm the appropriateness of Principal Component Analysis (PCA), a Bartlett's test of sphericity (BTS) and a Kaiser-Meyer-Olkin (KMO) were employed in this study. Table 4.17.2 shows the value of BTS at 133.558 and its level of significance, which indicates that the data were appropriate for PCA. The value of KMO is 0.491, indicating that there are enough items for each factor. We have selected a total of 10 relevant variables for this analysis.

The model is specified as follows:

$Z_1 = a_{11}X_1 + a_{12}X_2 + ... + a_{1n}X_n$

$Z_2 = a_{21}X_1 + a_{22}X_2 + ... + a_{2n}X_n$

$Z_3 = a_{31}X_1 + a_{32}X_2 + ... + a_{3n}X_n$

$Z_4 = a_{41}X_1 + a_{42}X_2 +... + a_{4n}X_n$

$Z_5 = a_{51}X_1 + a_{52}X_2 + ... + a_{5n}X_n$

$Z_6 = a_{61}X_1 + a_{62}X_2 + ... + a_{6n}X_n$

$Z_7 = a_{71}X_1 + a_{72}X_2 + ... + a_{7n}X_n$

$Z_8 = a_{81}X_1 + a_{82}X_2 + ... + a_{8n}X_n$

$Z9 = a_{91}X_1 + a_{92}X_2 + ... + a_{9n}X_n$

$Z_{10} = a_{101}X_1 + a_{102}X_2 +\ldots + a_{10n}X_n$

$Z_{11} = a_{111}X_1 + a_{117}X_2 + + a_{11n}X_n$

Where,

Z_1 = Cost of transportation (CT)

Z_2 = Market prices (MP)

Z_3 = Poor access road (PAR)

Z_4 = Price instability (PI)

Z_5 = Storage facility (SF)

Z_6 = Credit (UC)

Z_7 = Cost of labour (CL)

Z_8 = Maize varieties (MV)

Z_9 = Cost of processing (CP)

Z_{10} = Extension services (ES)

Z_{11} = Modern processing facilities (MPF)

a_1 - a_n = con-elation coefficients

3.5 Test of hypothesis

Hypothesis i, ii and iii were achieved using the t-test from the multiple regression analysis for objective v

Hypothesis iv was analyzed using ANOVA.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Socio-economic Characteristics of the Respondents

It is pertinent to describe the socio-economic characteristics of the farmers so as to comprehend their predisposing influence on the maize value chain in Imo State, Nigeria. The socio-economic characteristics of the respondents investigated include age, sex, marital status, household size, educational qualifications, major occupation, farm size, membership of cooperative association and years of farming experience.

4.1.1 Gender

The distribution of respondents by gender is presented in Table 4.1.

Table 4.1 Distribution of respondents by gender

Variable	Suppliers	Producers	Processors	Marketers
Gender	%	%	%	%
Male	46.67	46.67	21.67	55
Female	53.33	53.33	78.33	45
Total	100	100	100	100
n	60	60	60	60

Source: Field Survey, 2019

Table 4.1 shows that majority (53.33%, 53.33% and 78.33%) of the respondents were female suppliers, producers and processors of maize respectively. This suggests that females were more actively involved in maize supplies, production and processing business than the males. Maize farming were believed to be more female activity in the study area due to its subsistence level practiced and is less strenuous. The result is in line with the findings of Eboiyehi (2006), Fodor (2006) and Joda (2010), Muhammed-Lawal *et. al*. (2013) who observed that supplies, production and processing of maize are predominantly female activities. Similarly, majority (55%) of the respondents were male marketers of maize. This is due to the strenuous nature of marketing especially travelling to a long distance which imposes a lot of marketing risks and this deter females from participating in maize marketing. This agrees with the findings of Ogunniyi and Omotesho (2011) and Osondu *et. al*. (2014) who reported that maize marketing activities were carried out by males.

4.1.2 Age

The distribution of respondents by age is presented in Table 4.2.

Table 4.2 Distribution of respondents by age

Variable	Suppliers	Producers	Processors	Marketers
	%	%	%	%
Age				
15-29	-	1.67	18.33	13.33
30-44	-	20	38.33	28.33
45-59	65	65	41.67	46.67
60-74	35	13.33	1.67	11.67
Total	100	100	100	100
n	60	60	60	60
Mean	57.25	50.5	41	45.5

Source: Field Survey, 2019

Table 4.2 shows that majority (65%, 65%, 41.65% and 46.67%) of the respondents were within the age bracket of 45 and 59 years for suppliers, producers, processors and marketers of maize respectively. Their mean ages were 57.25, 50.5, 41 and 45.5 years respectively. This implies that respondents were in their active and productive age during which they would be willing to engage in various economic activities (such as maize seed supplies, production, processing and marketing) that could enhance their income generation. It also indicates that their productivity is expected to increase because younger farmers adopt new agricultural innovations easier than older farmers. This agrees with the findings of Amao *et. al*. (2007); Obasi *et. al*. (2012; 2015) and Oluwasola (2010) who observed that younger household heads are more dynamic with regards to adoption of innovations.

4.1.3 Marital status

The distribution of respondents by marital status is presented in Table 4.3.

Table 4.3 Distribution of respondents by marital status

Variable Marital status	**Suppliers** %	**Producers** %	**Processors** %	**Marketers** %
Single	1.67	5	30	20
Married	85	85	63.33	80
Widowed	13.33	6.67	6.67	-
Divorced	-	3.33	-	-
Total	100	100	100	100
n	60	60	60	60

Source: Field Survey, 2019

Table 4.3 shows that majority (85%, 85%, 63.33% and 80%) of maize seed suppliers, producers, processors and marketers were married and still together with their spouse. It implies that they have family members that could serve as a source of ready labour for their maize processing business. This result agrees with the findings of Amao *et. al*. (2007) and Ibekwe *et. al*. (2012). Family members promote information flow as they serve as a prospective source of information on maize value addition techniques (Chikaire *et. al*. 2012). About 1.67%, 5%, 30% and 20% of maize seed suppliers, producers, processors and marketers were single while 13.33%, 6.67% and 6.67% of maize seed suppliers, producers and processors were widowed.

4.1.4 Household size

The distribution of respondents by household size is presented in Table 4.4.

Table 4.4 Distribution of respondents by household size

Variable	**Suppliers**	**Producers**	**Processors**	**Marketers**
Household size	%	%	%	%
1-3	25	21.67	48.33	45
4-6	55	70	48.33	51.67
7-9	20	8.33	3.33	3.33
Total	100	100	100	100
n	60	60	60	60
Mean	5	7	4	4

Source: Field Survey, 2019

Table 4.4 also shows that majority (55%, 70%, 48.33% and 51.67%) of maize seed suppliers, producers, processors and marketers had household size within 4-6 persons, while 25%, 21.67%, 48.33% and 45% had household size within 1-3 persons. Furthermore, 20%, 8.33%, 3.33% and 3.33% had household size within 7-9 persons respectively. The mean household size were 5, 7, 4 and 4 persons for maize seed suppliers, producers, processors and marketers respectively. This is in line with the reports of National Population Commission (NPC) and Inner City Fund (ICF) (2014), which established that the mean household size in Nigeria is 5 persons. According to Abdeleteif and Siegfried (2015) large household size may translate to higher usage of family labour.

4.1.5 Educational level

The distribution of respondents by educational level is presented in Table 4.5

Table 4.5 Distribution of respondents by educational level

Variable	**Suppliers**	**Producers**	**Processors**	**Marketers**
Educational level	%	%	%	%
Primary	25	38.33	10	1.67
Secondary	48.33	30	56.67	53.33
Tertiary	26.67	31.67	26.67	45
n	60	60	60	60
Mean	9.6	9.1	9.9	12.1

Source: Field Survey, 2019

Table 4.5 shows that majority (48.33%, 30%, 56.67% and 53.33%) of maize seed suppliers, producers, processors and marketers had secondary education, 25%, 38.33%, 10% and 1.67% had primary education, 26.67%, 31.67%, 26.67% and 45% had tertiary education respectively. Only 6.67% of maize producers had no formal education. The mean number of years spent in school were 9.6, 9.1, 9.9 and 12.1 respectively. This implies that majority of the respondents were literate and thus had the advantage of adopting innovation, since education helps in adopting improved agricultural technologies. Educational status affects the level of exposure to new ideas, managerial capacity and the perception of the household members on how to adopt and integrate innovations into the household's survival strategies. Ajao *et. al*. (2012) stated that the more educated farmers are, the higher their utilization of agricultural innovation.

4.1.6 Major occupation

The distribution of respondents by major occupation is presented in Table 4.6.

Table 4.6 Distribution of respondents by major occupation

Variable	**Suppliers**	**Producers**	**Processors**	**Marketers**
Occupation	%	%	%	%
Trading	51.67	10	46.67	66.67
Civil servant	10	16.67	8.33	1.67
Craft	3.33	1.67	5	-
Farming	35	71.67	40	31.67
Total	100	100	100	100
n	60	60	60	60

Source: Field Survey, 2019

Table 4.6 shows that 51.67%, 46.67% and 66.67% of maize seed suppliers, processors and marketers had trading as their major occupation, while 71.67% of the producers had farming as their major occupation. However, 10%, 16.67% and 8.33% of suppliers, producers and processors respectively had civil service as their major occupation. Similarly, 31.67% of the marketers had farming as their main occupation.

4.1.7 Experience

The distribution of respondents by years of experience is presented in Table 4.7

Table 4.7 Distribution of respondents by years of experience

Variable	**Suppliers**	**Producers**	**Processors**	**Marketers**
Experience	%	%	%	%
1-10	61.67	40	66.67	50
11-20	38.33	30	33.33	35
21-30	-	20	-	15
31-40	-	6.67	-	-
41-50	-	3.33	-	-
Total	100	100	100	100
n	60	60	60	60
Mean	9.3	15.8	8.8	12

Source: Field Survey, 2019

Table 4.7 shows that majority (61.67%, 40%, 66.67% and 50%) of maize seed suppliers, producers, processors, and marketers respectively had between 1-10 years of experience. About 38.33%, 30%, 33.33% and 35% had 11-20 years experience in their respective business. However, 20% and 15% of maize producers and marketers had 21-30 years of experience, 6.67% of maize producers had 31-40 years experience while 3.33% of the producers had 41-50 years experience. The mean years of experience were 9.3, 15.8, 8.8 and 12. Lengthy years of experience is an important requirement for the success of any business (Amao *et. al*., 2007; Ibekwe *et. al*., 2012). Findings of the study agrees with Dauda and Ndanitsa (2009) who observed that the length of experience of a working population in any occupation determines its performance and enables managers to overcome administrative problems.

4.1.8 Membership of association

The distribution of respondents by membership of an association is presented in Table 4.8.

Table 4.8 Distribution of respondents by membership of cooperative association

Variable	**Suppliers**	**Producers**	**Processors**	**Marketers**
Membership association	%	%	%	%
Yes	65	45	20	61.67
No	35	55	80	38.33
Total	100	100	100	100
N	60	60	60	60

Source: Field Survey, 2019

Table 4.8 shows that 65%, 45%, 20% and 61.67% of maize seed suppliers, producers, processors and marketers respectively were members of one cooperative association or the other, while 35%, 55%, 80% and 38.33% of maize seed suppliers, producers, processors and marketers respectively were not members of any cooperative association. This is in agreement with the findings of Bakari (2016) that some respondents do not belong to any association, and surely miss out on opportunities to participate in any programme that is communicated through cooperative societies.

