ANALYSIS OF VALUE CHAIN ON IRRIGATED TOMATO IN KANO STATE, NIGERIA

BY

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DECLARATION

I, Adamu, Ibrahim Kabuga hereby declare that the work in this thesis titled "**Analysis of Value Chain on Irrigated Tomato in Kano State, Nigeria"** presented to the Department of Geography, Ahmadu Bello University, Zaria is the result of my own research and it has not been presented in any form, anywhere for the award of a degree in any institution. Any literature herein referenced and cited has been duly acknowledged. All shortcomings in this work are entirely my responsibility.

ADAMU, Ibrahim Kabuga

Signature	**Date**

CERTIFICATION

This thesis entitled "**Analysis of Value Chain on Irrigated Tomato in Kano State, Nigeria**" by ADAMU, Ibrahim Kabuga, meets the regulations governing the award of the degree of Doctor of Philosophy (Ph.D.) in the Department of Geography of Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

I dedicate this work to my mother, Sa'adatu Abdullahi and my uncles Alhaji Yakubu Umar and Alhaji Yusuf Umar.

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ABSTRACT

This study assesses the value chain of irrigated tomato in Kano State with a view to identifying areas of the chain that may need policy interventions. The specific objectives of the study are the requirements for irrigated tomato production in the study area; mapping the value chain in order to identify the activities of the key actors and their relationships; technical capacities of the actors in the value chain and its economic performance with a view to identify strong and weak aspect of the chain and the appropriate policy intervention needs they require. Field surveys, focus group discussions and questionnaire were used to gather the required data which were subjected to descriptive and SWOT analyses. The findings indicate that the area is dominated by small scale tomato farms most of which were allocated to their respective operators by the state. The actors identified and indicated on the value chain are extension workers, agro-chemical dealers, farmers, labourers, transporters, commission agents, middlemen, wholesalers, retailers and consumers. In respect of the strong aspects of the value chain, the study reveals that the area possesses a natural environment that is favourable for irrigated tomato production. There is in existence in the study area abundant skilled labour that works in a harmonious relationship with the farmers in all aspects of tomato production and distribution. The irrigation infrastructure runs efficiently, making water available as and when required, though with some hitches once in a while. Extension services are adequately provided for the farmers by agencies such as the Kano State Agricultural and Rural Development Authority (KNARDA). There was a sizeable employment generated (142,541) in all aspects of irrigated tomato production across the State at the time of the study. The weak aspects that were identified with the value chain of irrigated tomato in the study area include the dominance of manual labour in all areas of tomato production and distribution, except land clearing, a phenomenon that slows down the processes. There are no storage facilities and processing industries in the study area, a situation that leads to a severe glut of tomato at the peak of the season which leads to a drastic fall in the price of the commodity. Most parts of the tomato producing areas are poorly served with regular electricity supply and circulation roads. The farmers have no access to seeds of improved tomato species. They are forced, therefore, to continue using the UC82B variety seeds with low yield and short shelf life. Packaging of tomato is done in baskets for transportation over long distances resulting in a lot of damages and losses. Transportation costs are high and movement of vehicles from one place to another is slow as a result of bad roads. The actors in the irrigated tomato value chain examined lack access to cheap credit facilities and are left to rely solely on self-financing which is a major constraint to growing their business. The findings indicated that the farms are located at the Watari irrigation scheme and Kadawa irrigation scheme areas in the state. More than 50% of the tomato produced in the state are lost to post harvest spoilage annually. The study also revealed that tomato marketers earn more profits than tomato farmers in the study area. It is recommended that there should be improved infrastructure such as water, electricity, better preservation methods, storage facilities and processing industries and good road network in the state and in the country at large. It was also recommended that the Dangote tomato industry under construction at Kadawa area should be hasten and completed. More of such companies should be established in the tomato producing areas in the state. As rainy season begins and drop on the flowering of irrigated tomato, the crop dries up. This area should be further investigated and further studies carried out on it so as to get all year round production.

CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND TO THE STUDY

In response to the drought of the early 1970s, the Kano State Government searched for ways to improve the management of water resources in the state. It planned irrigation projects to be executed in phases such as Kano River Irrigation Project (KRIP), Hadejia Valley Project, Tiga Dam, et cetera. The Tiga Dam is 4.72m high and 7.24km long, has a reservoir with a capacity of 1,514 million litres of water. The water which is to be used to irrigate 180,000 hectares of land in the Kano River Basin under the KRIP (Ibrahim, 2010) is conveyed over a distance of 50 kilometres from the dam. The Kano River Irrigation Project has the primary aim of bringing a rapid increase in hectarage under cultivation and raising crop output per hectare.

Fadama cultivation is a traditional form of irrigation using the Shaduf,complete with its own system of canals (Olofin, 1987). The most common crops grown are vegetable, onions, potatoes, peppers, garden eggs and tomato. This traditional method of market gardening is as old as man himself in the Kano region. However, modern system of irrigation started in the State in 1970/1971 when the first Dam (Bagauda) was completed.

The main purpose of the Bagauda Dam,built on the river of the same name and a small tributary of Kano River, is irrigation. The Dam was actually a pilot irrigation scheme at Kadawa. The dam increased the quantity of water in the channel sands of River Kano which also increased the water available for treatment at the Challawa water works. Then came the dam on a small tributary of Challawa at Karaye, designed to improve the water supply of that town. The first real multipurpose dam is the Tiga Dam on the Kano River itself, which was completed in 1974. It was designed to irrigate, supply water for rural and urban uses, enhance fishing and aid the generation of hydroelectricity. The Tiga Reservoir remains the largest in the State to date. It has a maximum storage capacity of about 1,900 million cubic metres and

a surface area of 178 km^2 (Olofin, 1987). The estimated storage of water in the canals in the Kano River irrigation project is put at 149.06 million cubic metres.

Modern irrigation layouts with elaborate canal systems are now a common sight, especially on the upland plains of the Basement Complex Section, and on the abandoned floodplains of the Hadejia Valley. The Kadawa pilot scheme was the first modern irrigation project in the state. The scheme is now part of the Kano River project. A total of 62,000 hectares is irrigated in Phases I and II of the Kano River Project. More than 12,000 hectares of land are irrigated in Phase I. About 25,000 ha are irrigated in the Hadejia Valley and a total of 50,000 ha in other areas of the Basement Complex such as the Tomas, Gari and other dams. The most common crops grown are vegetables, onions, potatoes, garden eggs and tomato, with tomato as the dominant crop (Olofin, 1987).

A value-chain can be defined as 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), delivery to final customers, and final disposal after use (Jon and Madelon, 2006; Chrisopher and Jonathan, 2011). Agro-food value-chain encompass activities that take place at the farm or rural level, including input supply, production and continues through handling, processing, storage, packaging and distribution. As products move successively through the various stages, transactions take place between multiple chain stakeholders, money changes hands, information is exchanged and value is progressively added (UNIDO, 2009). A value chain analysis therefore provides a deeper understanding of the chain structure and functioning by portraying the various chain actors and their intricate relationships.

Tomato is believed to have originated in the Andes area of South America and it was introduced to Europe by the Spanish and subsequently to Africa through Gibraltar and Morocco (Rufai, 1999; Wikipedia, 2007;Hussaini, 2008; Samaila, 2009). Tomato was

introduced to Nigeria in the 19th century (Hussaini, 2008). It is currently the most important commercial vegetable grown in Nigeria. Large scale tomato production in Nigeria is mainly under irrigation during the dry season (September to March) when temperatures are mild and humidity moderate. The rainfed crop (June to September) is also important due to continuous demand for fresh tomato, but generally limited by pests and diseases that are prevalent under such humid and warm condition (Rufa'i, 1999). The area of major production is the northern part of the country, between latitude 8^0 and 13^0 N, but the biggest market is mostly in the south and other neighbouring countries. The crop stays for up to 3 months in the field and yields between 20-50 t/ha. It requires a well-drained, fertile soil, rich in organic matter and thrives best under a temperature range of 15 – 20^0C for optimum growth and development (Hussaini, 2008). The period between the months of March to June is normally too hot for successful tomato production. Tomato production has continued to expand in Nigeria because of the increasing demand for fresh tomato.

Tomato is a major crop in world vegetable trade. In 2005, five million metric tonnes of the commodity were traded globally at a value of over five billion US dollars. In the same year, Nigeria imported 28,972 metric tonnes of canned tomato paste costing US$30 million in foreign exchange (FAO, 2006). From 2010 to date Nigeria annually imports 65,809 tonnes of processed tomato worth over N11.7 billion (AbdulFatai, 2012; Haruna, 2014).

Tomato is used mainly in the preparation of soup and stew recipes. It is also used as salad vegetable or processed into paste and ketchup for the eating of pasta and chips. Tomato is also a rich source of essential vitamins, like Vitamin A, B, B6 and C, with a high acidic property that brings out other hycopene which is a natural anti-oxidant used in the treatment of high blood pressure and prostate cancer (Wikipedia, 2006; Victoria, 2012). The seeds of tomato contain fat, which can be extracted and used as salad oil, and in the manufacture of

margarine and soap. After oil extraction the residual cake is used as livestock feed and manure.

World production of tomato was 126 million metric tonnes in 2007 with China as the largest producer with 33.2 million metric tonnes, followed by USA and Turkey with 11.5 and 9.9 million metric tonnes respectively. In Africa, Egypt is the highest producer with 7.6 million metric tonnes, followed by Morocco, Tunisia and Nigeria with production outputs of 1.1 million, 1 million and 898,000 metric tonnes respectively (FAO, 2007).

Tomato is produced in Kano State under two conditions, rainfed and irrigated. The irrigated aspect is also divided into two parts, namely, the informal on *fadama* lands and the formal used in irrigation schemes.

Market prices are influenced by political situation and civil unrest in both Kano State and the rest of the country. When there is peace, the market is good for the product as the demand for tomato is high and stable, but in times of civil unrest, demand falls and so the price of tomato. This is because when there is peace many traders/marketers come to KanoState to buy the product, but in times of civil disturbance traders do not come to the State or market to buy. This problem seriously affects the interregional marketing of tomato and other products whenever there is crisis in the state and the country in general (Ariyo, Voh, Ahmed, 2001). For example, the recent incidence in the State of Boko Haram crisis in 2012 and 2013 affected the market of the product greatly. Before the crisis a basket of tomato (18kg) was sold at N900 per basket, but during the crisis a basket of the product was sold at N300 per basket, because of excess product on ground with fewer numbers of people to buy. In addition, major social unrest or crisis taking place at any point on the interregional transport route adversely affect the movement and by implication the prices of produce from points of production to consuming centres (Ariyo, Voh, Ahmed, 2001).

1.2 STATEMENT OF THE RESEARCH PROBLEM

The production and marketing of irrigated tomato in Kano State are laden with problems which lead to low producer prices on the one hand and exorbitant prices paid by consumers on the other. A major share of the exorbitant prices consumers pay goes to a few market intermediaries who exploit the farmers. This is due to poor marketing linkages, virtually non-existent ofcold storage infrastructure and processing facilities. In addition production and marketing of irrigated tomato in the State are constrained by poor transport infrastructure, especially roads in the areas of production. Other problems include poor access to credit, improved seeds, fertilizers and other farm inputs, costly machinery and susceptibility of the product to pest and diseases (Yusuf, 2011; Musa, 2011; Bako, 2012; Muhammad, 2012).

A number of studies have been carried out on irrigated tomato production in Kano State. These studies have focused largely on the agronomic performance of tomato under different conditions such as the effect of crop spacing on growth and yield of different tomato varieties under rain-fed and irrigated conditions (Rufa'i, 1999), the influence of irrigation interval and poultry manure on the productivity of tomato varieties at Kadawa (Hussaini, 2008); growth, yield and fruit quality of tomato as influenced by mulching, nitrogen and irrigation interval (Sama'ila, 2009). The Agricultural Development in Nigeria (ADENI) project, sponsored by the French Government and Nigerian team in 2003, conducted a study of tomato commodity chain in Kano River irrigation Project. The major areas of concern in the study are the production and marketing and its major findings and recommendations are the frequent glut and lower producer prices that are experienced yearly and how to reduce the glut in order to increase the farm-gate price of the commodity (Aminu and Shehu, 2003). Each of the studies cited above has focused on a fragment of the entire process of tomato production, marketing and consumption. A holistic approach would be better as it would show how each component part in the process of tomato production, marketing and

consumption is connected to and is constrained by other parts of the process. A value chain analysis provides such a holistic and comprehensive approach.

A value chain can be defined as 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), delivery to final customers, and final disposal after use (Jon and Madelon, 2006; Christopher and Jonathan, 2011). An agricultural commodity value chain describes the links and steps a product goes through from the farmer to the consumer. It includes research and development, input suppliers and finance. The farmer combines these resources with land, labour and capital to produce a commodity.

Previous studies that are accessible to this writer as indicated above have concentrated largely on the "production and marketing" component of commodity value chains in Nigeria, either of crops or livestock, to the neglect of the other components which strongly affect production and marketing. These other components are at best mentioned in passing as general recommendations to improve commodity production and marketing without any specific strategies of how to do it. This study aims to bridge this gap in knowledge by examining the operation and efficiency of all the components of the value chain of irrigated tomato in Kano State, with a view to identify strong and weak aspect of the chain and the appropriate policy intervention needs they require.

The research questions

The study provides answer to the following research questions:-

i) What are the requirements for irrigated tomato production in Kano State

ii) Who are the actors, their activities and relationship in the value chain?

iii) What are the technical capacities of the actors in the value chain?

iv) What are the efficiency of the economic performance of the value chain?

v) What are the appropriate policy intervention needs of the value chain?

1.3 AIM AND OBJECTIVES OF THE STUDY

The aim of this study is to assess the value chain of irrigated tomato in Kano State with a view to identifying areas that may need policy interventions at different levels of the value chain. The specific objectives pursued to achieve this aim are to

i) examine the requirements for irrigated tomato production in the study area

ii) map the value chain of irrigated tomato in Kano state in order to clearly identify the activities of the key actors and their relationships in the value chain

iii) examine the technical capacities of the actors in the value chain

iv) examine the chain's economic performance

v) identify appropriate policy intervention needs across the value chain

1.4 SCOPE OF THE STUDY

The study covers areas within latitude $10^{0}03^{I}$N and $12^{0}03^{I}$N and longitudes$7^{0}35^{I}$E and $9^{0}20^{I}$E within which lie Kura, Garun Malam, Bagwai, Danbatta, Bunkure and Karaye Local Government Areas (LGA). These LGAs have been selected from areas of high tomato production in humid areas with an average annual rainfall of 1,000mm and inless humid areas with an average annual rainfall of 800mm in the State, where intensive irrigated tomatoe1s are produced.

The study focuses on identifying the attributes of Kano State which favour large scale production of irrigated tomato; links in the value chain of irrigated tomato in the study area, the activities of the key actors in each link, the relationships amongst the links, the technical capabilities of actors in each link, their economic performance and policy interventions that would be required to improve performance across the value chain. Tomato was chosen for the study because of its perishable and fragile natures among other crops produced under irrigation scheme in the state.

1.5 JUSTIFICATION OF THE STUDY

Previous studies have addressed tomato production and marketing in the study area in a partial way, either concerned with the agronomic aspect of irrigated tomato production or some segments of the marketing of tomato.