4.1.9 Farm size

The distribution of respondents by farm size is presented in Table 4.9

Table 4.9 Distribution of producers by farm size

Variable Farm size	%
01-1.0	68.33
1.1-2.0	6.67
2.1-3.0	13.33
3.1-4.0	1.67
4.1-5.0	1.67
5.1-6.0	8.33
Total	100
n	60
Mean	1.42Ha

Source: Field Survey, 2019

Table 4.9 shows that majority (68.33%) of the maize producers had farm size of 0.1-1.0 hectares. This was followed by 13.33% of maize producers within the category of 1.1-2.0 hectares, 8.33% within the category of 5.1-6.0 while 1.67% were within the category of 3.1-4.0 and 4.0-5.0 hectares respectively. The mean farm size was 1.42 hectares. Ojo *et. al*. (2008) and Omonona *et. al*. (2010) both reported that majority of their respondents had small and segmented farm holdings probably because they acquired their land through inheritance.

4.2 Value chain map in maize value chain

The value chain map of maize value chain actors is presented in figure 4.1 below

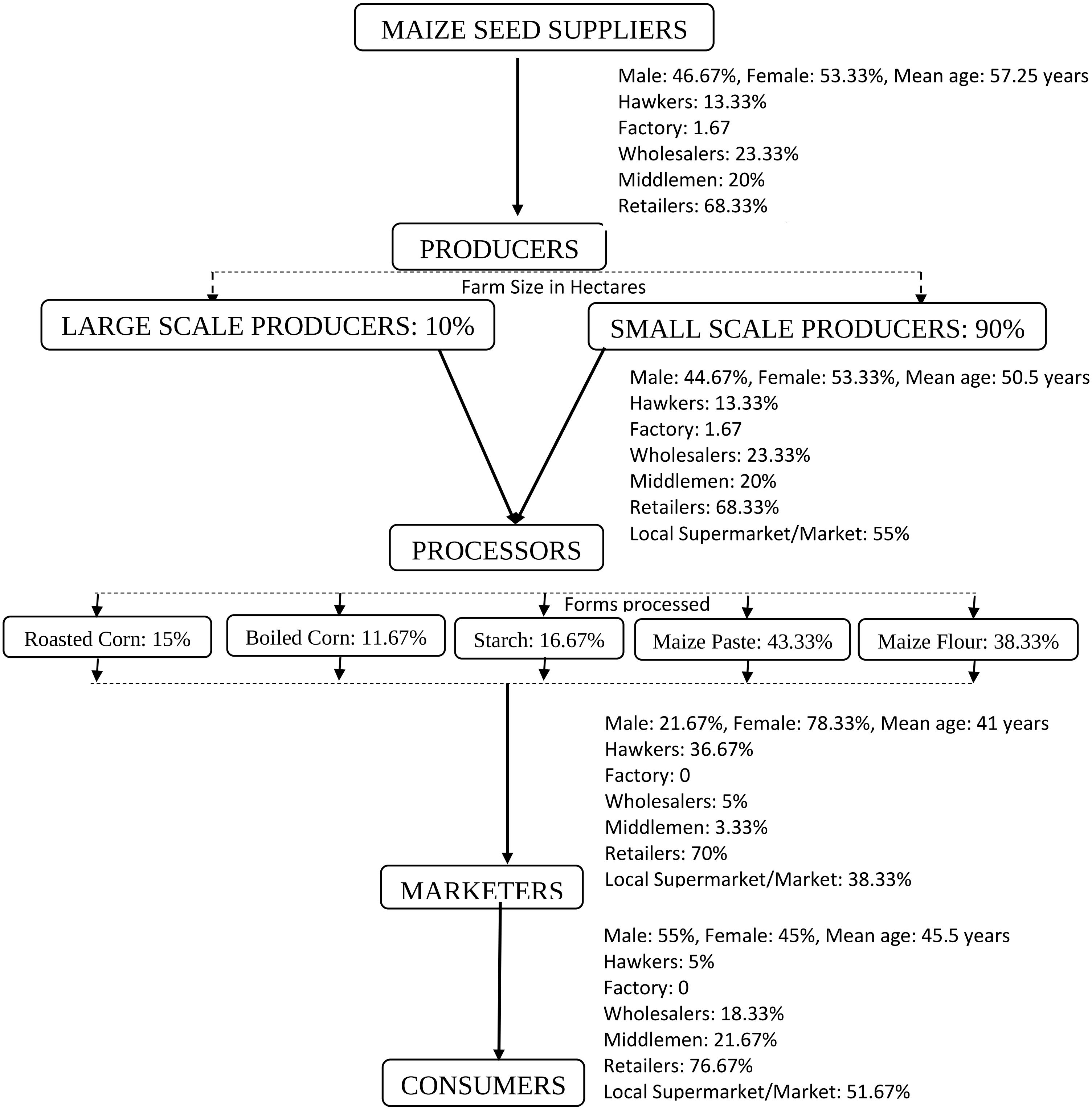


Figure 4.1: Maize value chain map in Imo State. Source: Field survey, 2019

(Note: percentages under each enterprise in the chain does not sum up to 100 because various actors engage in more than one distribution channel for their products)

4.2.1 Seed suppliers

Maize seed suppliers are responsible for making available improved varieties of maize seeds from research institutions to farmers. They also offer advisory services on the application of the improved maize seeds. Maize seed supply in the study area were dominated by females, who easily travel long distances to purchase maize seeds from wholesalers or from research institutions. The finding showed that more women are involved in maize seed supply. The results were in consonance with the findings of Eboiyehi (2006), Fodor (2006), Joda (2010) and Muhammed-Lawal *et. al*. (2013) who opined that supplying, producing and processing are predominantly female activities. The seed suppliers are at the top level in the chain and therefore do not play significant role in the study area, because in the absence of adequate seed supplies there will definitely be low production.

4.2.2 Producers

Maize production is in the hands of the producers (farmers). Establishment and management of the farm make up the activities of the producers. Production of maize is labour intensive and it involves numerous procedures such as land clearing, land tillage, weeding, planting of seeds, and harvesting. Most farmers use family labour or paid labour which they usually employ on daily basis. Men and women are involved in different maize production activities. Some activities such as land clearing and land tillage are done by men while others such as weeding, planting of maize seeds, and harvesting are done mostly by women. The result shows that majority of maize producers are small-scale farmers who cultivate on the average

1.42 hectares. This is similar to the findings of Trias (2012) and Adeoye *et. al*. (2013) who observed that small-scale farmers were the main producers of maize in Africa. Farmers in the study area inter-cropped maize with other crops such as melon, cassava, vegetable, yam, and groundnut.

4.2.3 Processors

Harvested maize cobs were processed into different products such as maize flour, popcorn, poultry feed, sweeteners, starch, alcoholic beverages etc. Processors buy directly from producers/farmers. Maize cob produced in Imo State undergo numerous processing before they reach different markets. The primary processing activities involve; fermentation, baking, puffing, flaking, frying and extrusion. Men and women were found in this activity. It was found that majority of the women were responsible for seed preparation and processing. Findings show that more women were involved in fermentation, baking, puffing, flaking, frying and extrusion.

4.2.4 Marketers

Maize products such as maize flour, popcorn, poultry feed, sweeteners and maize starch are marketed in major markets in the study area. Maize products such as flour, popcorn, poultry feed, sweeteners, starch are traded in different towns and cities, national markets and international markets. Each market usually represents different customers who demand for different quantities of the various maize products. Majority of the maize products are sold to whoever needs them at the market place and often at better price. Maize product sales are done by both men and women. There is existence of wholesalers and retailers of maize product in the study area. Maize and its products are important staple in most households interviewed. Almost all families reported that they consume products mostly in the evening, while some said they eat it twice daily. The result in figure 4.1 shows that all the value chain actors interact with the consumers directly or indirectly.

4.3 Net margin and profitability of maize value chain actors

The costs and returns items of the maize seed suppliers, producers, processors and marketers are presented in Table 4.10 from which the net margin and profitability of the value chain actors were estimated.

Table 4.10 Costs and returns per ton of maize value chain actors

Variables	Suppliers	Producers	Processors	Marketers
Return	19,886.67	138,521	18,222.2	34,634.83
Depreciation	3,350.82	1,889	3,885.57	1,778.85
Total fixed cost	3350.82	1,889	3885.57	1,778.85
Product cost	400	2,755.52	8,825.42	18,495
Preservation cost	1,349.02	-	-	-
Market/security levy	186.67	-	-	285.09
Charcoal	-	-	2,658.33	-
Labour	-	7,610	133.33	-
Fertilizer	-	5,461.67	-	-
Pesticides	-	3,501.58	-	-
Fuel	-	-	584.17	-
Transportation	640	1,072.42	902.54	1,087.07
Packaging material	595.37	2,891.43	727.74	456.44
Total variable cost	3,171.06	23,292.62	13,831.53	20.323.60
Total cost	6,521.88	25,181.62	17,717.10	22,102.45
Gross Income	16,715.61	115,228.38	4,390.67	14,311.23
Net Income	13,364.79	113,339.38	505.10	12,311.23
Profitability index	2.049	4.87	0.029	0.557

Source: Field survey, 2019

The results in Table 4.10 show that the total revenue realized by maize seed suppliers, producers, processors and marketers were ₦19,886.67, ₦138,521, ₦18,222.2 and ₦34,634.83 respectively per ton with a total variable cost of ₦3,171.06, ₦23,292.62, ₦13,831.53 and ₦20,323.60 respectively and a total fixed cost of ₦3,350.82, ₦1,889, ₦3,885.57 and ₦1,778.85. The maize actors made a net income of ₦13,364.79, ₦113,339.38, ₦505.10 and ₦12,532.38, indicating that the actors made profit from their investment. With regards to the profitability of the enterprise by the actors; 2.049, 4.87, 0.029 and 0.557 were estimated indicating that every ₦1 invested yielded ₦2.049, ₦4.87, ₦0.029 and ₦0.557 to the maize seed suppliers, producers, processors and marketers respectively. This implies that maize seed suppliers and producers were profitable enterprises in the study area while processors and marketers were not profitable enterprises in the study area. This result agrees with the findings of Abu *et. al*. (2012). The profitability index measures the overall financial success of the maize actors in the area. A ratio greater than one is preferable for any enterprise because the higher the ratio, the higher the profit (Olukosi and Isitor, 2008). Given the value of these ratios, it can be adjudged that maize seed supplies and production are profitable ventures while processing and marketing are not profitable ventures in the study area.

4.4 Maize market share

The contribution to market by the actors in maize seed suppliers, producers, processors and marketers per ton are presented in Table 4.11.

Table 4.11 Distribution of maize market share by the actors

Variables	Suppliers	Producers	Processors	Marketers
Total return per ton	11,932,000	68,405,500	10,933,320	20,780,900
Average return per ton	198,866.7	1,140,092	182,222	346,348.3
Market share	1.67	1.67	1.67	1.67

Source: Field survey, 2019

Table 4.11 shows the results of the contribution of the major actors in the maize value chain in the study area. The findings show that the maize seed suppliers, producers, processors and marketers each contributed 1.67% respectively to the market. This implies that the various actors can choose to remain in their present enterprise or choose any other since all the enterprises made equal contribution to the market.

A large market share can give an enterprise price leadership in the market, where competitors are more likely to follow the price points established by the company. This situation most commonly arises when the enterprise is the low-cost leader in the sector. However, an enterprise that offers goods at a low price point may not be the most financially successful one in the industry. A smaller enterprise might reap more profits by occupying a more profitable niche within the market (Bragg, 2020).

4.5 Determinants of value addition in maize seed supply, production, processing and marketing in Imo State

The determinants of value addition in maize seed supply, production, processing and marketing are presented below:

4.5.1 Determinants of Value Addition in Maize Seed Supply in Imo State

The result of the multiple regression analysis on the determinants of maize seed supply is shown in Table 4.12

The result shows that all the functional forms were statistically significant at 1% level of probability, implying that any of the functional forms is adequate in estimating and explaining the determinants of maize seed supply. However, upon critical evaluation of the results of the various functional forms, the exponential form of the regression model was chosen as the lead equation which explained 79.8% of the total variation at 1% level of significance. The exponential function was chosen based on other consideration such as value of the F-Statistic (17.198), low standard errors (1.47254), highest number of significant variables and *a priori* expectation.

Table 4.12: Results of Multiple Regression Analysis on the Determinants of Value Addition in Maize Seed Supply

Variable	Linear	Exponential	Semi-Log	Double-Log
Constant	-7808.503	2.333	-139061.459	-39.962
	(-1.538)***	(0.742)	(-4.615)***	(-4.141)***
Gender(X_1)	-159.116	0.192	45.493	0.233
	(-0.190)	(0.371)	(0.034)	(0.540)
Age(X_2)	108.440	0.155	-2302.849	5.959
	(1.445)	(3.340)***	(-0.356)	(2.876)***
Marital Status(X_3)	-76.598	-1.328	6428.854	-1.452
	(-0.064)	(-1.780)*	(1.630)*	(-1.150)
Household Size(X_4)	-359.660	-0.340	2133.304	-0.346
	(-1.328)	(-2.024)**	(1.371)	(-0.694)
Education Level(X_5)	-99.351	-0.010	-1075.188	-0.016
	(-0.810)	(-0.127)	(-0.579)	(-0.027)
Experience(X_6)	93.396	0.049	-180.508	0.170
	(1.258)	(1.066)	(-0.165)	(0.487)
Association Mem.(X_7)	-181.608	-0.874	-7.547	-0.397
	(-0.223)	(-1.733)*	(-0.005)	(-0.873)
Product Cost (X_8)	-6.153	-0.008	7765.175	-1.441
	(-2.921)***	(-5.795)***	(4.355)***	(-2.525)***
Transport Cost(X_9)	-0.870	0.001	-1849.489	-0.046
	(-0.675)	(1.698)*	(-1.535)	(-0.120)
Preservation Cost(X_{10})	-0.850	-0.001	917.034	-0.158
	(-1.578)	(-3.209)***	(2.661)***	(-1.434)
Output(X_{11})	1.073	0.000	12077.509	3.662
	(25.727)***	(10.405)	(14.634)***	(13.857)***
R^2	0.949	0.798	0.864	0.855
F-Statistics	81.729	17.198	27.707	25.689
Standard Error	2377.47291	1.47254	3895.32738	1.24731
n	60	60	60	60

***Significant at 1%, **Significant at 5% and *Significant at 10%

Source: Field survey, 2019

Age(X_2) of maize seed suppliers was found to be positively related to their net income and statistically significant at 1% level. This implies that as the farmers advance in age, it will result to a proportionate increase in net income. The implication is that an increase in age will lead to a corresponding increase in maize output. Age of the farmer has profound effect on output. Age as proxy for experience has been shown to enhance farming initiative and efficient use of resources (Nwaobiala, 2010). This result disagrees with the findings of Martey *et. al*. (2013) who observed a negative relationship between performance (profit) and age of respondents in their study on "performance and Constraints of Small Scale Enterprises in Accra Metropolitan Area of Ghana".

Marital status(X_3) of maize seed suppliers was found to be negatively related to net income and statistically significant at 10% level. This implies that as the farmers advance from singlehood to married, their net income decreases. This can be due to the increase in the number of persons who consume from the proceeds of the enterprise. The finding was contrary to Amao, Adesiyan and Salako (2007) who found that the high performance of married farmers could be attributed to the fact that spouses can serve as a form of labour by reducing the cost on hired labour and hence, increasing the profit base of the enterprise.

Household size(X_4) was found to be inversely related to net income and statistically significant at 5% level. This implies that as farmers' household size increases, there would be a corresponding decrease in net income earned from maize seed supply.

Membership of social organizations(X_7) was found to be inversely related to their net income and statistically significant at 10% level. This implies that as the farmers participate in more social gatherings, it will result to a decrease in their net income. This could be due to the high cost of registering in most of the social organizations and the dues imposed on them which in turn increase their expenses resulting to a corresponding decrease in their net income.

Production cost(X_8) was found to be negatively related to their net income and statistically significant at 1% level. This implies that as the cost of producing the maize seed increases, there will be a corresponding decrease in the net income of the enterprise.

Transportation cost(X_9) was found to be positively related to their net income and statistically significant at 10% level. This implies that as the cost of transportation increases there will be a corresponding increase in the net income of the enterprise. This could be due to the long distance they had to travel to meet the demand for their product and hence make a higher return from volume of sale.

Preservation cost(X_{10}) was found to be inversely related to their net margin and statistically significant at 1% level. This implies that as the cost of preserving the maize seed to be supplied increases, there will be a corresponding decrease in the net income of the enterprise. This could be attributed to the additional cost which rips part of the suppliers' net income in form of storage activities against rodents and other insects before being sold. This is in line with *a priori* expectation, because maize require adequate storage to avoid spoilage thereby increasing the variable cost.

4.5.2 Determinants of Value Addition in Maize Production in Imo State

The result of the multiple regression analysis on the determinants of maize production is shown in Table 4.13

Table 4.13: Results of Multiple Regression Analysis on the Determinants of Value Addition in Maize Production

Variable	Linear	Exponential	Semi-Log	Double-Log
Constant	-245539.572	4.671	-705044.256	-10.078
	(-1.686)*	(0.667)	(-0.453)	(-0.223)
Gender(X_1)	-56275.367	-1.674	-52148.493	-1.528
	(-2.487)**	(-1.539)	(-1.462)	(-1.478)
Age(X_2)	2712.648	0.067	173165.822	1.405
	(1.523)	(0.788)	(1.193)	(0.334)
Marital Status(X_3)	-13304.962	-0.831	-84542.905	-2.362
	(-0.550)	(-0.715)	(-0.877)	(-0.845)
Household Size(X_4)	8253.884	0.288	44230.566	1.380
	(1.031)	(0.748)	(0.872)	(0.939)
Education Level(X_5)	1223.686	0.102	-18209.240	0.264
	(0.597)	(1.034)	(-0.822)	(0.411)
Experience(X_6)	1101.960	0.059	27089.975	1.972
	(0.825)	(0.925)	(0.694)	(1.743)
Association Mem.(X_7)	29754.068	-0.670	40818.844	-0.739
	(1.173)	(-0.549)	(1.023)	(-0.638)
Farm Size(X_8)	34631.836	0.368	102790.307	0.561
	(4.007)***	(0.885)	(3.959)***	(0.745)
Labour Cost(X_9)	-4.611	0.000	-83155.445	-1.946
	(-2.571)***	(-2.425)	(-2.801)***	(-2.261)**
Fertilizer Cost(X_{10})	11.699	0.000	-18214.864	0.796
	(0.540)	(0.122)	(-0.107)	(0.162)
Transport Cost(X_{11})	9.834	-0.001	13615.586	-0.495
	(0.801)	(-1.088)	(0.558)	(-0.699)
Kg Seed(X_{12})	5.066	0.000	-7904.466	0.548
	(0.933)	(1.048)	(-0.552)	(1.321)
Output(X_{13})	0.820	9.184E-006	90730.229	1.680)
	(13.700)***	(3.192)***	(6.701)***	(4.279)***
R^2	0.868	0.628	0.667	0.447
F-Statistics	23.196	2.310	7.095	2.856
Standard Error	81343.93240	3.91056	128982.2163	3.73976
N	60	60	60	60

***Significant at 1%, **Significant at 5% and *Significant at 10%

Source: Field survey, 2019

The result show that all the functional forms were statistically significant at 1% level of probability, implying that any of the functional forms is adequate in estimating and explaining the determinants of maize production. However, upon critical evaluation of the results of the various functional forms, the Linear form of the regression model was chosen as the lead equation which explained 86.8% of the total variation at 1% level of significance. The linear function was chosen based on other consideration such as value of the F-Statistic (23.196), highest number of significant variables and *a priori* expectation.

Sex(X_1) of the maize producers was found to be inversely related to net income and statistically significant at 5% level. This implies that farmers who employ services of male labour incurred more cost which reduces their net income because maize production is perceived to be done by the females in the study area.

Farm size(X_8) of maize producers was found to be positively related to net income and statistically significant at 1% level. This implies that an increase in farm size allotted for production will result to a significant increase in their net income. This is so because the more the farm size a farmer has access to for production the more the output and hence, an increased net income. This finding is supported by Tesso (2003).

Labour cost(X_9) was found to be negatively related to net income and statistically significant at 1% level. This implies that as the cost of hired labour increases, there will be a corresponding decrease in the net income of the enterprise. Agricultural production is labour intensive which results hiring of labour in addition to family labour, this results to higher expenses on the part of the farm and hence reducing the net income.

Output(X_{13}) was found to be directly related to net income and statistically significant at 1% level. This implies that as the output of the maize producer increases, there will be a corresponding increase in the net income of the enterprise. The increase in the net income due to increased output is as a result of higher sales volume from higher yield and can also be as a result of less losses to insects and pest which alter the yield of maize.

Age(X_2), Household Size(X_4), Educational Level(X_5), Years of Experience(X_6), Membership of Association(X_7), Fertilizer Cost(X_{10}), Transportation Cost(X_{11}) and Kg of Seeds(X_{12}) were found to be directly related to their net income but were not significant. This implies that a change in Age, Household Size, Educational Level, Years of Experience, Membership of Association, Fertilizer Cost, Transportation Cost and Kg of Seeds will result to no significant change in the net income of the enterprise.

4.5.3 Determinants of Value Addition in Maize Processing in Imo State

The result of the multiple regression analysis on the determinants of maize processing is shown in Table 4.14

The result shows that all the functional forms were statistically significant at 1% level of probability, implying that any of the functional forms is adequate in estimating and explaining the determinants of maize processing. However, the Linear functional form was chosen as the lead equation and used for further analysis of the data. The linear function was chosen based on other considerations such as value of the F-Statistic (18.406), highest number of significant variables and *a priori* expectation.

Table 4.14: Results of Multiple Regression Analysis on the Determinants of Value Addition in Maize Processing

Variable	Linear	Exponential	Semi-Log	Double-Log
Constant	568.163	2.444	28382.650	5.413
	(0.123)	(2.483)**	(1.121)	(1.340)
Gender(X_1)	-450.286	-0.550	-5055.939	-1.092
	(-0.200)	(-1.139)	(-1.421)	(-1.924)
Age(X_2)	-269.764	-0.047	-25678.048	-2.820
	(2.214)**	(-1.817)*	(-1.449)	(-0.998)
Marital Status(X_3)	2928.783	0.623	13683.233	1.439
	(1.298)	(1.289)	(0.700)	(0.461)
Household Size(X_4)	308.675	0.060	-4306.070	-0.575
	(0.430)	(0.394)	(-0.404)	(-0.338)
Education Level(X_5)	54.081	-0.013	5.396	-0.056
	(0.288)	(-0.313)	(0.001)	(-0.077)
Experience(X_6)	114.147	0.017	6276.649	0.989
	(0.556)	(0.389)	(1.144)	(1.129)
Association Mem.(X_7)	1610.743	0.611	5868.810	1.107
	(0.671)	(1.190)	(1.510)	(1.784)*
Labour Cost (X_8)	-1.358	-0.001	-1040.197	-0.217
	(-0.718)	(-1.328)	(-0.588)	(0.771)
Product Cost(X_9)	-1.345	0.000	-2649.845	-0.026
	(-6.531)***	(-3.208)***	(-0.889)	(-0.055)
Transport Cost(X_{10})	-0.255	0.000	-486.952	-0.669
	(-0.316)	(-1.361)	(-0.151)	(-1.296)
Output(X_{11})	0.945	0.000	5287.969	0.693
	(11.795)***	(6.804)***	(4.081)***	(3.352)***
R^2	0.808	0.647	0.462	0.448
F-Statistics	18.406	7.986	3.740	3.541
Standard Error	5749.38442	1.23018	9637.28289	1.53765
N	60	60	60	60

***Significant at 1%, **Significant at 5% and *Significant at 10%

Source: Field survey, 2019

Age(X_2) of maize processors was found to be inversely related to net income and statistically significant at 5% level. This suggests that as the farmers advance in age, there will be a decrease in net income. Age of the farmer has profound effect on output. Age as proxy for experience has been shown to enhance farming initiative and efficient use of resources (Nwaobiala, 2010). This result agrees with the findings of Martey *et. al* (2013) who found a negative relationship between performance (profit) and age of respondents in their study on Performance and Constraints of Small Scale Enterprises in Accra Metropolitan Area of Ghana.