Kano State produces a lot of tomato which are wasted, especially during the harvesting periods. These tomato can be harnessed and processed into finished or semi-finished products through local industries for future use when there is scarcity. The tomato should serve as a raw material for tomato paste manufacturing industries. While previous studies have addressed tomato production and marketing in the study area in a partial way, either concerned with the agronomic aspect of irrigated tomato production or some segments of the marketing of tomato, the present study seeks to unravel missing as well as weak links in the value chain of irrigated tomato in the study area, which will serve as a knowledge base for policy formulation for sustainable development of the tomato industry in Kano State.

CHAPTER TWO
CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

2.1 INTRODUCTION

The first part of this literature review chapter presents an overview of the conceptual framework that underpins the study, these include, the constraints to agricultural production in the rural development process and concept of value chain as a comprehensive approach to the understanding of the dynamics of tomato commodity production and marketing. The second part examines previous studies with a view to identifying issues that are germane to our understanding of agricultural production and marketing which could aid our analysis of the value chain of irrigated tomato in Kano State.

2.2 CONCEPTUAL FRAMEWORK

2.2.1 Agriculture in Rural Development

Agriculture is the principal source of food and rural livelihood in Nigeria, and employs nearly three-quarters of the nation's workforce. Over the past two decades, agricultural yields have stayed the same or declined. Although there has been a recent rise in agricultural output, it is derived more from expanded planting areas for stable crops than from yield increases. Increasing and sustaining high agricultural productivity should be a critical component of programmes that seek to reduce poverty and attain food security in Nigeria. (Dayo, Ephram, John, Omobowale, 2008). Some of these issues are subsequently examined in further details.

2.2.1.1 Sector-wide constraints

Available literature has identified a number of sector-wide constraints to increasing agricultural productivity in Nigeria. These constraints are unfavourable agricultural commodity pricing policies, low fertilizer use, low access to agricultural credit, land tenure insecurity, land degradation, poverty and gender issues, low and unstable investment in

agricultural research and poor market access and marketing efficiency (Dayo, *et al* 2008; Hope, 2014).

Fertilizer use is promoted mainly by the fertilizer subsidy policy in Nigeria. Input subsidies have been a part of Nigeria's agricultural development policy since independence, and in spite of economic reforms in Nigeria, fertilizer subsidies have remained. In addition, under these sustained and high input subsidy programmes, investments in core public goods such as research and extension, which also aim to boost productivity, are limited. (Dayo, *et al* 2008).

Although improved crop varieties exist, low fertilizer use is a serious constraint to agricultural productivity growth. An important factor is low and unstable domestic production of fertilisers in Nigeria (Dayo, *et al* 2008). There has been no domestic production of fertilizer since the early 2000s, because NAFCON, the dominant fertilizer producer in Nigeria, has been shut-down. Although the Growth Enhancement Scheme (GES) introduced by the former Minister of Agriculture has facilitated farmers' access to agro-inputs through the GES distribution system. This is a programme which distributes farm inputs to farmers in the country directly through the electronic system (e-wallet) through mobile phone text messages (sms) (Vincent, 2015). Majority of the farmers still experience some of the problems indicated above. Other issues which affect domestic supply of fertilizer include high transport costs from port to inland destinations, poor distribution infrastructure, the absence of capital for private sector, participation in distribution, significant business risks facing fertilizer importers, and inconsistencies in government policies.

Access to agricultural credit has been positively linked to agricultural productivity in several studies (Bayo, *et al*, 2008). Yet this vital input has eluded smallholder farmers in Nigeria. Banks with large loan funds are generally difficult for smallholder farmers to access. Problems with collateral and high interest rates appear to frequently screen out most potential

rural smallholder beneficiaries. In addition, agricultural loans are often short-term with fixed repayment periods, a loan structure that is not suitable for annual cropping or livestock production (Dayo, *et al* 2008).

An important institutional constraint is the absence of a clear title to land. Group ownership of land in Nigeria has been associated with such problems as limited tenure security, restrictions on farmers' mobility, and the inevitable fragmentation of holdings among future heirs (FAO, 2007; Dayo, *et al*, 2008) Communal land ownership may also limit access to formal credit, since the farmer cannot use such land as collateral. This reduces incentives to invest in land quality maintenance or improvement (FAO, 2007; Dayo, *et al*, 2008). Because poor farmers cannot afford alternative farmlands, and do not have customary access to lands not inherited, they remain on depleted lands and further degrade these resources. Thus, poverty and custom may constrain farmers' ability and willingness to mitigate land degradation, leading to declining productivity. Land degradation, particularly due to soil fertility depletion and soil erosion, is a serious constraint to agricultural productivity in much of Nigeria (Dayo, *et al*, 2008).

According to the Global Assessment of Soil Degradation (GLASOD), more than one-fourth of the agricultural land in Nigeria is severely degraded. Most of this very severely degraded lands have also suffered major and irreversible losses in productivity. In situations where technology is affordable, poor knowledge may lead to over-use of agrochemicals such as fertilizers which may precipitate environmental problems (FAO, 2007, Dayo, *et al*, 2008). But of immediate concern today in Nigeria is under usage of fertilizers as a result of high costs. Land degradation has been manifested in soil erosion, especially in the southeast zone; desertification due to deforestation, mainly in the northeast and northwest zones; and oil spillage, especially in the oil producing states. In addition, shorter fallow periods, especially around homesteads, have resulted in low soil fertility.

Poverty is a constraint to agricultural productivity by limiting farmers' access to yield-enhancing inputs, which results in low productivity and food insecurity. Gender imbalances also constrain productivity. In spite of their significant role in agricultural production in many parts of Nigeria, women have varying and relatively limited rights to farmland, and lower access to extension services and credit (Dayo, *et al,* 2008). These constraints limit their agricultural productivity.

When research is poorly funded, agricultural technologies cannot be improved, and there will be no downstream farm income increase, rural employment generation, reduction in food prices, establishment of agro-based industries, and economic growth.

In short, the absence of new technologies in agriculture slows down the growth of agricultural productivity and the reduction of rural poverty. Public Research and Development (R & D) spending in Nigeria has been low and unstable since independence, and the government budget process for funding agricultural research is complex. The time between the submission of planned budgets by research agencies and the approval and release of funds is lengthy and often out of tune with research work plans. The amount approved and the actual amount disbursed very often fall far short of the planned budgets of the research agencies. Private sector involvement in agricultural research has remained negligible to date.

Agricultural marketing efficiency in Nigeria is dismally low (Dayo, *et al*, 2008; Muhammad, 2012). Transport costs are high due to poor road conditions, limiting access to inputs, credit, and output markets, and reducing the transmission of key market information.

2.2.1.2 Commodity-specific constraints

*Staple Crop Constraints:*Three of the leading staple food crops in Nigeria are cassava, maize and rice. Several improved varieties of these commodities have been released through years of on-station and adaptive research. Most of the varieties released, however, have multiplication problems (FAO, 2007; Dayo, *et al*, 2008). Contract growers (also called out-

growers) are often denied good prices for the resulting harvests at the end of the growing season, which in turn discourages future participation of the farmers. In addition, while many of the varieties are high yielding, they score low on other parameters such as resistance to drought, pests, and disease, and early maturity. On farm costs of producing these crops are still very high at the small-scale level in Nigeria. Agrochemicals are largely imported at very high costs. Thus, fertilizers and insecticides are rarely applied to at recommended levels (Dayo, *et al* 2008).

Making food available goes beyond increasing on-farm production to include year-round storage and processing. Due to a combination of low productivity and post-harvest losses, year-round grain availability is low in Nigeria. Grains in storage are partially lost to storage pests and diseases. It has been estimated that 10% of the total production of grains and 20% of the total production of tubers are lost or wasted annually to poor or non-storage. (FAO, 2007). There are also everyday challenges faced by the various levels of tuber and grain processing. Medium to large scale processors face problems such as inadequate equipment and fabricators. Problems that cut-across all processors include unstable market conditions, unstable government trade policies and difficulty sustaining the supply of raw materials to processors (Aderibigbe, 2007; Dayo, *et al,* 2008; Bako, 2012).

2.2.1.3 Livestock Production Constraints

The constraints to livestock production in Nigeria include biological limitations of the indigenous breeds of animals, inadequacy of production inputs such as feed, water and good quality pasture year-round, lack of effective veterinary services, and scarcity of vaccines and veterinary drugs at reasonable costs (Paolo, *et al*, 2008).

Non-grazing livestock depend on compounded feeds, which are affected by seasonality and the cost of raw feed materials. The pastoral system relies on natural rangeland for ruminant feeding. However, the expansion of cropping activities has reduced available

water and grazing resources, leading in turn to conflicts among pastoralists, fishermen and farmers (Paolo, *et al,* 2008). With 90% of the national livestock herd under traditional management, genetic factors seriously limit livestock productivity in Nigeria. The absence of grandparent stock and the collapse of the livestock breeding and multiplication programmes have reduced high-quality livestock production.

Public veterinary services have declined and livestock diseases account for 30 to 40% of the productivity losses (Paolo, *et al,* 2008). The specific constraints in meat production, marketing and processing in Nigeria include poor packaging facilities for products in the value chains, lack of cold storage facilities in abattoirs and at wholesale and retail outlets, and the absence of standards for meat and other livestock and poultry products.

All the foregoing constraints to agricultural production in the rural development process will not feature with equal severity in the production and marketing of all agricultural commodities. In order to be able to tailor policies that will meet the peculiarities of specific agricultural commodities, it is necessary, therefore to examine all the factors that influence a commodity of interest from the conception to produce it and through all the stages of its production to the point of consumption. The value chain analytical approach recommends itself as the most comprehensive method that best incorporates all the factors that may directly or indirectly influence the production, distribution and consumption of a commodity. This is why a value chain approach has been adopted in this study.

2.2.2 Concept of Value Chain

A value-chain describes the entire range of activities undertaken to bring a product from conception to the initial input-supply stage, through various phases of processing, to its final market destination, including its disposal after use. For instance, agro-food value-chain encompass activities that take place at the farm or rural level, including input supply, production and continues through handling, processing, storage, packaging and distribution.

As products move successively through the various stages, transactions take place between multiple chain stakeholders, money changes hands, information is exchanged and value is progressively added. Macroeconomic policies, laws, standards, regulations and institutional support services (communications, research, innovation, finance, et cetera.), which form the chain environment are also important elements affecting the performance of value chains (UNIDO, 2009).

A generic agricultural commodity value chain which consists of five major components is shown in Figure 2.1. The components are described as (i) enabling environment (ii) facilitating institutions, (iii) production and distribution, (iv) facilitating services and (v) incentives. The interrelated factors that make up each of the major component of the value chain are indicated below each one in its respective box. For example for an agricultural product like irrigated tomato the enabling environment consists of the prevailing macroeconomic climate, official policies and regulations and agro-ecological conditions. The facilitating institutional component of an agricultural value chain would, for example, include existing laws, produce standards, food safety requirements, market information et cetera. And together with facilitating services they influence research and development that impinge directly on production and marketing. The last component of the value chain consists of the incentives or the value which every function adds to the chain and which is the real driving force for participation.

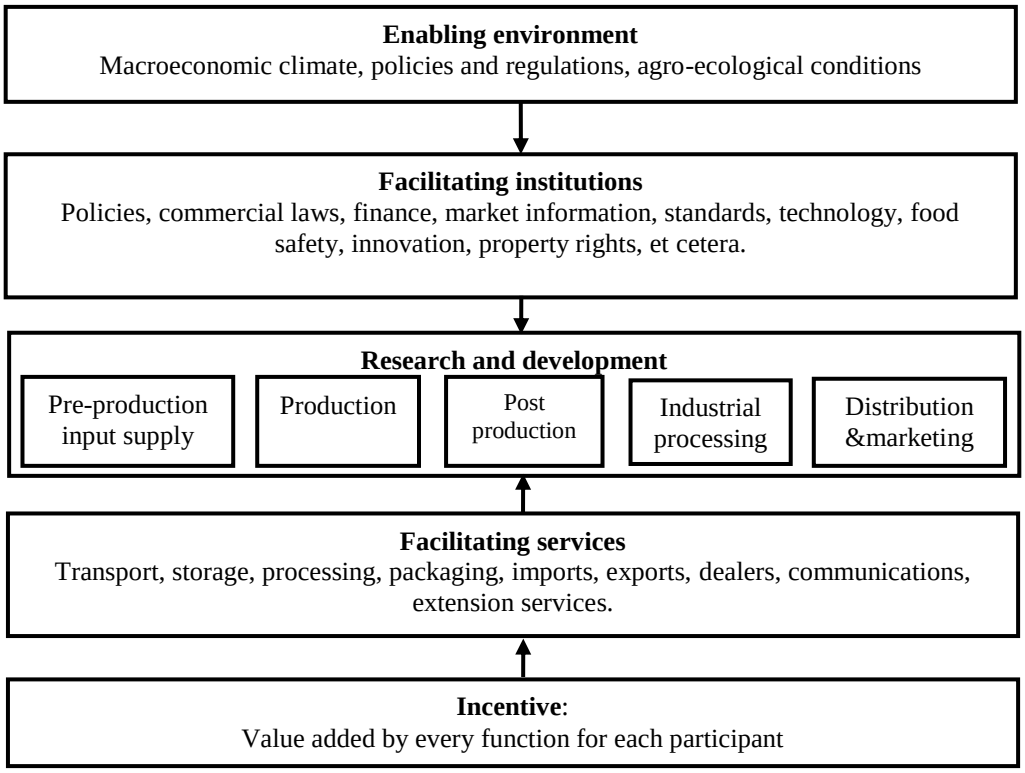


Figure 2.1: A generic value chain

Source: Adapted from UNIDO (2009)

The complex relationships amongst the component parts of a value chain are depicted in Figure 2.2. It shows the numerous interlinked activities and industries with multiple types of firms which may be operating in different regions of one country or in different countries around the globe. Agro-food value chains encompass activities that take place at the farm as well as in rural settlements and urban areas. They require input supplies (seeds, fertilizers, pesticides, et cetera), agricultural machinery, irrigation equipment and manufacturing facilities, and continue with handling, storage, processing, and packaging and distribution activities (Figure 2.2). Other elements such as power generation, logistics, scientific research, et cetera., which form the chain environment, are also important factors affecting the performance of value chains.