Product cost(X_9) (raw maize for processing) was found to be negatively related to their net income and statistically significant at 1% level of. This implies that as the cost of maize seed for processing increases, there will be a corresponding decrease in the net income of the enterprise. The increased cost of maize seed increases the variable cost of the farmer and hence decreases his/her net income.

Output(X_{11}) was found to be positively related to net income and statistically significant at 1% level. This implies that as the output of the maize processors increases, there will be an increase in the net income of the enterprise. The increase in the net income due to increased output is as a result of higher sales volume from higher yield and can also be as a result of less losses to insects and pest which alter the yield of maize

Marital status(X_3), Household size(X_4), Educational level(X_5), Years of experience(X_6) and Membership of association(X_7) were found to be directly related to their net income but not significant. This implies that a change in Marital Status, Household size, Educational level, Years of experience and Membership of Association will result to no significant change in the net income of the enterprise. Sex(X_1), Labour cost(X_8), and Transportation cost(X_{10}) of maize producers were found to be inversely related to net income but not significant. This implies that a change in Sex, Labour cost, and Transportation cost will result to no significant change in the net margin of the enterprise.

4.5.4 Determinants of Value Addition in Maize Marketing in Imo State

The result of the multiple regression analysis on the determinants of maize marketing is shown in Table 4.15

Table 4.15: Results of Multiple Regression Analysis on the Determinants of Value Addition in Maize Marketing

Variable	Linear	Exponential	Semi-Log	Double-Log
Constant	-6229.071	2.035	-62988.825	2.312
	(-3.782)***	(2.160)**	(-1.106)	(0.630)
Gender(X_1)	93.224	0.204	-4550.166	-0.065
	(0.271)	(1.036)	(-0.977)	(-0.218)
Age(X_2)	-28.111	-0.039	29781.869	-2.149
	(-1.008)	(-2.441)**	(0.805)	(-0.902)
Marital Status(X_3)	329.562	0.424	-19962.670	-0.042
	(0.479)	(1.078)	(-0.523)	(-0.017)
Household Size(X_4)	-3.030	0.065	4259.078	0.796
	(-0.018)	(0.688)	(0.221)	(0.641)
Education Level(X_5)	283.931	-0.058	22414.680	0.446
	(2.854)***	(-1.015)	(0.607)	(0.187)
Experience(X_6)	41.391	0.025	-3717.589	0.572
	(1.187)	(1.229)	(-0.345)	(0.825)
Association Mem.(X_7)	973.847	1.211	8907.774	1.436
	(2.330)**	(5.064)***	(1.506)	(3.769)***
Transport Cost (X_8)	-1.601	0.000	-7584.993	-0.408
	(-8.910)***	(-2.642)	(-1.984)**	(-1.658)
Product Cost(X_9)	-1.031	-2.472E-005	-12142.339	-0.646
	(55.073)***	(-2.310)	(-4.270)***	(-3.528)***
Output(X_{10})	1.009	6.220E-005	17656.991	1.362
	(104.079)	(11.220)***	(5.264)***	(6.303)***
R^2	0.998	0.889	0.579	0.745
F-Statistics	2103.417	39.279	6.735	14.322
Standard Error	1260.41028	0.72090	16966.99995	1.09290
N	60	60	60	60

***Significant at 1%, **Significant at 5% and *Significant at 10%

Source: Field survey, 2019

The result shows that all the functional forms were statistically significant at 1% level of probability, implying that any of the functional forms is adequate in estimating and explaining the determinants of maize marketing. However, the Linear functional form was chosen as the lead equation based on the highest value of F-Statistic (2103.417), highest number of significant variables and *a priori* expectation.

Educational level(X_5) of the maize marketers was found to be directly related to net income and statistically significant at 1% level. This implies that as the maize marketers advance in their educational level, it will result to a significant increase in their net income. Marketers with low level of education would be less receptive to improved marketing techniques. Hence, the need for the educated people to be involved in agricultural marketing for improved efficiency.

Membership of social organizations(X_7) was found to be directly related to net income and statistically significant at 5% level. This implies that as the farmers participate in more social gatherings, it will result to an increase in their net income. This could be due to the awareness of innovative ideas and strategies to packaging and marketing of their products learnt as a result of their active participation in social gatherings.

Transportation cost(X_8) was found to be inversely related to net income and statistically significant at 1% level. This implies that as the cost of transportation increases there will be a corresponding increase in the net income of the enterprise. This could be due to the long distance they had to travel to meet the demand for their product and hence make a higher return from volume of sale.

Product cost(X_9) was found to be inversely related to net income and statistically significant at 1% level. This implies that as the cost of the various maize product increases there will be a corresponding decrease in net income of the enterprise. The increased cost of products purchased by the marketer increases the variable cost and hence decreases his/her net income

Output(X_{10}) was found to be directly related to net income and statistically significant at 1% level. This implies that as the output of the maize marketers increase there will be a corresponding increase in net income of the enterprise. The increase in the net income due to increased output is as a result of higher sales volume from higher yield and can also be as a result of less losses to insects and pest which alter the yield of maize

Sex(X_1), Marital status(X_3) and Years of experience of the maize marketers were found to be directly related to net margin but not significant. This implies that a change in Sex, Marital Status and Years of Experience of the maize marketers had no significant impact on net income of the enterprise.

Age(X_2) and Household size(X_4) were found to be inversely related to net income but not significant. This implies that a change in Age and Household Size of the maize marketers will have no significant impact on net income of the enterprise.

4.6 Constraints associated with maize value chain

The constraints associated with maize value chain in Imo State are presented below:

4.6.1 Constraints associated with maize seed supply

The correlation matrix of variables for constraints associated with maize seed supply is presented in Table 4.16.1.

Factor analysis techniques try to bundle up sub groups of variables together, based upon their correlations. By looking at the matrices, it can be concluded whether meaningful factor analysis is possible or not. As the statisticians suggest, if the correlation matrices has values more than 0.3 and less than 0.8. a meaningful factor analysis can be done (Robin, 2012) (Table 4.16.1).

Table 4.16.1 Correlation matrix of the variables for maize seed supply

	HTC	HCS	LGR	CMP	LGSF	LC	HCL	HCH	PES	LMPF
HTC	1.000	.537	.232	.157	.208	.318	-.146	.415	-.348	.075
HCS	.537	1.000	.030	.345	.262	.251	.102	.508	-.505	.067
LGR	.232	.030	1.000	-.010	.065	.151	.187	.347	.117	.040
CMP	.157	.345	-.010	1.000	.173	-.056	.002	.263	-.352	.018
LGSF	.208	.262	.065	.173	1.000	-.090	-.016	.187	-.044	-.115
LC	.318	.251	.151	-.056	-.090	1.000	.007	.320	-.113	.172
HCL	-.146	.102	.187	.002	-.016	.007	1.000	.409	-.120	.138
HCH	.415	.508	.347	.263	.187	.320	.409	1.000	-.393	.068
PES	-.348	-.505	.117	-.352	-.044	-.113	-.120	-.393	1.000	.096
LMPF	.075	.067	.040	.018	-.115	.172	.138	.068	.096	1.000

Source: Field survey, 2019

Table 4.16.2 Bartlett's test of sphericity (BTS) and Kaiser-Meyer-Olkin(KMO) for maize seed supply.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.640
Bartlett's Test of Sphericity		
	Approx. Chi-Square	127.073
	Df	45
	Sig	.000

Source: Field survey, 2019

In order to confirm the appropriateness of Principal Component Analysis (PCA), a Bartlett's test of sphericity (BTS) and a Kaiser-Meyer-Olkin (KMO) were employed in this study. Table 4.16.2 shows the value of BTS at 127.073 and its level of significance, which indicates that the data were appropriate for PCA. The value of KMO is 0.64, indicating that there are enough items for each factor. We have selected a total of 10 relevant variables for this analysis.

Table 4.16.3 Eigenvalues of Components for maize seed supply

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cum. %	Total	% of Variance	Cum. %	Total	% of Variance	Cum. %
1	2.843	28.434	28.434	2.843	28.434	28.434	2.000	19.998	19.998
2	1.487	14.865	43.299	1.487	14.865	43.299	1.873	18.730	38.728
3	1.218	12.182	55.480	1.218	12.182	55.480	1.563	15.631	54.359
4	1.132	11.317	66.798	1.132	11.317	66.798	1.244	12.438	66.798
5	.922	9.221	76.018						
6	.764	7.643	83.662						
7	.604	6.044	89.705						
8	.392	3.918	93.624						
9	.337	3.371	96.995						
10	.301	3.005	100.000						

Extraction Method: Principal Component Analysis.
Source: Field survey, 2019

The objective of PCA is to find common factors, called principal components, in the form of linear combinations of the constraints under study and to rank them according to their importance. Table 4.16.3 shows the eigenvalues of the components. There are four components whose eigenvalue is greater than one and they account for 66.80% of the total variance. It is important to note that only factors that have eigenvalues greater than one are retained. The plot of eigenvalues shows that only four factors are above the one eigenvalue (benchmark) and the rest are shown in Figure 4.2.