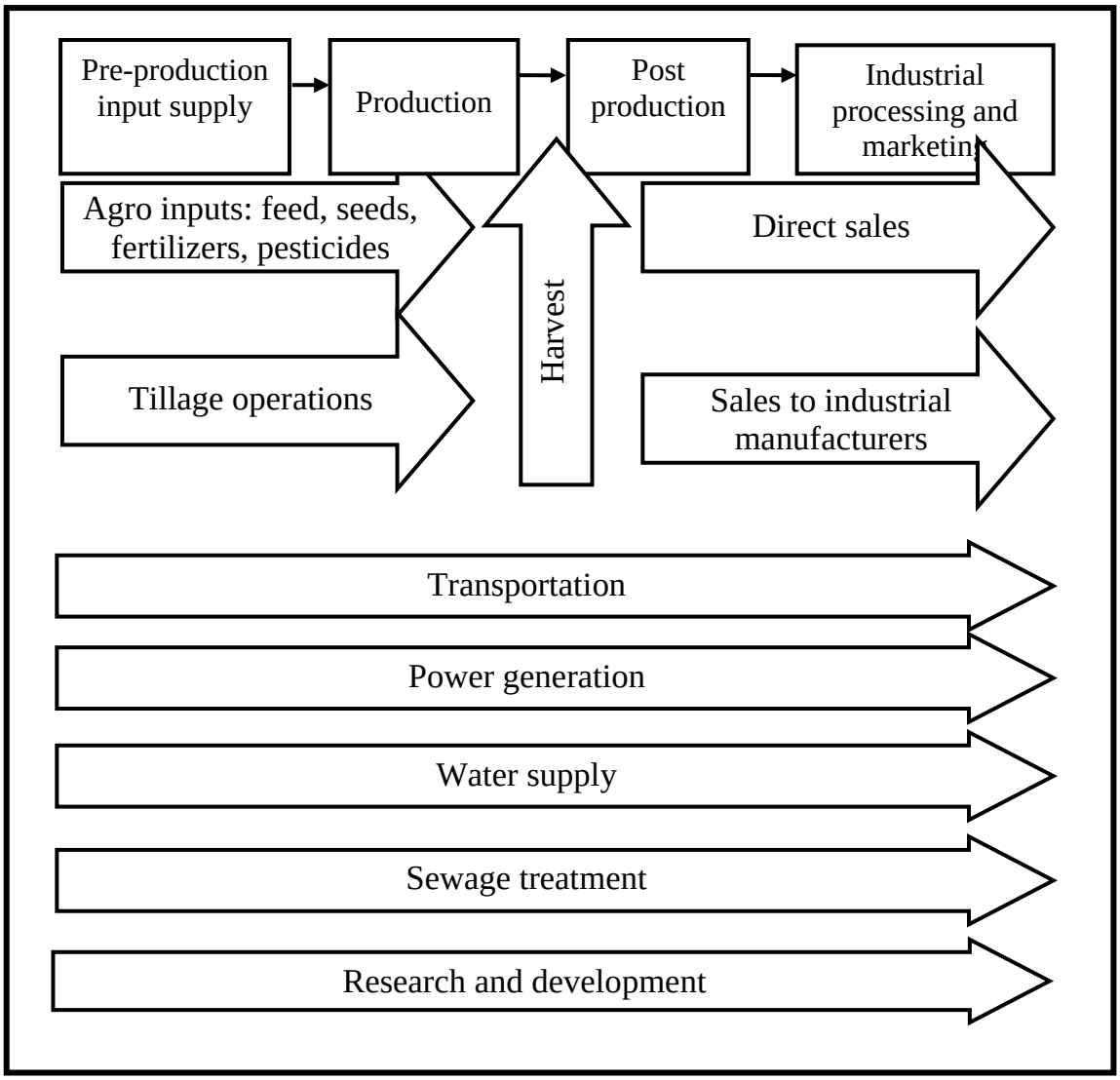


Figure 2.2: Links in a Food Commodity Value Chain

Source: Adapted from UNIDO (2009)

A value chain analysis therefore provides a deeper understanding of the chain structure and functioning by portraying the various chain actors and their intricate relationships. Value chain analysis goes beyond looking at agro-industrial production in isolation to analysing interactions and synergies among actors and between them and the business and policy environments. It shows that power relations are crucial to understanding how entry barriers are created and how profits and risks are distributed. It treats competitiveness in a global perspective and draws attention to the role of actors and factors

external to production clusters, including such issues as knowledge flows and learning (UNIDO, 2009).

By revealing strengths and weaknesses, value-chain analysis helps participating actors to develop a shared vision of how the chain should perform and to identify collaborative relations which can lead to improvements in chain performance. For policy makers, value chain analysis is a means of identifying corrective measures, investment priorities and development opportunities. Agro-commodity value chain analyses aid development agencies in ensuring that their supports for agro-businesses are precisely tailored to the specifics of each commodity in order to be more effective.

2.3 LITERATURE REVIEW

2.3.1 Potato Value Chain Analysis in Bhutan

A study carried out by Joshi and Gerung (2009) on potato value chain in Bhutan reveals a number of challenges which include labour shortage, inadequate access to quality seeds, fertilizers and chemicals, attacks by potato tuber moth, late blight diseases, crop damage by wild pigs, limited on-farm storage facilities which often resulted in low prices during the peak production periods; poor road infrastructure and disregard for standards such as weight per bag and rough handling of produce which result in high post-harvest losses. The study concluded by identifying the following issues which require policy interventions:

- bringing down the cost of production and increase the yields;
- reducing post-harvest losses and
- strengthening market linkages

To address the first issue extensions services as well as strengthening the input and service markets were recommended. Also recommended was the need to build farmers' capacity of and enhance their access to certified potato seeds, fertilizers and technical advice. Such capacity building includes training and financially empowering farmers through credit

facilities. Similarly, to reduce post-harvest losses and cut down the cost of transport, the improvement of the road networks, establishment of collection centres and awareness creation about proper handling of potatoes were also recommended. To strengthen market linkages, it was recommended that potato growers should be organised into cooperative groups so that they can assure bulk supply of the required potato grade to buyers. Finally it was recommended that significant investments be made in infrastructural development.

2.3.2 Study of Rice Value Chain in Cambodia

A rice value chain study in Cambodia by the World Bank reveals that over 80% of Cambodian farmers cultivate rice, primarily through traditional farming practices and the staple is the major source of income and sustenance of the nation. In spite of the critical importance of rice in the economy of Cambodia the production of the crop faces a number of constraints. Productivity average barely 2 tonnes per hectare. Farmers lack consistent access to credit for the purchase of inputs for rice production. Further downstream, the rice processing and distribution sector faces a number of key constraints: outdated milling technology resulting in high levels of broken rice; millers are fundamentally constrained by a lack of working capital that limits their ability to purchase paddy from farmers and update machinery; poor road and irrigation infrastructures. The key conclusion of the study is that there is a need to create an enabling environment for rice production by investing heavily in infrastructure and developing pro-poor financial institutions (Agrifood Consulting International, 2002).

2.3.3 Study of Tomato Value Chain in Nepal

Production, collection, whole sale and retail trading, and, processing, are the main functions covered in this value study. The actors who performed specific functions were identified as

farmer/producer, local collectors, commission agents, small and big wholesalers, road-head traders, itinerant traders and retailers, and processing industries.

The results of the value chain analysis indicate that returns on investment in tomato production or margins were reasonable. Neverthelessthe industry faces a number of challenges, namely:

a) increased price of major raw materials such as seeds, fertilizers, pesticides and fuel
b) severe price competition with imported fresh tomato from India
c) limited value addition
d) supply and price variation due to seasonality of the product
e) lack of proper information on market demand
f) heavy wastage during road blockage and strikes
g) losses due to inappropriate packaging and transportation

It was strongly recommended that an out-grower scheme be undertaken in the project area with the aim of moving the product smoothly from production to market through processing and value addition along the value chain (Ministry of Agriculture and Cooperatives, and Full Bright Consultancy Ltd; Nepal, 2008).

2.3.4 The Grain Industry Value Chain Study in Zimbabwe

The objective of the study highlighted here was to assess the market of staple food commodities in Zimbabwe through a value chain analysis with a view to determine the impact of ongoing policy interventions/reforms on intraregional trade. The grains studied were maize, soybeans, wheat and rice. The report of the study revealed that productivity in the grain sector has been poor and uncompetitive. Over the past five years the national average yield has been below half a tonne per hectare in maize, while in the wheat sector total annual output fell from 325,000 tonnes in 1990 to 18,500 tonnes in 2008.

Key constraints and policy challenges to the efficient operation of the grain sector include limited access to market, information, unreliable supply of low-cost inputs (For example, seed, fertilizers and electricity), limited capacity to mobilize capital for equipment purchase, lack of foreign direct investment, government policies on duty and taxes charged on imported technology which discourages local processing and manufacturing (Tinashe, *et al*, 2010).

2.4 EXAMPLES OF AGRO-COMMODITY VALUE CHAIN ANALYSIS IN NIGERIA

2.4.1 Value Chain Analysis of the Cassava Industry in Nigeria

Analysis of profitability and value chain indicators of cassava has attracted attention in Nigeria in recent times, not only because the commodity is assuming increasing economic importance in terms of domestic and industrial demand, but also in view of the current policy attention being focused on export of cassava products (Aderibigbe, 2007; Paul, 2014). With regard to profitability, studies have shown that cassava enterprises are quite profitable. Cassava production is profitable under the traditional and improved system of production. Under the traditional production system, a combination of maize, cassava, and melon yielded gross margins of N46,200 and N137,750 in south-east and south-south respectively. However, the same crop mixture, grown under improved system yielded N73,800 in the south-east. The study found that where cassava was cultivated as a sole crop in the southwest of the country, it was possible to realize a gross margin of N18,750.88 per hectare (Table 2.1).

Table 2.1: Gross Margin in Cassava Production in South-West Nigeria

Inputs	Improved sole cropping
Labour	29,470.00
Seed/cutting	1,114.97
Fertilizer	880.50
Herbicide	775.00
Pesticide	-
Tractor	-
Water application	-
Transportation	3,991.00
Total variable cost	36,231.47
Total value of output	54,981.55
Gross margin	18,750.08

Source: Aderibigbe, (2007).

The most extensive value chain study for cassava in Nigeria was conducted in 2005 by Yee and Pacudetto to support the World Bank's initiative in enhancing Nigeria competitiveness and growth in the non-extractive sectors of the economy. The value-chain was explored through a case study of a shipment of cassava starch from the south-western part of the country to Lagos. The value chain analysis for 16 tonnes of cassava starch requires that 80 tonnes of cassava roots with a value of N400,000 be transformed to produce cassava starch worth N886,000 yielding an increase in shipment values of about 122% (Aderibigbe, 2007).

The results show that there is insufficient value added to cover both the full cost of the value adding activities as well as provide a return to equity. In cassava farming, value added of N365,851 is used to cover logistics costs of N120,207 (33 percent of value added) as well

as primary input costs of N245,644 (67 percent of value added) that include depreciation, maintenance, labour, overheads, and utilities (power, diesel, water). In the case of starch production, value added of N466,064 is used to cover logistics costs of N58,064 (12 percent of value added) and primary input costs of N408,000 (88 percent of value added).

Accordingly, there is no resources left to reward risk equity capital and therefore no profit is accrued. Lack of profitability is due to:

i) High labour cost of root production

ii) High logistics cost of cassava farming and harvesting

iii) Unreliable supply and high cost of utilities.

The analysis of cassava starch production shows that the producer is operating with barely enough revenues to cover the costs of production but is not left with anything to recompense capital charge, particularly the cost of equity. Consequently, no profit is realized from operations.

Three major weaknesses are identified in the cassava value chain. The first major weakness in the Nigerian cassava value chain relates to growing and harvesting of the tubers. The yield of 12 to 15 tonnes per hectare is very low compared to countries such as India, Thailand and Barbados, that have been noted to record as high as 25 to 40 tonnes/ha (Aderibigbe, 2007). Nigeria's productivity yields fall short of these rates and this situation is due to a number of factors, including small scale farming (on plots that are usually less than 1 hectare), manual operations, little or no use of fertilizers and limited knowledge in the use of high yield root species Aderibigbe, 2007). Secondly, the small scale of operation has a deleterious effect on the supply chain in view of the uneconomic gathering or collection of the tubers in small shipments from numerous and dispersed growers frequently reaping only 12 to 15 tonnes per harvest. On this basis, the unit cost of transporting small shipments to the destination is naturally much higher than that of large shipments which could only

materialize through higher output farming. In addition, the performance of the supply chain is also negatively affected by the poor road infrastructure, as it provides poor access to the farms (Aderibigbe, 2007). Thirdly, at the processing plant level, the economics of production is impeded by a host of factors that are similar to that faced by producers in other industries. These are (i) high rate of interest, (ii) poor and costly public utilities, (iii) random disruption of utility supply that leads to temporary stoppages in plant operation with the consequence of cost output and product spoilage; and (iv) low productivity and poor quality of labour. Overall, the operating environment hinders competiveness and reduces profit-making to a high risk venture (Aderibigbe, 2007).

2.4.2 Value Chain Analysis of Cotton Production in Nigeria

The analysis focuses on key indicators of profitability in the cotton value chain (production, assembly, processing, trade) as well as the indicators of performance of the value chain with a view to determining the international competitiveness of the commodity (Poulton, 2007, ICAC, 2008). Cotton production is largely in the hands of small-scale farmers thus, the production stage of the analysis is limited only to the family farm

i) Financial costs and profitability indicators

The analysis keeps track of the build-up of financial costs at every stage of the value chain and this reveals the contribution of the various costs items. Whereas variable costs constitute a large proportion (94 percent) of local financial costs at the production stage, crop purchases are the major component in each of the other stages. Nonetheless, for comparative purposes, the crop purchase price is often excluded from the build-up of financial costs. At the production stage, labour cost is the single largest component (64 percent) of financial costs followed by seeds, fertilizer and chemicals (30 percent). The other stage where there is concentration of cost on a particular activity is the logistics stage where 78 percent of the cost

is accounted for by transportation to delivery points. At the assembly stage, the cost is spread among vehicle hiring (33 percent), depreciation (33 percent), hired labour (23 percent) and fees and crop levies (11 percent). At the processing stage, the major cost components are overhead and licence, energy and machine operation, hired labour and depreciation in that order (see table 2.2).

Table 2.2: Structure of Financial Costs in Cotton Enterprises: Family Farm

Cost Items	Farm product	Assembly	Processing	Logistics
Hired labour	64	23	25	
Seed, fertilizer and chemicals	30			
Loading and storage				11
Transport to delivery points				78
Vehicle hire		33		
Fees and crop levies		11		
Custom duties and tax				2
Plant repair and maintenance			2	
Overhead and licence			31	
Energy and machine operation			27	
Depreciation	6	33	15	
Total	100	100	100	100

Source: Aderibigbe, (2007).

The results show that operating profit and net profit are positive at every stage of value chain. At the production stage, the gross margin is US$28.55 while net profit is US$17.56; whereas at the assembly stage, the gross margin and net profit are US$76.82 and US$69.57 respectively. Profitability is lowest at the processing stage judging by the level of gross margin (US$7.70) and net profit (US$5.29). Moreover, the rate of return attained at the

processing stage is about one percent compared to 26 percent at the assembly stage and 7 percent at the production stage. Profit is highest at the trading stage. Cotton lint trade attracts net profit of US$472.88 with 58 percent rate of return while net profit for cotton seed trade is US$278.45 with 91 percent rate of return.

ii) Value Chain Indicators

The transformation of cotton into cotton lint and cotton seed results in considerable increase in value along the chain. The transformation of cotton into lint, is associated with an increase in shipment value from US$219.73 at the cotton production stage of US$815.11 at the stage of trading in cotton lint representing an increase of about 271 percent. For cotton seed, the shipment value increases from US$219.73 to US$307.55 or by about 40 percent. Cotton production yields a value added (US$219.72) which represents 89 of the shipment value. Value added also represents a high proportion of the shipment value of both cotton lint (88 percent) and cotton seed (81 percent) trade. In respect of cotton lint, 92 percent of the Domestic Value Added (DVA) is accounted for by domestic costs and mark-ups account for 94 percent of the DVA.

For the purpose of determining the international competiveness of cotton lint and cotton seed, the final shipment values are compared with the relevant export parity price. The shipment value (SV) for cotton lint (US$815.11) is lower than the export parity price (US$1.196) implying that Nigerian cotton lint is competitive at the international market. With regard to cotton seed, the final SV (US$307.55) is also lower than the export parity price (US$494) implying that the commodity is competitive at the international market. The composition of shipment values shows considerable variation within each stage but not across the various stages in the value chain. In general, domestic costs and mark-ups constitute not less 80 percent of SV in each of the stages. This is followed by the foreign costs, unofficial expenses and official duties and tax.

Analysis of the final shipment value is also carried out on the basis of the incremental cost incurred (per 1 metric tonne of raw material) at each stage of the value chain. The proportion of the shipment value at the trade logistics stage is the highest. It is closely followed by the farm product stage; whereas the proportions are much lower at the assembly and processing stages. By these results, it is clear that efforts aimed at reducing cost in the cotton value chain should be concentrated at the logistics and the production stages. Moreover, domestic costs and mark-ups are the major items that should be the focus of attention relative to foreign costs, official duties and tax and unofficial expenses.

iii) Major Impediments to Cotton Production in Nigeria

a. Production constraints

- Farmers accord higher priority to food crops than cotton, so they take an economic decision in most cases to cultivate food crops as against cotton. Arguably, food crops can be used at home and as well exchanged for other essentials whereas cotton can only be used to exchange for cash or other items.
- Farmers tend to reduce the area cultivated to cotton in reaction to poor prices and market dynamics.
- Since agriculture in Nigeria is mostly rain-fed, timely arrival of rain is critical. Farmers often take a decision against the cultivation of cotton due to late arrival of rain. The arrival of rain is as important as its cessation in maximizing yield. If rain continues beyond a particular time, it may lead to drastic reduction in output.
- Inadequate and ultimately supply of inputs.
- Seed contamination also leads to reduction in yield. The seeds approved for the two major cotton-growing regions – North East and North West, are samcot 8 and samcot 9 respectively. There is the tendency for seeds to be

mixed up as they are transported from one region to the other. This can happen either through buyers of the seed cotton or oil mills. The mixed up could lead to loss of viability and low yields.

- Unavailability of funds at critical times also affects production. In this case funds from household sources are scarce or non-existent. Farmers and operators are thus forced to take loans at commercial rates to finance the production of cotton. Recently, however, there exists a window of opportunity through the Nigerian Agricultural, Cooperation and Rural Development Bank (NACRDB) where loans for cotton cultivation are given at 8% interest rate.
- The impact of government policy towards the agricultural sector in general and cotton in particular also affects cotton production. Policies such as subsidy on inputs like fertilizers, provision of tractors at moderate rates for land preparation exist but only a few farmers have access to the good and services provided. (Bischof, *et al* 2007, Poulton, 2007, ICAC, 2008).

b. Marketing constraints

- Possibility of adulteration of seed cotton, (For example, sprinkling of water, adding stones to seed cotton to gain extra weight).
- Standard of cotton quality not assured.
- Different varieties are indiscriminately cultivated.
- Difficulty in controlling farmers' practices and the ginners.
- Absence of institutional arrangement for commodity grading and quality control.

2.4.3 Maize Value Chain in Nigeria

Studies in different parts of Nigeria have examined some aspects of commercialization and competitiveness of maize enterprises and have shown that maize production has been highly profitable in various agro-ecological zones across the country. The studies show that gross margins for maize enterprises vary widely, ranging from N1,090 in the northwest zone to N49,000 in the south-south zone (Table 2.3). The variation is attributed to differences in production systems and varying prices across the zones. It has also found that the trend of profitability in the country has been on the increase over the years. For instance, gross margins of N86.95 and N402 were obtained in 1985 and 1989 respectively for maize cultivated under the traditional production system, while gross margin of N607.75 and N1,310.50 were obtained during the same period for maize cultivated under improved system in Nigeria.

Table 2.3: Gross Margin in Maize production in Nigerian ago-ecological zones

	North-West Zone	North-East Zone	North-Central Zone	South-West Zone	South-East Zone	South-South Zone
Labour	15.170	4.58	12,300	15,825	20,600	20,000
Seed	750	7,333	500	2,625	1,000	-
Fertilizer	6,000	10,000	12,000	11,700	4,000	7,200
Herbicide		-	5,050	4,000	-	7,800
Seed dressing		-	500	-	-	-
Insecticide	750			-		-
Transportation	720	0	1,000		3,000	
Bags	720	1,650	600		-	
Tractor				5,500		20,000
Water application				3,000		
Total variable cost	24,110	20,893.79	31,950	42,650	27,600	55,000
Total value of output	25,200	62,700	35,720	64,750	75,000	104,000
Gross Margin	1,090	17,880.4	3,770	22,100	47,400	49,000

Source: Aderibigbe, (2007).

Some of the constraints identified by the studies include (i) inadequate access to formal credit facilities, (ii) inadequate security of good in transit, (iii) poor market infrastructure, (iv) unofficial charges by security agents on roads and (v) lack of insurance covers for produce (Aderibigbe, 2007; Hope, 2014).

The study suggests the following interventions to enhance the performance of the maize commodity value chain:

i) Transport sector improvements are essential across the maize distribution chain. This requires a concerted effort from central, state and local governments, together with donor support. Currently poor producers suffer substantial losses from: failure to evacuate products from producing areas and get them to the most profitable markets at the right time due to poor roads and unreliable transport; diversion of goods in transit by corrupt transporters and highway robbers; extortion from state officials during transit. These losses reduce prices of producers, reduce profits for traders and manufacturers and raise prices for consumers. Although informal insurance operates among richer traders who support one another when losses occur, poor producers do not have the same safety net. NGOs should be encouraged to find ways to empower transporters to resist unofficial payments, such as through radio phone-in programmes.

ii) Rent-seeking behaviour by state officials is widespread in the maize industry (and not only within the transport component), and must be reduced if the benefits of increased maize demand are to be translated into increased income for poor producers. This could be assisted by more timely payment of salaries in the public sector.

iii) Local government control over space/stall allocation in markets often leads to rent-seeking behaviour among elites and damages the interests of poorer traders, especially women. A national study, supported by central government, is needed to examine the

potential benefits, difficulties and processes of contracting out revenue collection and market management to private companies. This would be best conducted by an NGO or research institution.

iv) Small farmers' dependence on *dillalai* (commission agents) for credit (which reduces their flexibility in marketing) could be reduced by creating schemes specifically targeted at small producers; these need to provide much more timely credit with far less paperwork than conventional schemes (which commonly respond far too slowly and without consideration for credit needs over the farming year). Interest charges which are higher than conventional bank schemes would be needed to cover the costs of such schemes, but could still be lower than rates often charged by informal and family credit providers. Collaboration between private sector banks and NGOs could probably best achieve this.

v) Better regulation to ensure trader's correct use of standardized measures is needed in the maize sector. Market associations and/or independent NGOs would probably be the best group to undertake such regulation. NGOs could offer market-based education to poor buyers and sellers who need knowledge and experience of standard measures and how to identify potentially adulterated produce.

2.4.4 Rice Value Chain Studies in Nigeria

Studies on the competitiveness of rice production based on the methodology designed for the current study are non-existent in Nigeria. Available studies have tended to limit analysis to profitability indicators. In this category, the studies by NISER (2001) in Aderibigbe, (2007) found that rice production has been profitable in various parts of the country judging by the level of gross margins per hectare. Gross margins range between N17,880.4 in the Northeast zone and N71,560 in the North-central zone (Table 2.4). The authors attributed the variations to differences in the production system.

Table 2.4: Gross Margin in Rice Production in Nigeria

	North-West Zone	North-East Zone	North-Central Zone	South-East Zone
Labour	24,020	8,313.48	12,390	41,800
Seed	5,850	129	1,000	1,000
Fertilizer	12,600	3,510	10,000	2,000
Herbicide		-	7,500	-
Seed dressing		-	1,000	-
Tractor	3,600			
Transportation		700	1,000	3,000
Bags	840	1,200	910	-
Total variable cost	46,910	13,852.48	33,800	47,800
Total value of output	73,500	31,732.88	105,360	75,000
Gross Margin	26,590	17,770.4	71,560	27,200

Source: Aderibigbe, (2007).

Of the available studies focusing on production and trade the most relevant to the current work is the one by Ezedinma (2005) which, *inter alia*, assessed the competitiveness of domestic rice relative to imported rice. Data for the study were collected between 2001 and 2003 from 21 states namely; Abia, Akwa Ibom, Anambra, Adamawa, Benue, Cross River, Ebonyi, Enugu, Imo, Jigawa, Kaduna, Kano, Katsina, Kogi, Kwara, Niger, Ogun, Ondo, Osun, Taraba and Zamfara. The component of the study which deals with the issue of competitiveness involves a comparison between the domestic prices of paddy and milled rice in Nigeria with the international prices of the same grade of rice-white broken rice, Thai A1 super, f.o.b. Bangkok from 1993 to 2002. The author sought to know whether the price of Nigeria's domestic rice would be competitive in the local market if it were to be processed to the quality and standards of imported rice (that is polished, de-stoned and dirt free with

uniform grain characteristics). Field observations and interviews revealed that on the average an extra cost of 25 percent was needed to process domestic rice to the quality and standards of imported rice. The comparison of prices for different locations of rice mills as at 2002 is shown in Table 2.5.

Table 2.5: Comparison of domestic and import price of rice in Nigeria

Location of Mills	Miller's Price (₦/25kg)	Additional processing cost (25%) (₦/25kg)	Marketing Margin (₦/25kg)	Estimated Urban Market Price (₦/25kg)	Price of imported rice (₦/25kg)	Percentage difference
Abakaliki	900	225	613	1738	1575	10
Adani	1018	254	431	1704	1575	8
Omor	1068	267	531	1867	1575	18
Bende	1137	284	461	1883	1575	19

Source: Aderibigbe, (2007)

The results indicate that further processing of domestic rice to meet the quality and standards of imported rice will mean that rice from the Abakaliki mills will be 10.3 percent more expensive than the imported rice while rice from the Adani mills will be more expensive by 8.23 percent. Similarly, rice from the Omor mills will be more expensive by 18.53 percent and Bende by 19.50 percent. Thus, although improving the standards of local rice was feasible and desirable it was not competitive. The author concludes that Nigerian domestic rice is expensive to produce and also expensive to process and so cannot compete in the international market.

There are several constraints militating against the competitiveness of rice production in the country. These include:

i) Lack of pre-planting contracts which expose farmers to unfavourable market dynamics

ii) Inadequate processing facilities

iii) Inadequate financing of key activities in the value chain

2.5 CONCLUSION

The foregoing review of potato value chain in Bhutan, Rice value chain in Cambodia, Tomato value chain in Nepal, Grain value chain in Zimbabwe, Cassava value chain in Nigeria, Cotton value chain in Nigeria, Maize value chain in Nigeria and Rice value chain in Nigeria, all represent a partial value chain analysis which either considered only the production or marketing aspect of the value chain of the commodity under study, leaving out in their consideration the role of the enabling environment and facilitating institutions.

The present study incorporates the missing links as well as weak links in a comprehensive value chain analysis which are not covered in the previous studies, such as the examination of the characteristics of the irrigated tomato farms, the key actors and their activities, the relationship and technical capabilities of actors, their economic performance and policy interventions that would be required to improve performance across the value chain.

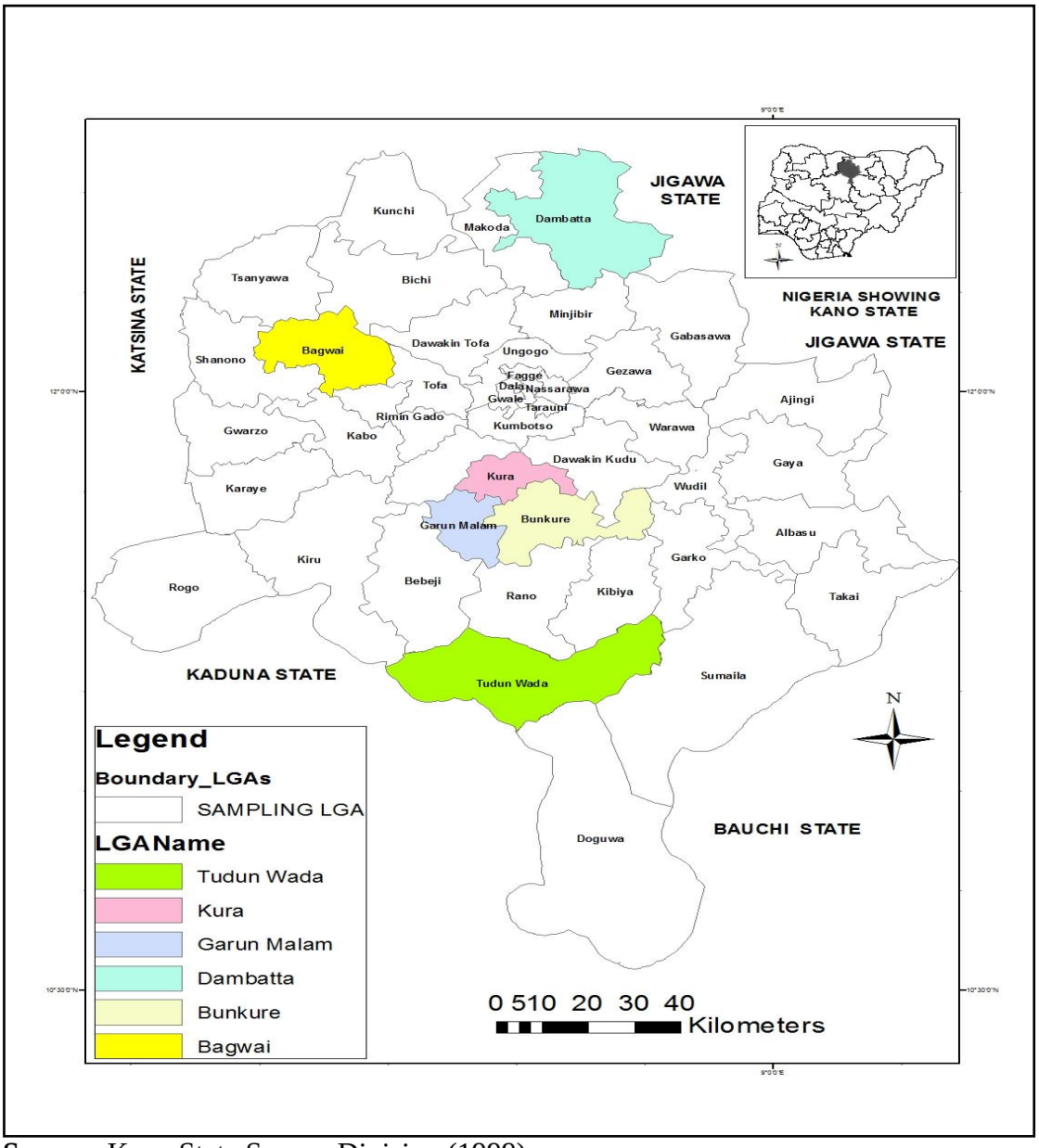
CHAPTER THREE

THE STUDY AREA AND METHODOLOGY

3.1 THE STUDY AREA

3.1.1 Location

Kano State is located between Latitude $10^0 03''$N and $12^0 03''$N of the Equator and Longitude $7^0 35''$E and $9^0 20''$E of the Greenwich Meridian. The State has a land area of about 20,760 square kilometres and is bordered by Jigawa State in the north and east, Katsina and Kaduna States in the west and southwest respectively and by Bauchi State on the extreme south-eastern part (Figure 3.1) (Olofin, 2008; Rilwan, 2011).