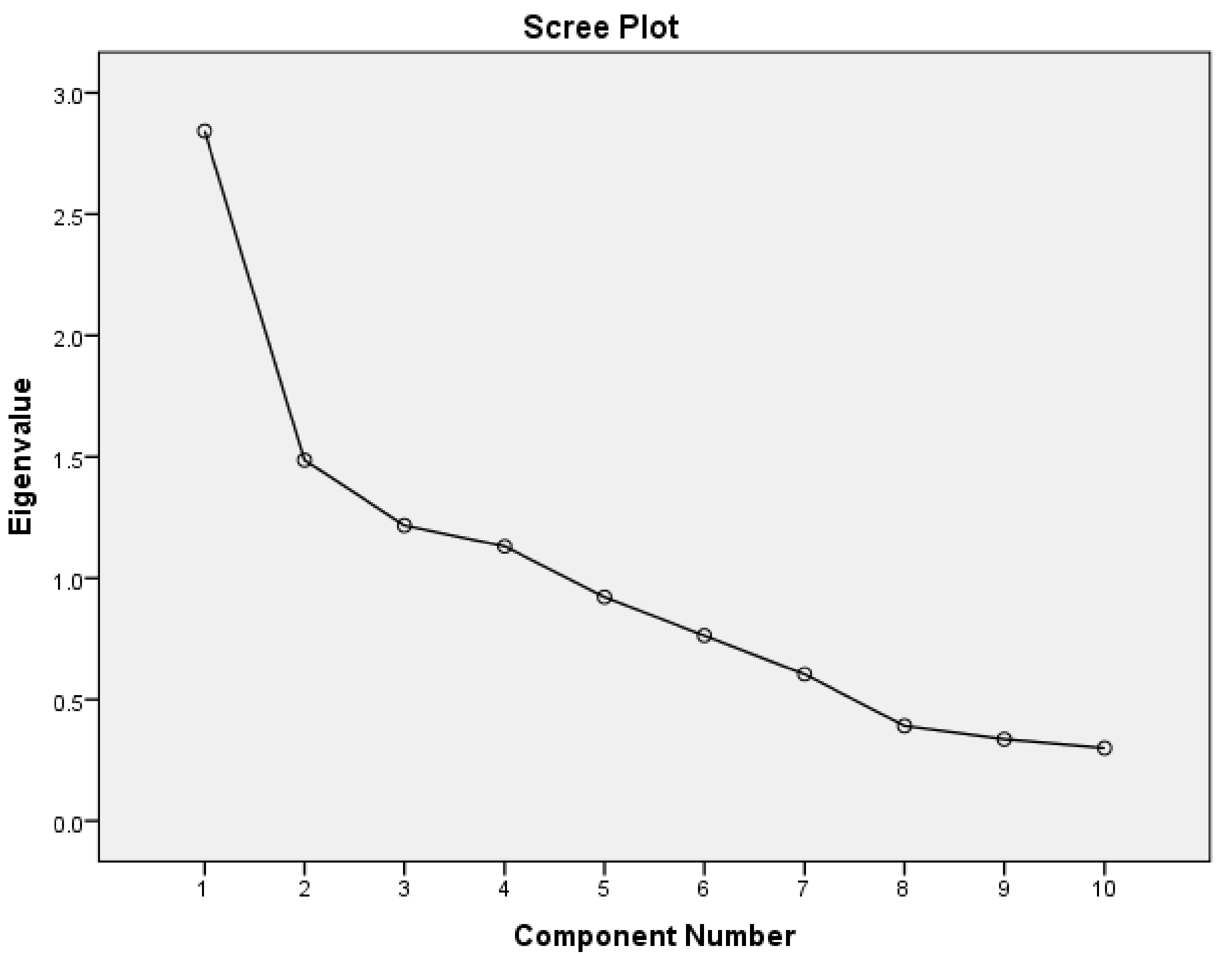


Figure 4.2 Scree plot for maize seed supply

The scree plot can be used as an alternative criterion for determining the number of factors to be retained after extraction (Williams *et. al*., 2012). The scree plot also suggests that four factor solution is appropriate as the most prominent "elbow" occurs at the fifth component, where four components positioned above the "elbow" is selected (Figure 4.2). Thus, both criteria (the "eigenvalues over 1" and the "elbow rule") suggest that extracting four factors is the most suitable to explain the total variance.

Table 4.16.4 Un-rotated and rotated factor loadings for maize seed supply

	Un-rotated factor loading Component				Rotated factor loading Component			
	Variable cost	Extension service	Overhead cost	Finance cost	Variable cost	Extension service	Overhead cost	Finance cost
HCS	.812	-.194	-.076	-.094	.673	.484	.129	.082
HCH	.800	.270	.238	.049	.418	.428	.643	.037
HTC	.705	-.040	-.461	.204	.296	.802	-.029	.149
PES	-.640	.361	-.094	.380	-.819	-.137	-.030	.046
CMP	.465	-.424	.249	-.153	.663	-.030	.059	.192
LGR	.281	.568	.093	.561	-.360	.421	.607	.223
LMPF	.102	.472	-.159	-.399	-.032	.185	.168	-.595
HCL	.244	.477	.726	-.196	.157	-.265	.845	-.210
LC	.414	.427	-.532	-.137	-.004	.694	.052	-.413
LGSF	.316	-.331	.168	.617	.135	.171	.120	.746

Extraction Method: Principal Component Analysis.
a. 4 components extracted

Rotation Method: Varimax with Kaiser Normalization
a. Rotation converged in 7 iterations

HCS: high cost of maize seed, HCH: high cost of hulling maize seed from the cub, HTC: high cost of transport, PES: poor access to extension service, CMP: change in market price of maize, LGR: lack of good access road, LMPF: lack of modern processing facility, HCL: high cost of hired labour, LC: lack of access to credit, LGSF: lack of good storage facility for maize seed

Source: Field survey, 2019

The eigenvalue of variable cost component is 2.000 and accounts for the variance of 19.998%. It is evident from Table 4.16.4 that the variable cost component consists of three items. The constraints included in this component are high cost of maize seed (HCS), high cost of hulling maize seed from the cub (HCH) and high cost of transportation to supply maize seed (HTC). HCS has the highest factor loading with a 0.819 value and other items include HCH (0.673), and HTC (0.663). the sum of the factor loading of variable cost component is 2.155.

The extension service component has an eigenvalue of 1.873 and a percent of variance of 18.730%. This component consist of two items, as follows: poor access to extension services (PES) (0.802) and change in market price of maize seed (CMP) (0.694). The sum of the factor loading of this component is 1.496.

The overhead cost component has an eigenvalue of 1.563 and accounts for the variance of 15.631%. This component consist of three items, as follows: lack of good access road (LGR) (0.845), lack of modern processing facility (LMPF) (0.643) and high cost of hired labour (HCL) (0.607). The sum of the factor loading of this component is 2.095.

The finance cost component has an eigenvalue of 1.244 and accounts for the variance of 12.438%. This component consists of two items, as follows: lack of access to credit (LC) (0.746) and lack of good storage facility for maize seed (LGSF) (0.595). The sum of the factor loading of finance cost component is 1.341. The cumulative variance of all four components is 66.798, which means that the underlying constraints in these four components account for 67% in the given data.

On the basis of the empirical finding, the most important constraints associated with maize value chain amongst suppliers: high cost of maize seed (HCS), high cost of hulling maize seed from the cub (HCH) and high cost of transportation to supply maize seed (HTC). This is followed by poor access to extension services (PES) and change in market price of maize seed (CMP) and least by lack of access to credit (LC) and lack of good storage facility for maize seed (LGSF).

4.6.2 Constraints associated with maize production

The correlation matrix of variables for constraints associated with maize production is presented in Table 4.17.1.

Table 4.17.1 Correlation matrix of the variables for maize production

	HTC	HCS	LGR	CMP	LGSF	LC	HCL	LMV	PES	LMTF
HTC	1.000	.433	.231	.009	-.104	.139	-.027	.499	.276	.070
HCS	.433	1.000	.107	.306	.112	.112	.194	.193	.193	-.020
LGR	.231	.107	1.000	.046	.064	.587	-.113	.420	.138	.169
CMP	.009	.306	.046	1.000	.346	.184	.046	.018	-.045	.403
LGSF	-.104	.112	.064	.346	1.000	.116	-.145	.076	.034	.134
LC	.139	.112	.587	.184	.116	1.000	-.040	.157	.280	.281
HCL	-.027	.194	-.113	.046	-.145	-.040	1.000	-.098	.313	.013
LMV	.499	.193	.420	.018	.076	.157	-.098	1.000	.384	.081
PES	.276	.193	.138	-.045	.034	.280	.313	.384	1.000	.255
LMTF	.070	-.020	.169	.403	.134	.281	.013	.081	.255	1.000

Source: Field survey, 2019

Table 4.17.2 Bartlett's test of sphericity (BTS) and Kaiser-Meyer-Olkin(KMO) for maize production.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.491
Bartlett's Test of Sphericity		
	Approx. Chi-Square	133.558
	Df	45
	Sig	.000

Source: Field survey, 2019

Table 4.17.3 Eigenvalues of Components for maize production

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cum. %	Total	% of Variance	Cum. %	Total	% of Variance	Cum. %
1	2.572	25.723	25.723	2.572	25.723	25.723	1.881	18.809	18.809
2	1.596	15.962	41.685	1.596	15.962	41.685	1.873	18.726	37.536
3	1.399	13.994	55.680	1.399	13.994	55.680	1.613	16.125	53.661
4	1.186	11.864	67.544	1.186	11.864	67.544	1.388	13.883	67.544
5	.889	8.890	76.433						
6	.828	8.277	84.711						
7	.553	5.526	90.237						
8	.397	3.969	94.206						
9	.356	3.558	97.764						
10	.224	2.236	100.000						

Extraction Method: Principal Component Analysis.
Source: Field survey, 2019

The objective of PCA is to find common factors, called principal components, in the form of linear combinations of the constraints under study and to rank them according to their importance. Table 4.17.3 shows the eigenvalues of the components. There are four components whose eigenvalue is greater than one and they account for 67.544% of the total variance. However, only factors that have eigenvalues greater than one are retained. The plot of eigenvalues shows that only four factors are above the one eigenvalue (benchmark) and the rest are shown in Figure 4.3.

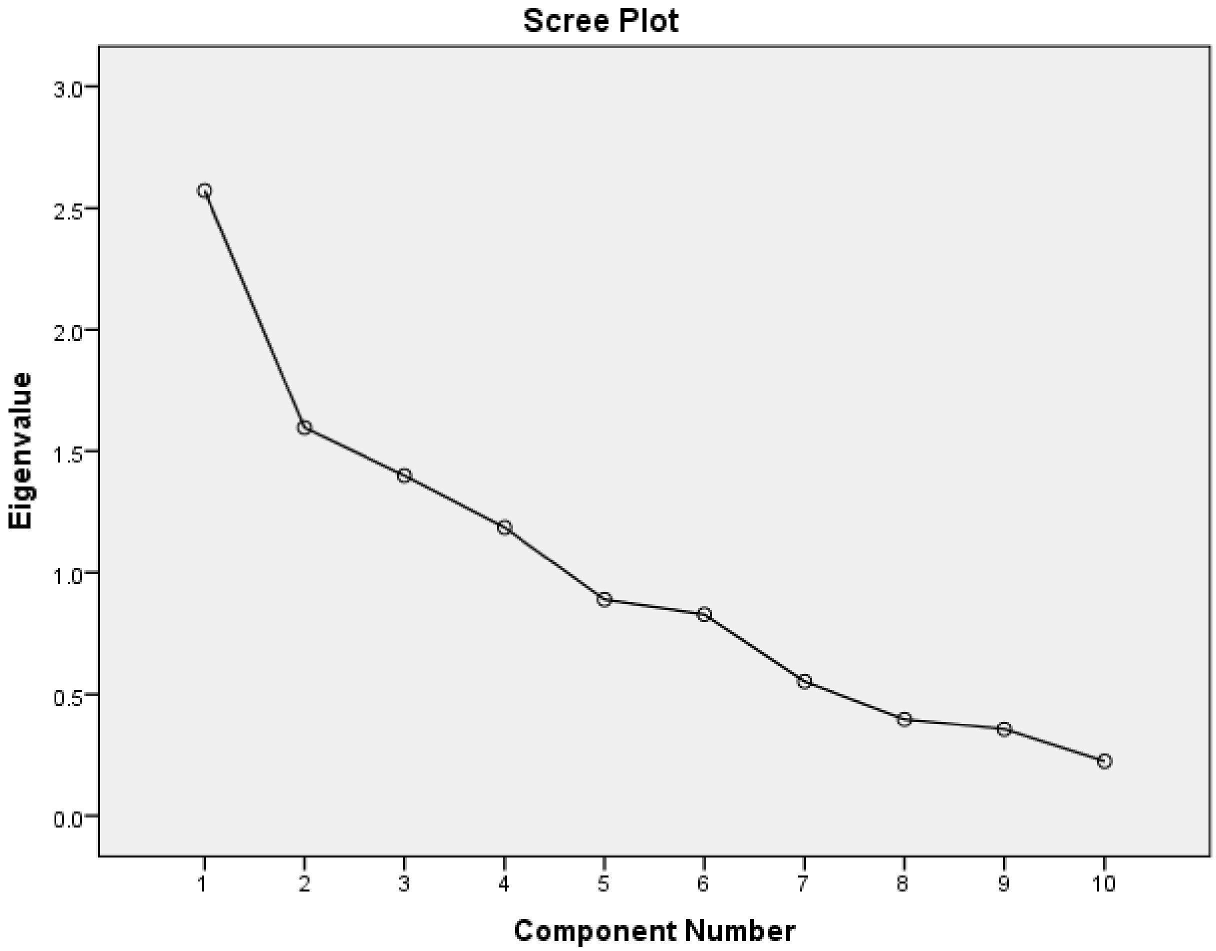


Figure 4.3 Scree plot for maize production

The scree plot can be used as an alternative criterion for determining the number of factors to be retained after extraction (Williams *et. al*., 2012). The scree plot also suggests that four factor solution is appropriate as the most prominent "elbow" occurs at the fifth component, where four components positioned above the "elbow" is selected (Figure 4.3). thus, both criteria (the "eigenvalues over 1" and the "elbow rule") suggest that extracting four factors is the most suitable to explain the total variance.