Source: Kano State Survey Division (1999).

Figure 3.1: Kano State showing the 44 Local Government Areas

Figure 3.2 shows areas of high tomato production in the humid parts of the state, while figure 3.3, presents areas of high tomato production in the less humid parts of Kano state.

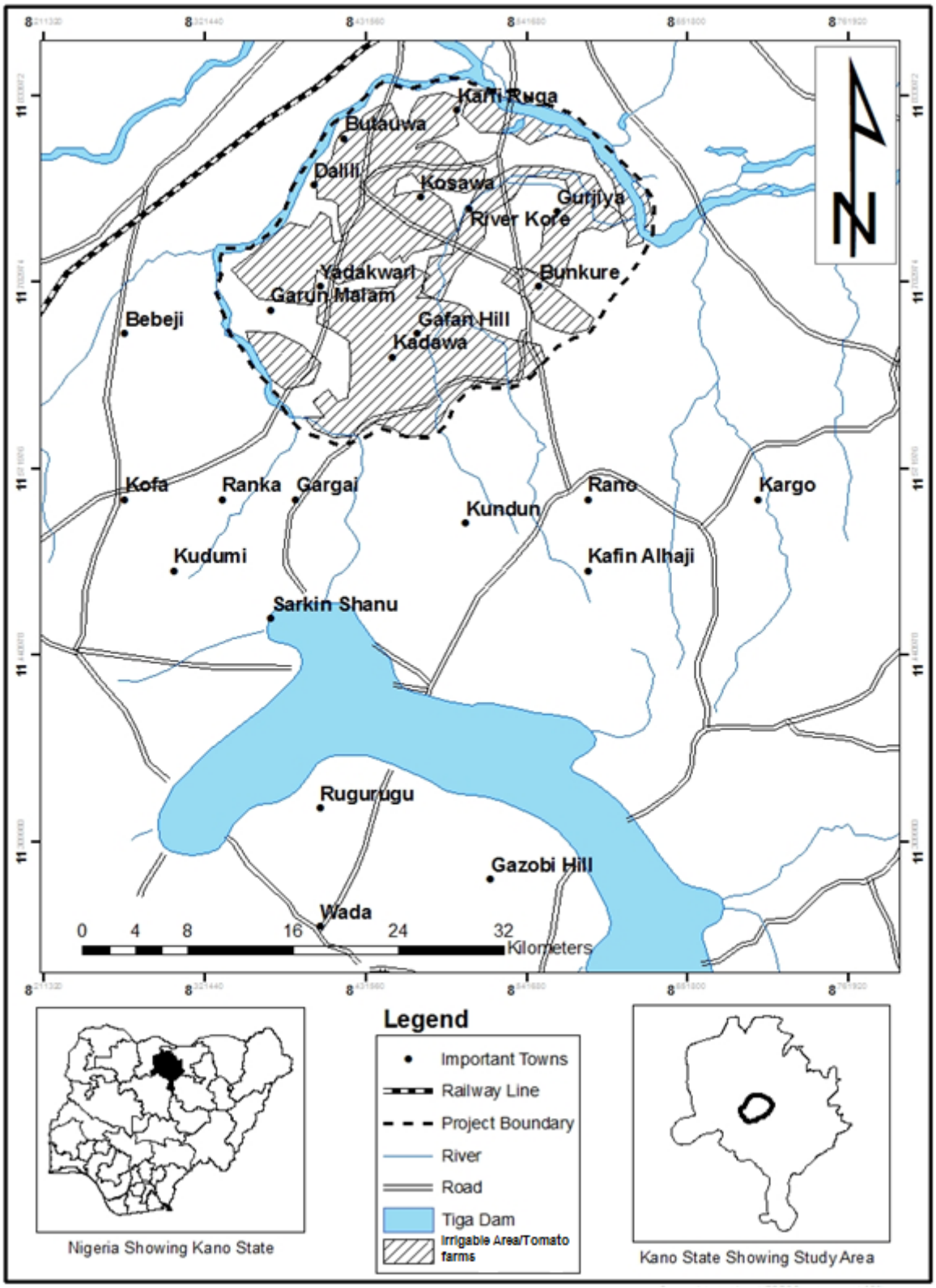


Figure 3.2: Areas of high tomato production in the humid parts of Kano State

Source: Field Work (2013)

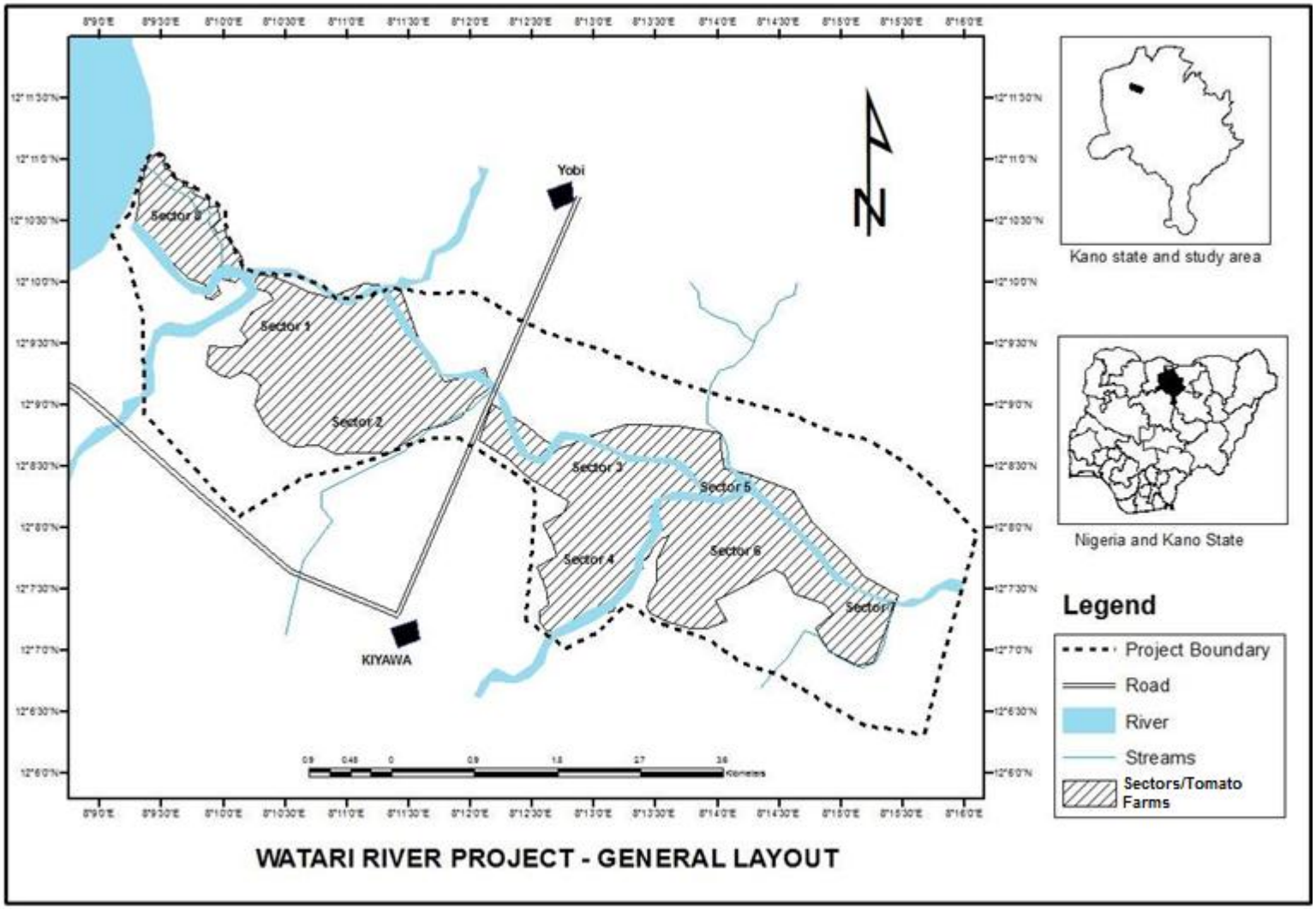


Figure 3.3: Areas of high tomato production in the less humid part of Kano state

Source: Field Work, (2013).

3.1.2 Relief and drainage

Kano State is located on the "high plains of Hausaland" with the occurrence of rock outcrops predominantly in the southern part of the State. The highest elevation is Riruwai in Doguwa Local Government Area, with a peak reaching up to 1230 metres above sea level (Olofin, 1987; Aliyu, 2007; Bashir, 2008, Rilwan, 2011). Towards the central and northern parts of Kano lies a plain with grouped or ungrouped hills, or only residual hills like Dala and Gwauron Dutse in urban Kano. The terrain is flatter towards the northern part of the state.

The natural drainage of Kano State consist of two major rivers, Kano and Challawa, and their numerous tributaries. The former rises from the extreme southern part of the State while the latter rises from the southwest. The two rivers join and drain north-eastwards into Hadejia-Nguru wetlands and ultimately into Lake Chad. However, the drainage system has been modified by the construction of dams and barrage for multipurpose uses and flood control.

3.1.3 Climate

The climate of Kano State is the tropical dry-and-wet type, classified by Koppen as *AW*. The seasonal migration of the Inter-Tropical Convergence Zone (ITCZ), also known as the Inter-Tropical Discontinuity (ITD), gives rise to two seasons, one dry and the other wet. The wet season last from June to September although May is sometimes humid. The dry season extends properly from mid-October of one calendar-year to mid-May of the next.

There are three main temperature seasons. A cool and dry season lasts from November to February, during which the mean monthly temperature is between 21 and 23^0C with a diurnal range of 12 to 14^0C. The harmattan winds prevail at this time. This period is usually followed by a hot and dry season which lasts from March to mid-May. The mean monthly temperature during this period is in excess of 30^0C and the daily range is up to 20^0C. This is followed by the wet season which is warm, with mean monthly temperature of about

26^0C and a diurnal range of about 10^0C, rising to 13^0C in September. Thus, when the temperature regime is merged with the rainfall regime, four seasons are identified in the state as follows:-

a) A dry and cool season (*kaka*) – this season is also known as the Harmattan period and it lasts from mid-November to the end of February. It is characterized by low temperatures in the nights and early mornings when the minimum temperature can drop to as low as 10^0C but the afternoon temperature can be as high as 35^0C. The monthly mean temperature, particularly December and January, is between 21 and 22^0C. The ITD or ITCZ lies south of the region during this period and the prevailing winds are the Northeast Trades.

b) A dry and hot season (*bazara*) – This is a very short season that follows the harmattan period. Its length in a particular year is determined by the onset of rains. On the average, it lasts from March to April and may extend to mid-May. This is the hottest period of the year with serious health problems. The mean monthly average temperature is between 30 and 32^0C, with a daily minimum around 24^0C and a maximum often above 40^0C. The weather is often characterized by windstorms as the ITD begins to move northwards. The dominant winds are still the Northeast Trades.

c) A wet and warm season (*Damina*) – This is the period when the ITD runs through the region and returns southwards. The length of the season in a particular year depends on the onset of rains. The onset of rains begin from the south from April or early may, reaching Kano metropolitan area around mid-May to early June and the rest of the region in mid-June. The cessation of rains starts from the north around mid-September moving southwards, reaching Kano metropolitan area about the end of September (first week of October in wet years) and the southern tips in mid-October. (Olofin, 2008). Thus, the wet warm season in a normal year may last only three

months in the northern parts of the region, four to five months in the middle and six months in the southern parts. The monthly average temperature during the period is about 25 to 26^0C, with a daily minimum of about 20^0C.

d) A dry and warm season (*Rani*) – This is the shortest of the seasons. The length in a particular year is affected by the cessation of rains and onset of the harmattan season. If the rains last till mid-October and the Harmattan begins in mid-November, it may last just a month or even less. On the other hand it may last for one and half months beginning of October to mid-November in the Kano metropolitan area. In general, the onsets and ends of these seasons vary between the southern and the northern parts of the region (Olofin, 1987, Olofin, 2008).

The onset of rains begin from the south from April or early May, reaching Kano metropolitan area around mid-May to early June and the rest of the region in mid-June. The cessation of rains starts from the north around mid-September moving southwards. Rainfall is the most critical element of climate in the region, thus, it is important to examine its spatial variation in the study area.

Average annual rainfall is higher in the southern parts, such as Riruwai where the normal annual total could be between 1000 and 1100mm. This amount decreases northwards to about 800 to 900mm at the latitude of Kano metropolis and about 500 to 600 at the northern fringes with increasing potential evaporation. This means, aridity increases northwards in the region.

3.1.4 Vegetation and Wildlife

The "natural" vegetation of Kano State is the savanna type. Most of the state is contained within the Sudan savanna variety. The exceptions include the southernmost area which is characterized by the northern Guinea savanna areas south of Tudun Wada, particularly the hilly areas of Dadi plains and Rashi hills in Riruwai areas. This is a woodland type of

vegetation composed of numerous trees of medium heights and sizes and grass undergrowth. The northern Guinea savanna is a mixture of trees and tall grasses (1.5 to 2 metres tall). Some of the trees include tropical hardwoods, the silk cotton tree which may be over 20 metres tall, while the grasses include the elephant grass. A few species of acacias are also found as well as the Baobab tree in areas with light vegetation (Olofin, 1987; Olofin, 2008).

The Sudan savanna can be said to be the typical vegetation of Kano State. It is composed of a variety of trees scattered over an expanse of grassland. The trees are usually characterized by broad canopies and they are rarely than 20 metres. The baobab is peculiar tree, taller and larger than others, which is common all over the landscape. There are various types of acacias *(albida, nilotica and seyal* among others), occasionally forming woodlands. Most of the tree species are adapted to drought conditions through long tap roots, leathery leaves and tiny leaves. These retain their greenness throughout the year, others shed their leaves during the dry season. A few thorny trees are encountered on an increasing occurrence as one move northwards.

The fauna of the state include mammals such as the elephants, rhinoceros, bush hocks, hyenas, leopards, monkeys, et cetera. in the Guinea savanna zone. Some of these are also found in the Sudan and Sahel areas but with a lot more of rabbits and avian populations, including migratory ones. There are also a lot of reptiles including snakes, alligators, snails and tortoise.

3.1.5 Soils

The factors of soil formation in Kano State is as in other places, which include the parent materials, climate, plants, other organisms, site conditions and time. The most widespread parent material in the state is the wind drift material deposited on the pediplains during the dry, or arid phase in the region. The drift materials are predominantly of silt and fine sand particles. Others parent materials include the regolith of granites where exposed, the sandy

deposits of the Chad formation and the sands of the fixed sand dunes. The parent materials have interacted with the climate and vegetation of the region to produce the matured ferruginous soils which generally characterise Kano State. The soils are highly leached, acidic, high in silt, clay particles and very low in organic matters which is usually less than 0.5%. They are either silty loam or sandy loam (Olofin, 2008, Essiet, 2014).

3.1.6 Water Resources

The sources of water in the study area are:

(i) Traditional shallow wells

(ii) Drilling of boreholes

(iii) Construction of new earth dams

(iv) Creation of mega water plant

(v) Rivers

(vi) Ponds

(vii) Rainfall (Adnan, 2014, Adamu, 2014, Ahmed, 2005).

In the State Government's effort to utilize these resources, a number of man-made dams were constructed all over the state to encourage dry season farming (irrigation), fisheries and as potentials means of generating hydro-electric power.

At present, the available water resources in the State allow for the irrigation of over 160,000 hectares producing nearly two million tons of crops that include vegetables such as tomato, onion, pepper, wheat, maize, rice and so on annually (Kano State Guide on Tourists, Industrial and Commercial, 2002, Yahaya, 2008). The most important irrigation projects are the Kano River Project and Hadejia Valley project, both which depend upon Tiga Dam for water supply (Table 3.1). These dams are used for irrigated production of crops especially tomato in the state.

Table 3.1: Important Dams for Irrigation Projects and their Location in Kano State

Dams	Location
Bagauda Dam	Bebeji Local Government Area
Challawa Gorge Dam	Karaye Local Government Area
Gari Dam	Kunchi Local Government Area
Garo Dam	Rimin Gado Local Government Area
Gude Dam	Kabo Local Government Area
Joda Dam	Gabasawa Local Government Area
Kafin Ciri Dam	Garko Local Government Area
Kusalla Dam	Karaye Local Government Area
Tiga Dam	Bebeji Local Government Area
Tomas Dam	Makoda/Dambatta Local Governments Area
Wase Dam	Minjibir Local Government Area
Watari Dam	Bagwai Local Government Area

Source: Fieldwork, (2013).

3.1.7 Mineral Resources

Kano State is endowed with bountiful solid mineral resources, some of which are in commercial quantities that can be exploited and utilized for industrial purposes and as a means of earning foreign exchange. The State Government is embarking on a comprehensive Geological survey of the state in conjunction with experts in the field to ascertain the commercial quantities of all known solid minerals existing in the state.

The Riruwai mining areas in Doguwa Local Government Area has large deposits of tins, columbite, granite, copper, zinc, lead and uranium. There is also evidence of gold, quartz, kaolin and mica in Sumaila, Karaye and Shanono Local Government Areas. There are

also very vast deposits of silica sand in Makoda and Dambatta Local Government Areas for glass making.

3.1.8 Population

Kano State is one of the most influential state in Nigeria and the most populous of the country's 36 states. According to the 2006 population census figures, the State has a total population of 9,383,682 million people (National Population Commission, 2006; National Bureau of Statistics, 2010). The State also has the highest number of local government area councils in the federation. Kano State has a total of 44 local government areas, six of which are located within the core Kano metropolis. The other 38 local government areas form the rural areas in the State. Current population densities range from 856 per km^2 in peri-urban locations to 8000 per km^2 in the metropolis (Falola, 2002). The population density for Kano has been comparatively high for centuries as even in pre-colonial times migration contributed a great deal due to the security afforded by the walls and the economic prosperity of the city. The majority of Kano's population is Hausa-Fulani. There are the Nupe and Kanuri "natives", Igbo, Yoruba and other ethnic groups from all over the country as well as Lebanese, Asians and other foreigners (Falola, 2002).

3.1.9 Agriculture

Kano state has a dense agricultural population working in permanent and well defined small holdings. In view of the high density, the agricultural system of the state has commonly been referred to as permanent or continuous cultivation or intensive annual cultivation. The agricultural system operated by the people represents an equilibrium established between the people and the physical environment over a long period (Danbazau, 2008).

Crop production: Two major system of crop production are practiced within the state. These are the rain fed and irrigated agriculture (Olofin and Tanko, 2002). These forms of farming

existed due to a number of factors which are both human and environmental. Such factors include the seasonality and unreliability of rainfall, the Sahel draught of 1960s and 1970s, the desire of government to transform the lives of people living in rural areas.

Rain-fed farming:This is the oldest and most widespread method of crop production in the state. The method is completely dependent on rainfall which is only available during the rainy season from April/May to September/October of every year. Under this system, production is mainly in the hands of the small holder peasant who constitute about 90% of the farmers (Danbazau, 2008). The different types of crops both food and cash crops that are cultivated under the system include early millet, late millet, guinea corn, cassava, boniseed, sweet potato, cocoyam, groundnuts, okra, soybeans, pumpkins, beans, sorrel, rice, tomato, et cetera.

It is important to note that under this system intercropping is very common. This involves the planting of two or more crops on the same piece of land either as an arbitrary mixture or in systematic alternative rows. The bulk of food production takes place under this system without much use of modern equipments. Holdings are small and the main tools consist of hoes, cutlasses, ploughs and axes. These characteristics and other farm practices have been passed down from one generation to another.

Irrigation farming has been defined as the artificial application of water for crop production (Muhammad, 2001). Irrigation agriculture can either be by the use of surface or underground water. The former is practiced where the natural flow of rivers can be diverted for irrigation, while, the later can either be from aquifer or artesian basin. Irrigation is therefore the practice of applying water to the soil to supplement the natural rainfall and provide growth (Saidu, 1991). The purpose is to add water to the soil, to supply moisture essential for plant growth, provide insurance for crops against drought, cool the soil and atmosphere, thereby making more favourable environment for plant growth. In Kano State,

three different types of irrigated agriculture can be identified, namely;fadama irrigation, which include urban cultivation, public sector irrigation projects and residual moisture utilization techniques.

Fadama Irrigation Farming: This type of farming has existed for a very long time as shadouf irrigation, especially along the flood plains of rivers such as Watari, Challawa, and Hadejia Valley. This farming method offers the farmer an all year round activity. The system is not restricted to the rural areas of the state but extends to near and within the urban centres for the purpose of supplying the large population to meet its daily demand for vegetables and fruits. It is commonly referred to as market gardening because of the type of produce and the target population.

The Kano River/Irrigation Project: This is the biggest irrigation project in the state, and one of the largest irrigation and drainage basin schemes in West Africa. It has an area of 62,000 hectares made up of 48,000 hectares arable, 3,600 hectares towns, villages, roads, 3,200 hectares forest reserve and 12,000 hectares grazing and waste lands. Out of the 48,000 hectares arable land, 22,000 hectares is under irrigation. Phase I of the project is divided into two regions, one served by the west branch canal and the other by the east branch canal, comprising of 14,000 hectares and 8,000 hectares respectively.

Residual Moisture Utilization Technique: Although this method is strictly not an artificial application of water for crop production, it is usually treated as a form of irrigation. This is a form of dry season farming whereby areas around flooded depressions are cropped as the water recedes (Olofin and Tanko, 2002). The farmers know when to stop tracing the receding water with their cropping to ensure that crops mature before the flood starts to advance again. Crops cultivated under this method include rice, sugarcane, tomato and several other vegetables.

Livestock Production encompasses the breading, feeding and management of animals, or livestock, for the production of food, fiber, work, and pleasure (Danbazau, 2008). Livestock rearing constitute yet another important part of farming in Kano State. It is important to note that livestock production in the state is predominantly extensive rather than intensive, using range land, crop residues and collected fodder. The different types of livestock being produced in the State are cattle, sheep, goats, chickens, guinea fowls, ducks, donkeys, horses and camels. Most people in rural areas practice the integration of crops and livestock rearing with the animals producing the manure that is used to sustain soil nutrient.

*Forestry:*Falgore Game Reserve is a natural forest located in between Tudun wada, Doguwa and Sumaila Local Government Areas. The Rurum Forest Reserve is also a natural forest located between Bebeji and Rano Local Government Areas. Several manmade forests are scattered in the State. These are Dambatta, Gabasawa and Panda shelterbelts. Forests provide habitats for a wide variety of plants and animals and perform many other important functions that affect humans. Photosynthesis is the chemical process in the leaves that uses sunlight and carbon dioxide to produce energy-supplying sugars for the tree. In the process the foliage gives off pure oxygen for breathing. The forest canopy (the treetops) and root systems provide natural filters for the water we use from lakes and rivers. Some of the precipitation flows down the trunks as stem flow, the rest percolates through the branches and foliage as through flow. The forest floor can hold as much as five time its weight in water and a tree contains water in its roots, trunk, stems and leaves. Because of all this stored moisture, forests help to maintain an even flow of water in rivers and streams in times of flood or drought. The roots of the trees and other vegetable hold the soil in place and control erosion from wind and rain, preventing flooding and clouding of streams and rivers.Forestry, involves the management of forestlands for maximum sustained yield of forest resources and benefits.

Although forestry was originally concerned mainly with timber production, it now also involves the management of grazing areas for domestic livestock, the preservation of wildlife habitats, watershed production, and the development of recreational opportunities. The management of forestlands therefore helps to ensure that wooded areas are used for maximum benefit according to their nature.

*Fishing:*This includes fish harvesting and fish farming. Fish harvesting in the wild, often referred to as fish poaching, is more widespread than fish farming. In other words, it means harvesting where one has not sown anything. This method is very common in the inland waters of the state, such as river Kano, as well as dams such as Watari, Thomas, Tiga, among others. Fish farming is a deliberate cultivation of fish in ponds and larger lakes as well as fenced sections of reservoirs. Fish farming is practised on small-scale in the state by agricultural department of schools and higher institutions, government parastatals related with agriculture and a few private individuals.

Over the years people within Kano State have started developing interest in commercial fish farming. Fishing involves the use of nets, boats and dragnets by the fishermen. In some cases it involves the occasional use of chemicals especially by small scale operators. The damming of some rivers such as river Kano and Watari has considerably affected the quantity of fish catch. Another problem which affects fishing in the state is the discharge of industrial effluents from industries into many of the rivers such as Challawa, Salanta and Jakara among others (Danbazau, 2008).

3.1.10 Manufacturing Industries

Kano State is the second largest industrial centre in Nigeria and the largest in northern Nigeria. There are at present over 500 privately owned large, medium and small scale industries in the state producing a wide range of products.

Although, prior to 1945, there were a handful of factories producing such products as local soap, vegetable oil and groundnut paste. From 1945 onwards, however, many more firms were established, producing a whole range of consumer goods. In the 1950s, the Bompai Industrial Estate was established as the first off its type in Kano. Following a host of incentives offered by the Federal Government to industrial enterprises between 1960 and 1973, over 75 new manufacturing plants were established in the Kano area, 11 of them in textile spinning, weaving and finishing. After the 1970s, following in the wake of the oil boom and the establishment of import substitution factories peaked, many investors, anxious to tap the opportunities associated with the expansion of the state expenditure and the increased purchasing power of the Nigerian consumers, established new plants in Kano or expanded their existing production capacity.

Between 1973 and 1982, not less than 165 new manufacturing plants were established in Kano, mostly concentrated in the production of plastics and plastic products, sweets, and confectionary, soft drinks, textile goods, metal and wooden furniture, rubber products, paper and paper products, perfume, cosmetics and toiletries, and leather goods (Nabegu, 2008, Kano State Tourist, Industrial and Commercial Guide, 2004).

To accommodate the dramatic increase in industrial production, four new industrial estates were opened at Sharada, Challawa, Tokarawa, along Hadejia Road and Dakata. By the end of 1985, there were over 500 manufacturing plants employing over 100,000 workers in Kano State. These factories were set up by indigenous and foreign private capital as well as by the state government through the Kano State Investment Promotion company (KSIP) and the former Northern Nigerian Development Corporation and now New Nigerian Development Corporation (NNDC).

Table 3.2: Manufacturing Industries in Kano State

Sub-Sector/Products	Numbers
Leather tanning and processing including footwear	37
Plastic, plastic products including footwear	54
Soap, perfumes, toiletries and cosmetics	20
Mineral water, packaged juices and spirit	59
Food, beverages and vegetable oil	43
Paper, paper products and stationary	22
Foam and rubber products, including rubber footwear	51
Glass products	05
Electrical and communication equipments	04
Cardboard packaging materials, suitcases	17
Metal processing and fabricating	37
Motor vehicle and bicycle assembly, spare parts	02
Textiles, weaving, knitting and spinning	24
Steel and steel products	11
Candles, paints, pharm. batteries and chemicals	10
Sweets and confectionary	44
Burnt bricks, floor and wall tiles, ceramic wares	11
Cement, asbestos and concrete products	51
Wood processing and wooden products	33
Enamel ware and aluminium products	12
Miscellaneous manufactured products	45
Total	592

Source: Nabegu, (2008).

Presently, the state is still being rated as the second leading industrial centre in Nigeria after Lagos. The state today has less than 200 medium and large scale manufacturing enterprises spread across five industrial estates at Sharada, Challawa, Bompai, Tokarawa and Zaria Road. The decline in the industries is as a result of shortage of power supply and frequent civil unrest in the state in the past two decades, compounded by the current economic meltdown in the country.

The leading manufacturing activities include plastic, leather processing, processing of arable seeds (vegetable oil production), grains and rice milling, textiles and garments production. (Lima, 2013, Kano State Investors' Handbook, 2013).

3.1.11 Commerce

Kano city was an ancient terminus of the famous trans-saharan trade routes that flourished for centuries attracting merchants, craftsmen and scholars from North Africa, the Arabian Peninsula and the European countries that bordered the Mediterranean Sea. Kano excelled in the field of trading in handcrafts, metal-works, leather works, weaving, and agricultural produce.

Commercial activities have developed all over the State. The state is a very important market for both raw materials for it's about 200 heavy and light industries located there as well as locally produced and imported finished goods that are patronized by the domestic market as well as some neighbouring countries in the West African sub-region.

The volume of trading activities conducted on a daily basis in the major markets, notably Muhammad Abubakar Rimi Market (Sabon Gari), Kwanar Singar, Kantin Kwari, Kurmi, Kofar Ruwa, Kofar Wambai, Dawanau, 'Yanlemo, Yankaba tomato market, et cetera. signify the state's great potentials as a market for consumable products. In addition to the large and unique markets Kano is also blessed with abundant and diverse agricultural products which provide immense opportunities for agro-based industries. Agricultural

products like maize, sorghum, rice, cotton and groundnut and tomato are readily available to serve as raw materials for oil milling, flour milling, textile and tomato industries. Other Agro-based raw materials are Gum Arabic, livestock, hides and skin, cowpeas and citrus fruits (Adamu, 2002; Bello, 2012).

The impressive infrastructural facilities such as the Mallam Aminu Kano International Airport (MAKIA), second only to Murtala Mohammed International Airport, Lagos, the road and railway links to other parts of the country as well as the excellent road networks within the state provide unique opportunities for the steady growth of commercial activities in the state.

There are also a sizeable number of both merchants and commercial banks of over 130 branches, such as First Bank, GT Bank, Unity Bank, Union Bank, United Bank for Africa, Fidelity Bank, FCMB, JAIZ Bank, Diamond Bank, Skye Bank, et cetera. (Kano State Tourist, Industrial and Commercial Guide, 2004).