Table 4.17.4 Un-rotated and rotated factor loadings for maize production

	Un-rotated factor loading Component				Rotated factor loading Component			
	Finance cost	Extension service	Capital cost	Variable cost	Finance cost	Extension service	Capital cost	Variable cost
LMV	.664	-.342	-.211	-.210	.382	.698	-.087	-.074
LGR	.650	.017	-.510	.132	.767	.282	-.026	-.180
LC	.634	.235	-.297	.353	.800	.060	.152	.064
HTC	.605	-.470	.048	-.357	.112	.835	-.062	.052
PES	.576	-.281	.283	.418	.396	.315	-.085	.635
CMP	.346	.680	.368	-.225	.063	.036	.869	.088
LGSF	.222	.603	.036	-.321	.086	.013	.675	-.232
LMTF	.439	.488	.103	.363	.517	-.159	.448	.283
HCL	.054	-.212	.722	.442	-.154	-.024	-.027	.860
HCS	.493	-.120	.504	-.466	-.185	.691	.396	.244

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization
a. 4 components extracted a. Rotation converged in 9 iterations
LMV: lack of high yielding maize variety, LGR: lack of good access road to farm, LC: lack of access to credit, HTC: high cost of transportation, PES: poor access to extension service, CMP: change in market price, LGSF: lack of good storage facility for harvested maize, LMTF: lack of modern tillage facility, HCL: high cost of hired labour, HCS: high cost of maize seed cultivated.

Source: Field survey, 2019

The eigenvalue of finance cost component is 1.881 and accounts for the variance of 18.809%. It is evident from Table 4.17.4 that the variable cost component consists of three items. The constraints included in this component are lack of high yielding maize variety (LMV), lack of good access road to the farm (LGR) and lack of access to credit (LC). LMV has the highest factor loading with a 0.800 value and other items include LGR (0.767), and LC (0.517). the sum of the factor loading of finance cost component is 2.084.

The extension service component has an eigenvalue of 1.873 and a percent of variance of 18.726%. This component consist of three items, as follows: high cost of transportation (HTC) (0.835), poor access to extension service (PES) (0.698) and change in market price of maize seed (CMP) (0.691). The sum of the factor loading of extension service component is 2.224.

The capital cost component has an eigenvalue of 1.613 and accounts for the variance of 16.125%. This component consist of two items, as follows: lack of good storage facility for harvested maize (LGSF) (0.869) and lack of modern tillage facility (LMTF) (0.675). The sum of the factor loading of capital cost component is 1.544.

The variable cost component has an eigenvalue of 1.388 and accounts for the variance of 13.883%. This component consists of two items, as follows: high cost of hired labour (HCL) (0.746) and high cost of maize seed cultivated (HCS) (0.595). The sum of the factor loading of variable cost component is 1.341. The cumulative variance of all four components is 67.544, which means that the underlying constraints in these four components account for 68% in the given data.

On the basis of the empirical finding, the most important constraints associated with maize value chain amongst producers: lack of high yielding maize variety (LMV), lack of good access road to the farm (LGR) and lack of access to credit (LC). This is followed by high cost of transportation (HTC), poor access to extension service (PES) and change in market price of maize seed (CMP) and least by high cost of hired labour (HCL) (0.746) and high cost of maize seed cultivated (HCS).

4.6.3 Constraints associated with maize processing

The correlation matrix of variables for constraints associated with maize processing is presented in Table 4.18.1.

Table 4.18.1 Correlation matrix of the variables for maize processing

	HTC	IMS	LGR	CMP	LGSF	LC	HCL	PES
HTC	1.000	.359	.383	.378	.352	.284	.310	.135
IMS	.359	1.000	.312	.439	.449	.281	.295	.126
LGR	.383	.312	1.000	.303	.477	.379	.274	.210
CMP	.378	.439	.303	1.000	.600	.237	.228	.135
LGSF	.352	.449	.477	.600	1.000	.097	.309	.286
LC	.284	.281	.379	.237	.097	1.000	.123	.046
HCL	.310	.295	.274	.228	.309	.123	1.000	.216
PES	.135	.126	.210	.135	.286	.046	.216	1.000

Source: Field survey, 2019

Table 4.18.2 Bartlett's test of sphericity (BTS) and Kaiser-Meyer-Olkin(KMO) for maize processing.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.758
Bartlett's Test of Sphericity	
Approx. Chi-Square	102.993
Df	28
Sig	.000

Table 4.18.3 Eigenvalues of Components for maize processing

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cum. %	Total	% of Variance	Cum. %	Total	% of Variance	Cum. %
1	3.105	38.811	38.811	3.105	38.811	38.811	2.437	30.458	30.458
2	1.067	13.341	52.152	1.067	13.341	52.152	1.736	21.694	52.152
3	.923	11.541	63.693						
4	.799	9.988	73.682						
5	.658	8.228	81.910						
6	.619	7.740	89.650						
7	.534	6.681	96.331						
8	.294	3.669	100.000						

Extraction Method: Principal Component Analysis.
Source: Field survey, 2019

The objective of PCA is to find common factors, called principal components, in the form of linear combinations of the constraints under study and to rank them according to their importance. Table 4.18.3 shows the eigenvalues of the components. There are two components whose eigenvalue is greater than one and they account for 52.152% of the total variance. However, only factors that have eigenvalues greater than one are retained. The plot of eigenvalues shows that only two factors are above the one eigenvalue (benchmark) and the rest are shown in Figure 4.4.

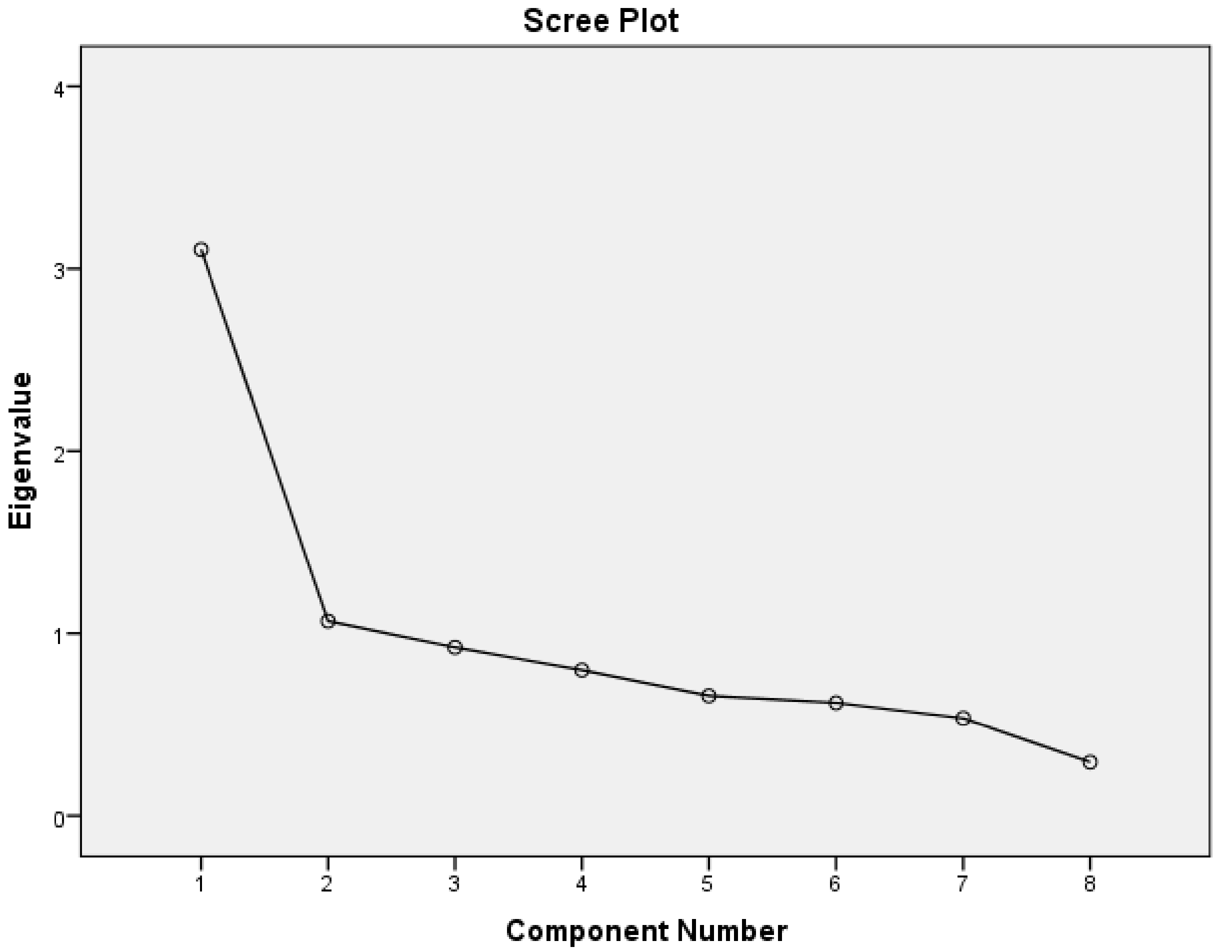


Figure 4.4 Scree plot for maize processing

The scree plot can be used as an alternative criterion for determining the number of factors to be retained after extraction (Williams *et. al*., 2012). The scree plot also suggests that two factor solution is appropriate as the most prominent "elbow" occurs at the third component, where two components positioned above the "elbow" is selected (Figure 4.4). thus, both criteria (the "eigenvalues over 1" and the "elbow rule") suggest that extracting two factors is the most suitable to explain the total variance.

Table 4.18.4 Un-rotated and rotated factor loadings for maize processing

	Un-rotated factor loadings Component		Rotated factor loadings Component	
	Extension service	Finance cost	Extension service	Finance cost
LGSF	.765	.294	.458	.680
CMP	.712	.012	.576	.418
LGR	.687	-.148	.648	.272
IMS	.685	-.106	.622	.305
HTC	.662	-.183	.648	.229
HCL	.537	.261	.291	.522
LC	.459	-.672	.762	-.288
PES	.367	.627	-.059	.724

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization
a. 2 components extracted a. Rotation converged in 3 iterations
LGSF: lack of good storage facility for processed maize, CMP: change in market price of maize seed, LGR: lack of good access road, IMS: inadequate maize seed, HTC: high cost of transportation, HCL: high cost of hired labour, LC: lack of access to credit, PES: poor access to extension services.