3.2 METHODOLOGY

3.2.1 Reconnaissance Survey

A reconnaissance survey was carried out in order to be well acquainted with the study areas. The reconnaissance survey involved visits, interview and discussions with relevant government officials, especially from Kano State Ministry of Agriculture and Rural Development, Hadejia-Jama'are River Basin Development Authority, Kano State Agricultural and Rural Development Authority (KNARDA), farmers and other relevant agencies in the state. The survey helped to determine the appropriate sampling technique need to select the sample population. The visit also allowed the researcher to identify all the various actors along the value chain in the study area.

3.2.2 Types of Data Used

The types of data used for the study are

i. tomato production technology and organisation in the study area

ii. producers of tomato and production quantity

iii. organisation of tomato marketing

iv. constraints in the production and marketing of tomato

v. opportunities for tomato production in the study area

vi. official policies that may have effects on the tomato value chain

vii. appropriate interventions to manage the constraints and opportunities of irrigated tomato production

3.2.3 Sources of Data

3.2.3.1 Primary sources of data

Questionnaire survey: The targets of the survey are the various categories of actors along the value chain. The snowball sampling technique was used to select knowledgeable individuals for the study. The questionnaire were designed in English language, but during its administration, the researcher and trained research assistants translated to these farmers, marketers and various categories of actors along the value chain who did not understand English language. The questionnaire consists of open and close-ended questions which were designed to elicit information from the various actors in the value chain of irrigated tomato in the study area. A total of 455 copies of the survey questionnaire were administered to various actors in the value chain of irrigated tomato in the study area, 315 of which were targeted at the actors in high humid areas of production and 140 in the areas of less humid production in the study area. The questionnaire covers the tomato farmers, marketers, labourers, pickers, graders, loaders, transporters and extension workers. The questionnaire were administered appropriate to the actors in the study area with the help of trained research assistants who were

recruited and trained on the appropriate ways of administering questionnaires (Table 3.4). The sample were chosen arbitrarily

Table 3.3 Questionnaire administration procedures

	Number of questionnaire administered in high humid parts of the state	Number of questionnaire administered in less humid parts of the state	Number returned
Tomato farmers	45	20	65
Tomato marketers	45	20	65
Tomato labourers	45	20	65
Tomato pickers	45	20	65
Tomato graders	45	20	65
Tomato loaders	45	20	65
Tomato transporters	45	20	65
Total	315	140	455

Source: Field survey, (2013).

Focus group discussion (FGD): Focus group discussion with the use of a checklist to guide the discussions was also carried out (Muhammad, 2006). This involves the various categories of actors along the value chain, especially the farmers and marketers (Appendix I^J and I^K). The FGD involved talking to some group of farmers and marketers. The discussion provided a great deal of information about the actors and also complements the information collected from the administration of the questionnaire. Six (6) different focus group discussion were conducted from four farm areas and two market centres, that is Kura, Bunkure, Garun

Malam, Bagwai, Kwanar Gafan market and Liberia market. The focus group discussion lasted for three (3) months, that is 16th January to 13th April, 2013.

Field observation: The research conducted observations on the participants at different stages in the tomato value chain such as farmers, marketers and agencies in the study area (Plates 1 to 6).

3.2.3.2 Secondary Sources of Data

The researcher consulted relevant documented materials such as textbooks, published journals, conference papers and materials from the internet for the purpose of literature review and acquisition of statistics on tomato production, distribution and marketing.

3.2.4 Sample Size and Sampling Techniques

The first step in the sampling process was to identify all the existing links in the value chain of irrigated tomato in the study area. There is no comprehensive list containing the names of all the actors and such list is difficult to develop. In this case, it is more appropriate to use non-probability sampling technique to select the sample (Ismaila, 2006). Then the purposive technique was used to select a sample population from areas of high tomato production in the study area. The sample population consists of individual actors who are knowledgeable about the various links in the tomato value chain of irrigated tomato in the study area. The "snowball" sampling technique was used to select such knowledgeable individuals. Snowball sampling is similar to the purposive sampling. The procedure for selection is appropriate when all members of a special population are difficult to identify. Snowball is also known as a network, chain referral sampling. (Ismail, 2006).To do this a network of contacts was established by first identifying a person who is a highly knowledgeable actor in a particular link in the tomato value chain in a locality. The first individual so selected introduced the researcher to another equally knowledgeable person, and so on, until the required sample size

was reached (Table 3.4). The sampleswere chosen arbitrarily using the snowball sampling technique.

3.2.5 Methods of Data Analysis

The data collected from questionnaire survey, focus group discussion and interviews were subjected to four different forms of analysis as explained below, using descriptive and SWOT analysis (Yode, 1999; Sagir, 2006; Shahzad, 2012):

(a) *Mapping the value chain*: These were of two forms (i) graphical presentation to represent the various actors of the chain, their links and operations from pre-production to marketing and (ii) quantitative analysis in which the focus were on the size and scale of actors, production volume, number of jobs, sales, destination of output, et cetera.

(b) *Examination of the technical capacities of the value chain:* These were based on an analysis of (i) the production system: quantity and types of inputs and machinery being used, production process being followed, (ii) technical performance: productivity (input-output relationship), production cost and, quality of produce, (iii) technical supports available: infrastructure and equipment maintenance, extension services and quality control.

(c) *Examination of the economic performance of the value chain*: This entails (i) a measurement of all costs, gross margins, added value and share of each actor as irrigated tomato in Kano state move from production to the consumer and (ii) a comparison of the result obtained with reported best practices in small holder tomato production and marketing.

(d) *Determination of the policy intervention needs of the chain*: A SWOT (Strength, weakness, opportunities, threats) analysis was used across the tomato value chain SWOT analysis is an effective way of identifying the strengths and weaknesses of an

organisation or production unit, and of examining the opportunities and threats it faces. The SWOT analysis format as recommended by Shahzad, (2012) and Bennett, Bill, Wade, Brenda and Stan (2005) was followed in the present study. This requires the listing and characterisation of all strengths, weaknesses, opportunities identified by the actors in the value chain and deriving from these the policy intervention needs of the irrigated tomato value chain in Kano State.

CHAPTER FOUR

PRESENTATION AND DISCUSSION OF FINDINGS

4.1 INTRODUCTION

This chapter presents summaries of data generated from the field survey which are used to address the following issues: the irrigated tomato farms surveyed, the identified links in the value chain and associated actors and their technical capacities, the economic performance of the chain, policy intervention needs of the value chain and the implications of the study for rural development in Kano State.

4.2 THE IRRIGATED TOMATO FARMS SURVEYED

4.2.1 Location and the Physical Environment

4.2.1.1 Watari Irrigation Scheme

The Watari Scheme is located about 100 kilometers north east of Kano City. It is situated in the Sudan savanna agro-ecological zone. The Scheme is situated in a river valley and covers the valley bottom and parts of the slopes on both sides. Heavy clay soils with high organic content dominate the valley bottom (natural swamps, which are flooded during the wet season), but lighter textured soils (sandy loam) are found in the higher positions (Kebbeh, Haefele and Fagade, 2003).

Water is supplied by gravity from the Watari Dam which was constructed by the State in 1990. The Scheme was commissioned for cultivation in 1991 as a pilot phase, with initial plans to develop 8 blocks with a total area of 1354 ha. However, only five blocks (sectors) were developed between 1991 to date, with a total operational area of 689 ha. Sectors 3, 6 and 7 are presently under construction. Farmers, also use water from the Scheme to crop about 300ha in the surrounding areas of the Scheme (Table 4.1).

4.2.1.2 Kadawa Irrigation Scheme

The Kadawa irrigation project is about thirty-five kilometres south of Kano city. The Kadawa Scheme is situated in the Sudan savanna agro-ecological zone, which is characterized by a uni-modal rainfall distribution averaging 550 to 1000 mm per annum. Atmospheric humidity is high during the wet season and very low during the dry season. Minimum temperatures occur from November to February, and highest temperatures occur in March and April. Daily temperature variation is high during the dry season and low in the wet season (Olofin, 2008).The area is characterized by reddish-brown to brown soils, with mainly sandy to clay loam texture. The soils tend to be slightly alkaline, and soil organic matter content.

The Kadawa project was initiated with the construction of the Tiga dam between 1970 and 1974 to irrigate a total area of about 62,000 ha in phases. The first phase with a potential of 22,000ha irrigated area was completed in 1974 (Kadawa Scheme) and remained largely operational (Table 4.1). The irrigation system is by gravity from the Tiga dam through an 18km long concrete lined, main irrigation canal and a 320km long main drain. Although the scheme was initiated by the Kano State Government, the Management of the water resources in the Scheme was taken over by the Federal Government-owned Hadejia Jama'are River Basin Development Authority (HJRBDA) following the creation of more states in the country. The Authority has a total of 45,000km^2 arable land in its area of jurisdiction in Kano and Jigawa States.

Table 4.1: Watari and Kadawa Irrigation Schemes

Irrigation scheme	No. of hectares developed	%
(A) Watari		
Sector 1	68.90	10
Sector 2	137.80	20
Sector 4	103.35	15
Sector 5	275.60	40
Sector 8	103.35	15
Total	689	100
(B) Kadawa		
Kura	7,920	36
Garun Malam	7,260	33
Bunkure	6,820	31
Total	22,000	100

Source: Field survey, (2013)

4.2.1.3 Methods of Acquisition of Irrigated Farmlands

Three categories of land ownership exist in the State. At the commencement of the irrigation schemes, some farmers were allocated (0.4 hectare) plot each, with a considerable portion of the land remaining state-owned while other farmers bought their plots. Figure 4.1 shows the distribution of the methods of farmland acquisition in the state in which the majority of the tomato farmers in the State hired their farmland (55.3%), while 37% of the farmers owned their land outright. Only 7.7% of the farmers had their lands allocated to them by government. This implies that land rent would constitute an important component of the cost of producing tomato on irrigated lands in the study area.

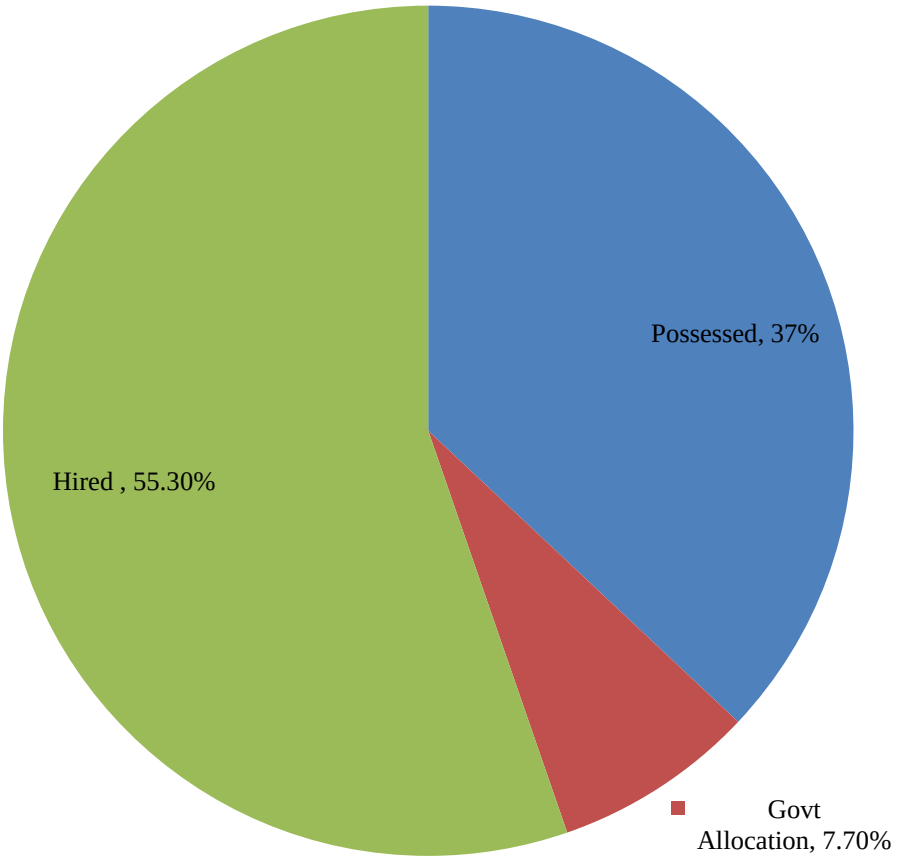


Figure 4.1: Distribution of irrigated tomato farmlands by method of acquisition.

Source: Field survey, 2013

4.3 MAPPING THE VALUE CHAIN OF IRRIGATED TOMATO IN THE STUDY AREA

4.3.1 Population of Tomato Farmers in the Study Area

Table 4.2 shows the population of tomato farmers in the study area. The Watari Scheme has (3,800) farmers, while the Kadawa scheme has (4,500) tomato farmers. The two schemes has a total of 8,300 tomato farmers in the study area. This number is quite large in terms of employment generation to the rural dwellers in the state. These people produce most of the tomato consumed in the Kano state and other states in Nigeria.

4.3.2 Organization of Irrigated Tomato Production

Before a person becomes an irrigation tomato farmer in the study area he or she has to undergo a process of skill acquisition in land preparation, harrowing, levelling, watering and transplanting. These skills are acquired on the farms in the study area. They are acquired as a result of continuous practice and participation in the activities. Other requirements of getting into irrigated tomato production include access to land, capital, labourers and registration with an association of tomato growers. These processes enable a potential irrigated tomato farmer get an insight into all that is required to be successful in the business.

Table 4.2: Population of Tomato Farmers in the Study Area

Irrigation scheme	Number of farmers in each sector	%
(A) Watari		
Sector 1	380	10
Sector 2	684	18
Sector 4	988	26
Sector 5	304	8
Sector 8	1444	38
Total	3,800	100
(B) Kadawa		
Kura	2,025	45
Garun Malam	1,485	33
Bunkure	990	22
Total	4,500	100

Source: Field survey, (2013)

There are many tomato associations in the study area. Although membership is not compulsory, 95.4% of the tomato farmers surveyed indicated that they belong to one association or another. Membership of an association requires a registered member to attend

meetings when called upon to do so, and pay the monthly due of ₦200.00 to the association. In returns the association assists members to acquire new skills in tomato production, access needed information, inputs, equipment loans, especially from government, NGOs and Banks, provision of security of products and clearing of water ways. Appendix II is a list of the tomato farmers' associations in existence at the time of the survey for this study.

4.3.3 Actors in the Value Chain of Irrigated Tomato in the Study Area

The groups of actors that have been identified in the study to contribute in different ways to make the business of tomato production possible in the state are government and its agents (KNARDA, Extension workers, Research Institutes, Irrigation Infrastructure), Non-Governmental Organizations (NGOs), development partners such as the United States Agency for International Development (USAID), extension workers, agrochemical dealers, farmers, labourers, transporters, middlemen, marketers and consumers.

The governments (federal and state) provide the irrigated land and construction of dams and canals in the irrigated areas. These are the first set of activities that are needed to be on ground for effective production of irrigated tomato. The state and federal governments also support the activities of institutions that are indirectly related to irrigated tomato production such as Kano State ministry of agriculture and Kano Agricultural and Rural Development Authority (KNARDA), Institute of Agricultural Research and National Agricultural Extension Research and Liaison Services, both of Ahmadu Bello University, Zaria.