Source: Field survey, 2019

The eigenvalue of extension service component is 2.437 and accounts for the variance of 30.458%. It is evident from Table 4.18.4 that the variable cost component consists of five items. The constraints included in this component are lack of good storage facility for processed maize (LGSF) has the highest factor loading with a 0.765 value and other items include; change in market price of maize seed (CMP) (0.648), lack of good access road (LGR) (0.648), inadequate maize seed (IMS) (0.622) and high cost of transportation (HTC) (0.576). The sum of the factor loading of extension service component is 3.256.

The finance cost component has an eigenvalue of 1.736 and a percent of variance of 21.694%. This component consist of two items, as follows: high cost of hired labour

(HCL) (0.724), lack of access to credit (LC) (0.680) and poor access to extension services (PES) (0.522). The sum of the factor loading of finance cost component is 1.926. The cumulative variance of all two components is 52.152, which means that the underlying constraints in these two components account for 52% in the given data.

On the basis of the empirical finding, the most important constraints associated with maize value chain amongst processors: lack of good storage facility for processed maize (LGSF), change in market price of maize seed (CMP), lack of good access road (LGR), inadequate maize seed (IMS) and high cost of transportation (HTC).

4.6.4 Constraints associated with maize marketing

The correlation matrix of variables for constraints associated with maize marketing is presented in Table 4.19.1.

	HTC	HCS	LGR	CMP	LGSF	LC	HCL	HCH	PES	LMPF
HTC	1.000	.625	.000	.625	-.093	-.052	.548	.463	.208	-.052
HCS	.625	1.000	-.212	.777	-.088	.096	.424	.424	.271	-.172
LGR	.000	-.212	1.000	-.212	.166	.395	.383	.475	.062	.116
CMP	.625	.777	-.212	1.000	-.088	.230	.424	.335	.182	.096
LGSF	-.093	-.088	.166	-.088	1.000	.222	.236	.236	.141	-.067
LC	-.052	.096	.395	.230	.222	1.000	.461	.354	.061	.353
HCL	.548	.424	.383	.424	.236	.461	1.000	.859	.173	.141
HCH	.463	.424	.475	.335	.236	.354	.859	1.000	.244	.034
PES	.208	.271	.062	.182	.141	.061	.173	.244	1.000	-.154
LMPF	-.052	-.172	.116	.096	-.067	.353	.141	.034	-.154	1.000

Source: Field survey, 2019

Table 4.19.2 Bartlett's test of sphericity (BTS) and Kaiser-Meyer-Olkin(KMO) for maize marketing.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.641
Bartlett's Test of Sphericity	
Approx. Chi-Square	286.952
Df	45
Sig	.000

Source: Field survey, 2019

Table 4.19.3 Eigenvalues of Components for maize marketing

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cum. %	Total	% of Variance	Cum. %	Total	% of Variance	Cum. %
1	3.462	34.623	34.623	3.462	34.623	34.623	2.995	29.948	29.948
2	2.079	20.794	55.417	2.079	20.794	55.417	2.491	24.910	54.859
3	1.298	12.981	68.398	1.298	12.981	68.398	1.354	13.539	68.398
4	.916	9.160	77.558						
5	.785	7.848	85.406						
6	.600	5.999	91.405						
7	.349	3.490	94.894						
8	.260	2.598	97.492						
9	.159	1.587	99.080						
10	.092	.920	100.000						

Extraction Method: Principal Component Analysis
Source: Field survey, 2019.

The objective of PCA is to find common factors, called principal components, in the form of linear combinations of the constraints under study and to rank them according to their importance. Table 4.19.3 shows the eigenvalues of the components. There are three components whose eigenvalue is greater than one and they account for 68.398% of the total variance. However, only factors that have eigenvalues greater than one are retained. The plot of eigenvalues shows that only three factors are above the one eigenvalue (benchmark) and the rest are shown in Figure 4.5.

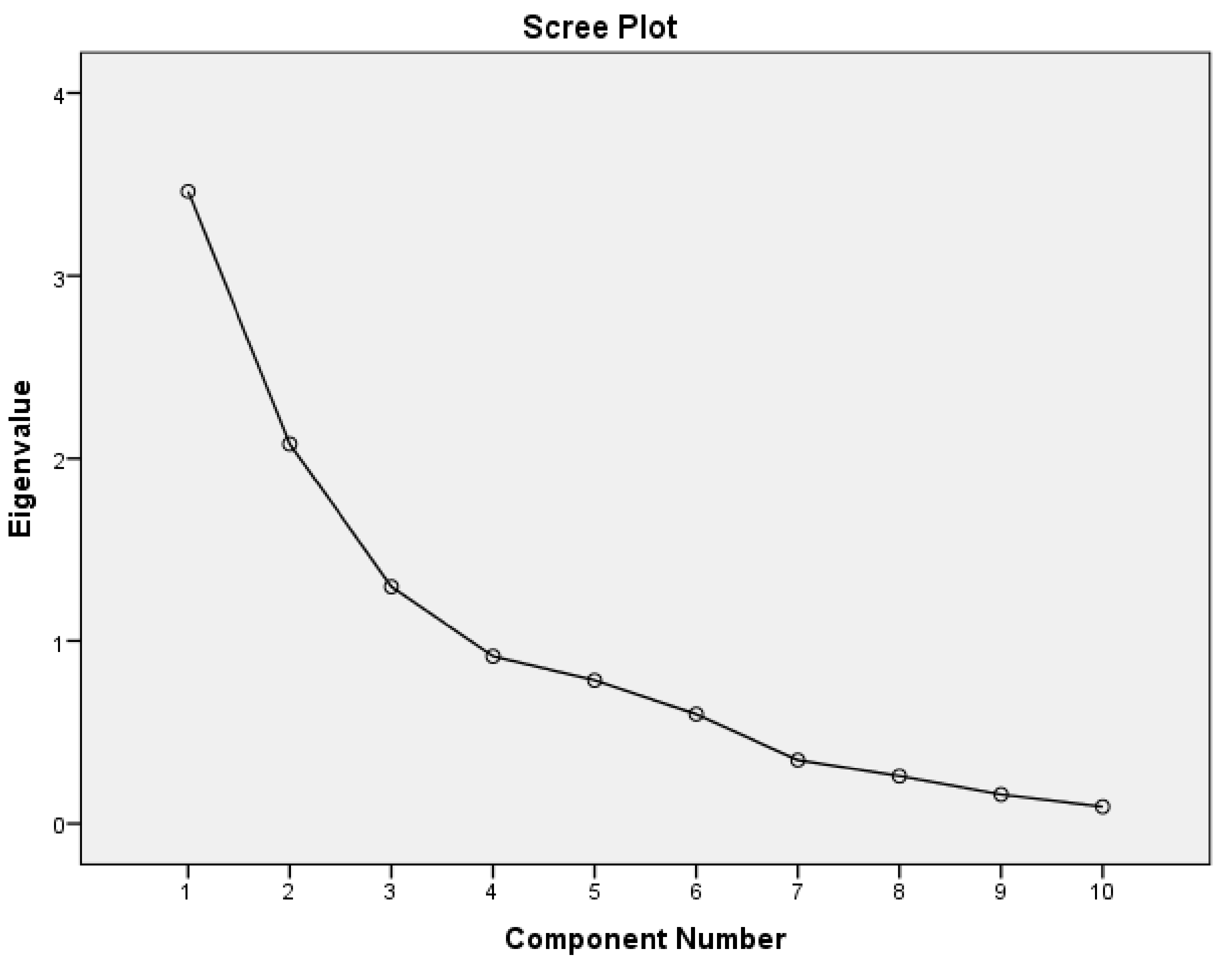


Figure 4.5 Scree plot for maize marketing

The scree plot can be used as an alternative criterion for determining the number of factors to be retained after extraction (Williams *et. al*., 2012). The scree plot also suggests that three factor solution is appropriate as the most prominent "elbow" occurs at the forth component, where three components positioned above the "elbow" is selected (Figure 4.5). thus, both criteria (the "eigenvalues over 1" and the "elbow rule") suggest that extracting three factors is the most suitable to explain the total variance.

Table 4.19.4 Un-rotated and rotated factor loadings for maize marketing

	U-rotated factor loading			**Rotated factor loading**		
	Component			Component		
	Variable cost	Finance cost	Extension service	Variable cost	Finance cost	Extension service
HCL	.871	.289	.004	.566	.722	.022
HCH	.831	.307	-.161	.493	.743	-.130
HTC	.732	-.403	.014	.821	.082	-.131
HCS	.730	-.543	.013	.894	-.033	-.166
CMP	.721	-.458	.298	.895	-.018	.131
LGR	.265	.748	-.133	-.204	.777	.041
LC	.439	.577	.314	.115	.659	.420
LMPF	.071	.367	.762	.007	.206	.823
PES	.361	-.094	-.510	.252	.214	-.539
LGSF	.160	.445	-.476	-.194	.532	-.359

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization
a. 3 components extracted a. Rotation converged in 4 iterations
HCL: high cost of hired labour, HCH: high cost of hulling maize seed from the cob, HTC: high cost of transportation, HCS: high cost of maize seed, CMP: change in market price of maize seed, LGR: lack of good access road, LC: lack of access to credit, LMPF: lack of modern processing facility.

Source: Field survey, 2019

The eigenvalue of variable cost component is 2.995 and accounts for the variance of 29.948%. It is evident from Table 4.19.4 that the variable cost component consists of three items. The constraints included in this component are high cost of hired labour (HCL) (0.895), high cost of hulling maize seed from the cob (HCH) (0.894) and high cost of transportation (HTC) (0.821). The sum of the factor loading of variable cost component is 2.61.

The finance cost component has an eigenvalue of 2.491 and a percentage variance of 24.910%. this component consist of five items, as follows: high cost of maize seed (HCS) (0.777), change in market price of maize seed (CMP) (0.743), lack of good access road (LGR) (0.722), lack of access to credit (LC) (0.652), and lack of modern processing facility (LMPF) (0.532). The sum of the factor loading of finance cost component is 3.426.

The extension service component has an eigenvalue of 1.354 and a percent of variance of 13.539%. This component consist of two items, as follows: poor access to extension services (PES) (0.823) and lack of good storage facility for processed maize (LGSF) (0.539). The sum of the factor loading of extension service component is 1.362. The cumulative variance of all two components is 68.398, which means that the underlying constraints in these two components account for 68% in the given data.

On the basis of the empirical finding, the most important constraints associated with maize value chain amongst marketers: high cost of hired labour (HCL), high cost of hulling maize seed from the cob (HCH), high cost of transportation (HTC) and least important constraints are poor access to extension services (PES) and lack of good storage facility for processed maize (LGSF).

4.7 Test of hypotheses

4.7.1 value added by suppliers is positively and significantly influenced by output, educational level, marital status, marketing experience and is not negatively and significantly influenced by household size, sex, farm size and age of the farmer.

For the supply actors in the maize value chain, out of eleven (11) explanatory variables, eight (8) were statistically significant, seven (7) which include; age (X_2), marital status (X_3), household size (X_4), membership of association (X_7), supply cost (X_8), preservation cost (X_{10}) and output (X_{11}) were negatively related to net margin while transportation cos t(X_9) was positively related to net margin. Hence the hypothesis which states that "value added by suppliers is positively and significantly influenced by output, educational level, marital status, marketing experience and is not negatively and significantly influenced by household size, sex, farm size and age of the farmer" is rejected.

4.7.2 value added by producers is positively and significantly influenced by output, educational level, marital status, marketing experience and is not negatively and significantly influenced by household size, sex, farm size and age of the farmer.

For producing actors in the maize value chain, out of thirteen (13) explanatory variables, four (4) were statistically significant, two (2) which include; sex (X_1) and labour cost (X_9) were negatively related to net margin while two (2) which include; farm size (X_8) and output (X_{13}) were positively related to net margin. Hence, the hypothesis which states that "value added by producers is positively and significantly influenced by output, educational level, marital status, marketing experience and is not negatively and significantly influenced by household size, sex, farm size and age of the farmer" is accepted.

4.7.3 value added by processors is positively and significantly influenced by output, educational level, marital status, marketing experience and is not negatively and significantly influenced by household size, sex, farm size and age of the farmer.

For processing actors in the maize value chain, out of eleven (11) explanatory variables, four (4) were statistically significant, three (3) which include; age (X_2), product cost (X_9) and transport cost (X_{10}) were negatively related to net margin while; output (X_{11}) was positively related to net margin. Hence, the hypothesis which states that "value added by processors is positively and significantly influenced by output, educational level, marital status, marketing experience and is not negatively and significantly influenced by household size, sex, farm size and age of the farmer" is accepted.

4.7.4 value of processed maize products sold is positively and significantly influenced by output, educational level, marital status, marketing experience and is not negatively and significantly influenced by household size, sex, farm size and age of the farmer.

For the marketing actors in maize value chain, out of ten (10) explanatory variables, five (5) were statistically significant, two (2) which include; transport cost (X_8) and product cost (X_9) were negatively related to net margin while three (3) which include; educational level (X_5), membership of association (X_7) and output (X_{10}) were positively related to net margin. Hence, the hypothesis which states that "value of processed maize products sold is positively and significantly influenced by output, educational level, marital status, marketing experience and is not negatively and significantly influenced by household size, sex, farm size and age of the farmer is accepted.

4.7.5 Analysis of variance of the net margin amongst maize seed suppliers, producers, processors and marketers

Result of ANOVA on the significant difference in the net margin among the various actors in maize value chain in Imo State, Nigeria is shown in Table 4.20.

Table 4.20 Analysis of variance of the net margin amongst maize seed suppliers, producers, processors and marketers

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Suppliers	60	801950.7232	13365.84539	90727537.47
Producers	60	7054440.584	117574.0097	40107769558
Processors	60	172727.6222	2878.793703	140328318.6
Marketers	60	729448.8871	12157.48145	567685385.5

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	5.29868E+11	3	1.76623E+11	17.27085018	3.58253E-10	2.642851047
Within Groups	2.41348E+12	236	10226627700			
Total	2.94335E+12	239				

Source: Field survey, 2019

The result of ANOVA on the significant difference in the net margin amongst the various actors in maize value chain in Imo State, Nigeria in Table 4.20, shows a significant mean difference in the net margin amongst the various maize value chain actors (maize seed suppliers, producers, processors and marketers) since P-value ($3.58253E^{-10}$) is less than α-level (0.05) and F-calculated (17.271) is greater than the

F-critical (2.643). Hence the null hypothesis which states that there is no significant difference in the net margin amongst the various actors in maize value chain in Imo State, Nigeria is rejected.

CHAPTER FIVE

SUMMARY, CONCLUSION, RECOMMENDATIONS

5.1 Summary

The study focused on the analysis of maize value chain in Imo State, Nigeria. The specific objectives were to examine the socio-economic characteristics of maize value chain actors in Imo State; ascertain the value chain map in maize value chain in the area; estimate the net margin and profitability of maize supply, production, processing and marketing in the area; estimate the contributions of the major actors in the maize value chain in the state; evaluate the value added and hence, the determinants of value addition in maize supply, production, processing and marketing in the study area and identify the constraints associated with maize value chain among producers, processors and marketers in the study area.

The result shows that majority (53.33%, 53.33% and 78.33%) of the respondents were female suppliers, producers and processors of maize respectively while majority (55%) of the respondents were male marketers of maize. Their mean ages were 57.25, 50.5, 41 and 45.5 years respectively. Majority (85%, 85%, 63.33% and 80%) of maize seed suppliers, producers, processors and marketers were married and still together with their spouse. The mean household size were 5, 7, 4 and 4 persons for maize seed suppliers, producers, processors and marketers respectively. The mean number of years spent in school were 9.6, 9.1, 9.9 and 12.1 respectively. The result also shows that 51.67%, 46.67% and 66.67% of maize seed suppliers, processors and marketers have trading as their major occupation, while 71.67% of the producers have farming as their major occupation. The mean years of experience were 9.3, 15.8, 8.8 and 12. Also, 65%, 45%, 20% and 61.67% of maize seed suppliers, producers, processors and marketers respectively were members of one cooperative association or the other, while 35%, 55%, 80% and 38.33% of maize seed suppliers, producers, processors and marketers respectively were not members of any cooperative association. The mean farm size was 1.42 hectares.

The result of the value chain map shows that the chain starts with the maize seed suppliers and ends with the consumers, all the actors in the chain interacted more with the retailers and local supermarkets.

The result also shows that maize actors made a net income of ₦13,364.79, ₦113,339.38, ₦505.10 and ₦12,532.38 indicating that the actors made profit from their investment. With regard to the profitability of the enterprise by the actors; 2.49, 4.87, 0.029 and 0.557 were estimated indicating that every ₦1 invested yielded ₦2.49, ₦4.87, ₦0.029 and ₦0.557 to the maize seed suppliers, producers, processors and marketers respectively. It was also found that maize seed suppliers, producers, processors and marketers each contributed 1.67% respectively to the market.

The result of multiple regression analysis on the determinants of value addition of maize seed supply shows that age, marital status, household size, association membership, product cost, transportation cost, preservation cost, and output are the determinants of maize seed supply. The determinants of value addition of maize production are gender, farm size, labour cost and output. The determinants of value addition of maize processing are age, product cost and output while the determinants of value addition of maize marketing are educational level, association membership, transportation cost, product cost and output.

The most important constraints associated with maize value chain amongst suppliers are high cost of maize seed (HCS), high cost of hulling maize seed from the cub

(HCH) and high cost of transportation to supply maize seed (HTC); amongst producers are lack of high yielding maize variety (LMV), lack of good access road to the farm (LGR) and lack of access to credit (LC); amongst processors are lack of good storage facility for processed maize (LGSF), change in market price of maize seed (CMP), lack of good access road (LGR), inadequate maize seed (IMS) and high cost of transportation (HTC) and amongst marketers are high cost of hired labour (HCL), high cost of hulling maize seed from the cob (HCH), high cost of transportation (HTC).

The hypothesis which states that value added by suppliers is positively and significantly influenced by output, educational level, marital status, marketing experience and is not negatively and significantly influenced by household size, sex, farm size and age of the farmer was rejected.

The hypothesis which states that value added by producers is positively and significantly influenced by output, educational level, marital status, marketing experience and is not negatively and significantly influenced by household size, sex, farm size and age of the farmer was accepted.

The hypothesis which states that value added by processors is positively and significantly influenced by output, educational level, marital status, marketing experience and is not negatively and significantly influenced by household size, sex, farm size and age of the farmer was accepted.

The hypothesis which states that value of processed maize products sold is positively and significantly influenced by output, educational level, marital status, marketing experience and is not negatively and significantly influenced by household size, sex, farm size and age of the farmer was accepted.

The null hypothesis which states that there is no significant difference in the net margin amongst the various actors in maize value chain in Imo State, Nigeria was rejected.

5.2 Conclusion

From the results of the study, it can be concluded that there were more females amongst the female suppliers, producers and processors with more males amongst marketers. Their mean ages were 57.25, 50.5, 41 and 45.5 which implies that the various actors were still young and vibrant. Also, maize value chain starts with the maize seed suppliers and end with the consumers and all the actors in the chain interacted more with the retailers and local supermarkets.

The result also shows that maize actors made a net income of ₦13,364.79, ₦113,339.38, ₦505.10 and ₦12,532.38 indicating that the actors made profit from their investment. With regard to the profitability of the enterprise by the actors; 2.49, 4.87, 0.029 and 0.557 were estimated indicating that every ₦1 invested yielded ₦2.49, ₦4.87, ₦0.029 and ₦0.557 to the maize seed suppliers, producers, processors and marketers respectively.

Also maize seed suppliers, producers, processors and marketers each contributed 1.67% respectively to the market. The result of multiple regression analysis on the determinants of value addition of maize seed supply are age, marital status, household size, association membership, product cost, transportation cost, preservation cost, and output. The determinants of value addition of maize production are gender, farm size, labour cost and output. The determinants of value addition of maize processing are age, product cost and output while the determinants of value addition of maize marketing are educational level, association membership, transportation cost, product cost and output.

The most important constraints associated with maize value chain amongst suppliers are high cost of maize seed (HCS), high cost of hulling maize seed from the cub (HCH) and high cost of transportation to supply maize seed (HTC); amongst producers are lack of high yielding maize variety (LMV), lack of good access road to the farm (LGR) and lack of access to credit (LC); amongst processors are lack of good storage facility for processed maize (LGSF), change in market price of maize seed (CMP), lack of good access road (LGR), inadequate maize seed (IMS) and high cost of transportation (HTC) and amongst marketers are high cost of hired labour (HCL), high cost of hulling maize seed from the cob (HCH), high cost of transportation (HTC).

The null hypothesis which states that there is no significant difference in the net margin amongst the various actors in maize value chain in Imo State, Nigeria is rejected.

5.3 Recommendations

Based on the findings of the study, the following recommendations are made:

i. There should be effective educational training to strengthen the maize chain actors in all the enterprise. Thus the introduction of adult education and skill acquisition programmes will equip these actors and make their activities more profitable.
ii. Enterprise differentiation should be encouraged to maximize resource utilization and increased investment in the enterprise choice which in turn increases return on investment.

iii. Adequate rural road network for quick evacuation of inputs and output, power for processing and storage including cold chain to increase value addition and improve shelf life and irrigation facilities to assure year round production and income, are prerequisites.

iv. Maize chain actors should strengthen themselves financially by forming cooperative groups whereby members could have access to loans at a very low rate and farm inputs could be purchased in bulk to be shared among members at a reduced cost. The produce could also be sold in bulk, thereby lowering the average cost of marketing. Clustering the harvest and postharvest handling and the marketing, may increase efficiency.

v. There is need to expand substantially the domestic supply of modern farm inputs such as fertilizers, improved maize seeds, agro-chemicals, irrigation pumps, etc. through public/private sector partnership so as to achieve the desirable growth in the various enterprises.

vi. There is need to rehabilitate the research system through a preparation of a national research plan, increased and stable funding, proper co-ordination and guidance of research efforts, strengthening the linkages between research institutes with national universities and international/regional research centres as well as adequate training of both research scientists and technical support staff in specialized skills to be able to guide farmers properly.

vii. Improved extension service delivery to farmers is paramount to create awareness and assure effective use of improved inputs. Universal adoption of training and visit approach would be very beneficial. The emphasis should be to provide farmers with regular, systematic and up-to-date advice on resource management and on the cropping practices best suited to the study area.

viii. Efforts aimed at increasing maize producers access to more land for production should be intensified by government and other stakeholders. This will increase output and ensure a steady supply of the raw material and the final product while also increasing profit.

ix. Maize chain actors should be assisted to obtain bank credit by reducing the administrative bottlenecks associated with bank loans.

5.4 Contribution to knowledge

The study established that the activities involved in maize value chain addition in the state (input supply and production) were profitable with high return on investment while processing and marketing activities were not profitable and enlisted active participation of the youths. However, the activities were face with a lot of constraints in the areas of infrastructure , extension service component and high cost of production.

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