The non-governmental organizations (NGOs) and USAID assist the farmers in input supply and marketing of tomato products, organising and forming of tomato group associations for easy access of loans and other benefits.

The knowledge produced by the research institutes is propagated by extension workers of the state ministry of agriculture and KNARDA as technical advice and basic

information on tomato production to the farmers. They advise the tomato farmers on new methods and techniques of tomato farming, demonstrate new skills and innovation to the farmers. They advise on pest control and use of new seedlings.

The Agro dealers supply the tomato seeds/seedlings, chemicals, herbicides, pesticides, machineries, tractors and other farm inputs. The tomato farmers are the producers of the tomato.

The tomato labourers clear the land, harrow the land, plant the tomato seeds/seedlings, water the farm, transplant the seeds, spray the tomato farm, weed the tomato farm, pick the matured or ripe tomato, grade the tomato, package the tomato, and load them in lorries.

a) The tomato pickers are those labourer on the tomato farms who pick the ripe tomato. The number of baskets of tomato a person can pick per day range between 5 to 15 baskets depending on the period of tomato. During the peak period of tomato there are many tomato on farm to be picked, but during the slack period there are less on the farms.

b) The tomato graders are those labourers who sort out the good tomato either from the farm or collection centres/markets. There is no special training given to the graders in the study areas but experience is used by the graders to sort out the good tomato. The graders used eyes inspection and experience in sorting out the good tomato. The experience of many years in the tomato work gives a grader professionalism in the job.

c) The packaging of tomato in the study area is one of the problem affecting the quality and marketability of the product in Kano State. The poor packaging of tomato in local baskets made from canes and Typha sticks affect their marketability and also cause

the produce to rot easily. Both the tomato farmers and marketers said a large percentage of the product (78.3%) go to waste due to poor packaging of the products. The farmers and marketers lamented that the stick cane baskets pierce through the tomato thereby making them to rot easily. The baskets are usually big and each contains a lot of tomato that are pressed together. In the process they bruise one another, causing them to rot easily. The farmers and marketers complained bitterly that this local method of packaging tomato in baskets does not help them at all (Plate 2 and 6).

The packaging of tomato in crates or special cartons, as practised in other countries, makes the tomato to be neat, keep longer and attractive to buyers. The Federal and State government as well as private organizations and industries should intervene by introducing the packaging of tomato in plastics crates or special cartons. This method will add value to the product and attract buyers. This process will also create more employment for the teaming youths and population in the state and in the country generally as also observed by Shehu (2014) and Eyo (2015)

d) Tomato loaders are those who carry the tomato baskets into vehicles, lorries or trailers for onward transportation to market places and other destinations. The loaders neatly arrange the tomato baskets in the vehicle without damages to the product. The technology used in loading tomato into lorries and vehicles is the traditional method of using the physical strength and experience of the loaders (95.4%) (Plate 6).

Plate 1: Tomato farms in the study area

Plate 2: Fresh irrigated tomato packed in baskets in the study area.

Plate 3: Empty baskets for packing tomato at Kwanar Gafan market.

Plate 4: Sundrying of irrigated tomato in the study areas.

Plate 5: Dangote tomato processing industry under construction in the study areas

Plate 6: Loaders loading tomato in lorry in the study areas

e) Tomato transporters - Transportation involves the movement of goods from the manufacturer to the consumer. A good transport system is, therefore, essential for the development of a country (Gautam and Rastogi, 2002). The tomato produced in Kano State are transported to various destinations in the country. Transporters of tomato to the southern part of the country said that most of the tomato packaged in baskets do not last more than two days before they start going bad because of the way they get compressed. When tomato are package in crates, only the wooden frame of the crates will sit on one another. The tomato in the crates will not be pressed. Thus they will, therefore, make them last longer (Plate 6). Figure 4.2 shows the various destination of tomato produced in Kano State.

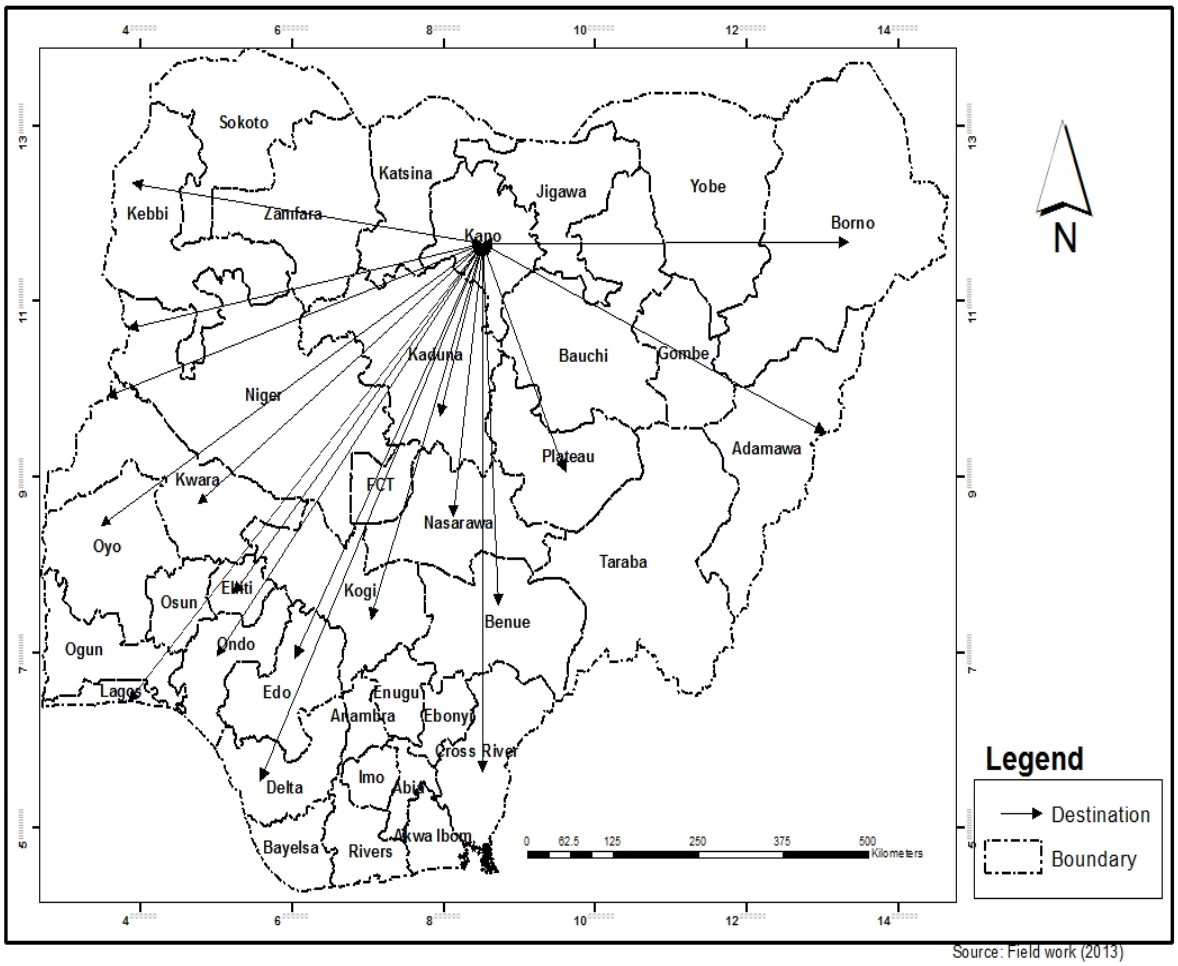


Figure 4.2: Destinations of Tomato Produced in Kano State

Source: Field survey, 2013

f) Middlemen/Agents - These are intermediaries between two or more parties. They mediate between the manufacturers/producers and wholesalers, retailers or customers. The middlemen broker the sale of tomato between the producers (farmers) and buyers and ensure the right size of measuring basket is used. The middlemen collect fees (Hausa = *la'ada*) for the services rendered, either from the seller/producer (Hausa = *la'ada ta ciki*) or from the buyer (Hausa = *la'ada ta waje*) or both. Agents, on the other hand, are representatives of individual big buyers, who reside in city and other states in Nigeria. The bulk buyer give money to the agents who are based in the rural areas of production to buy the product on their behalf. Agents collect *la'adata ciki* and are equally paid for their services by the big individual buyers.

g) Wholesalers: A wholesaler is a person that buys in large quantities from producers and resells in small quantities to retailers who in turn sell in smaller quantities to consumers. For example, when tomato are moved from Kano to large city centres like Lagos, they are delivered to the urban-based wholesalers through their agents in the producing areas.

h) Retailers: The retailer makes the tomato product available to the final consumers at the time and place, and in the quantity that the consumers wants. The retailers sell the tomato to the ultimate consumers. They are the only direct contact that most consumers have with many channels of distribution that characterized the selling of the products in the study area and Nigeria markets.

i) The Consumers – The consumers are the end-users of the tomato products. The consumers buy the tomato and consume as the end-users of the product. The consumers are the direct individual end-users of the product in the study area. The demand of the product is high in the state and in Nigeria generally as a result of high

population. The price of the product is low as a result of excess (glut) of the products because of absence of processing industries in the state.

4.3.4 Volumes of Inputs and Outputs in Irrigated Tomato Production

The average annual volumes of inputs and outputs of irrigated tomato production in the study area are shown in Table 4.3 which indicates variations in the total land area planted. There was a decline in the area planted from 2011 to 2013, as a result of the excess (glut) which are experienced yearly and the lack of processing and storage facilities. Yield per hectare increased from 2012 to 2013 as against 2011. This is attributed to an increase in the use of farm inputs and other services by the tomato farmers.

Table 4.3: Irrigated Tomato Input and Output Production in Thousand Metric Tonnes in Kano State (2011-2013)

Year	Total area ('000ha)	Yield/ha	Input ('000mt)	Output ('000mt)
2011	32,779.49	10,848.23	245,846.18	355,599.45
2012	6,362.98	11,826.83	47,722.35	75,253.88
2013	23,683.98	11,791.39	177,629.85	279,267.04

Source: KNARDA/Field survey, 2013

4.3.5 Employment Generation of Irrigated Tomato Production in Kano State

The irrigated tomato production has generated employment opportunities in the state for many people. Some of the categories of jobs created by the tomato production are farmers, marketers, transporters, labourers, pickers, graders, loaders, extension workers, Research Institute Workers, Agro-Chemical dealers, middlemen and agents (Table 4.4).

Table 4.4: Employment Generation of Irrigated Tomato in the Study Area

Type of Jobs	Number of People
Farmers	8,300
Marketers	41,200
Transporters	1,998
Labourers	24,050
Pickers	36,372
Graders	15,601
Total	142,541

Source: Field survey, 2013

From field surveys and focus group discussions (FGD) irrigated tomato production in the study area have created jobs for 142,541 people across Kano State.

4.3.6 Linkages and Flow in Irrigated Tomato Production in Kano State

The movement of tomato through various actors is shown in Figure 4.3 which clearly indicates that value chain starts right from the agro-input providers and ends up with the consumers. The chain is characterized by interactions among the various actors and enterprises involved in the tomato production, distribution, processing and consumption. The chain also shows the position of the consumers as the end-users whom all the actors are targeting.

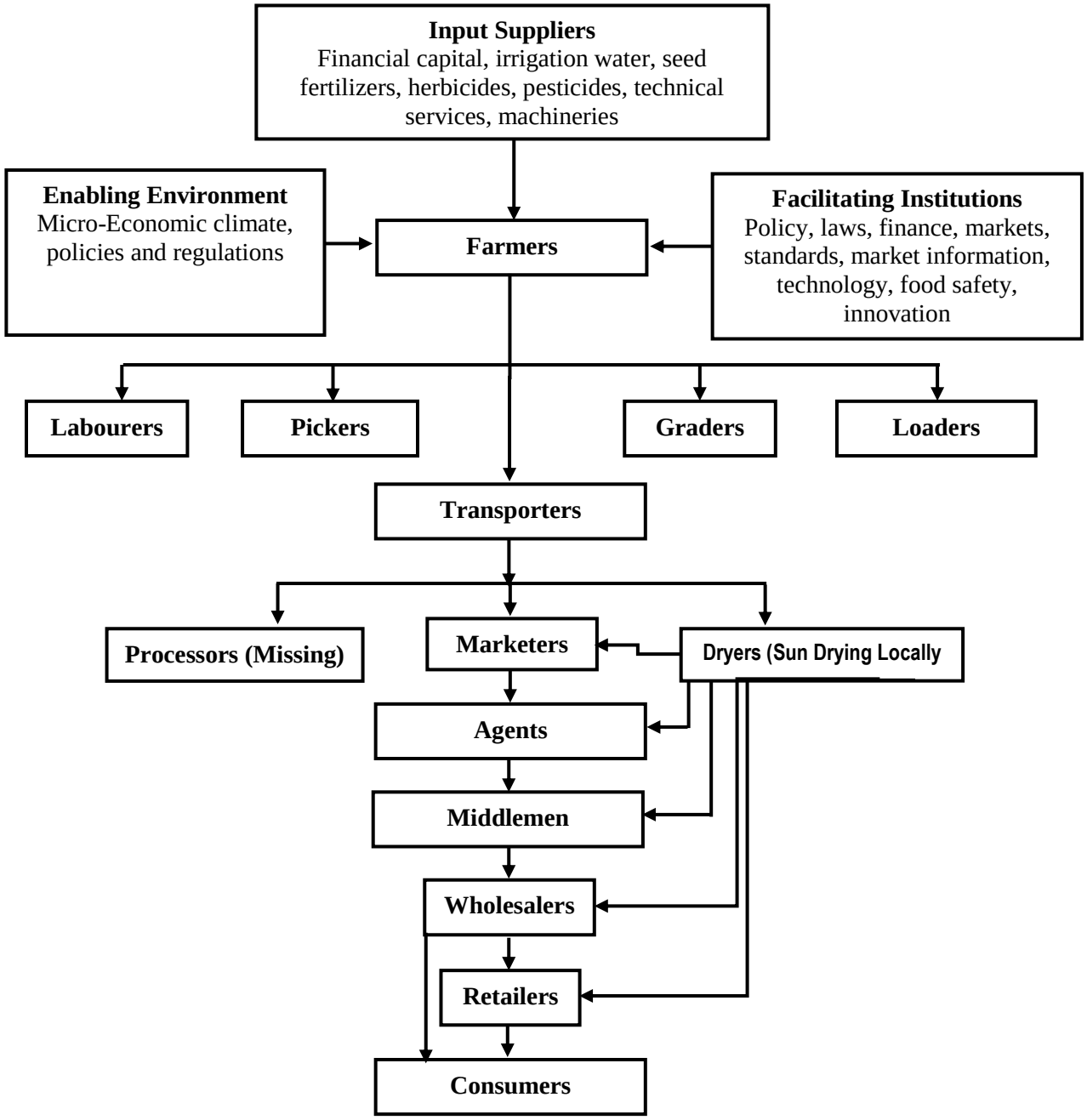


Figure 4.3: Linkages and Flow in Irrigated Tomato Value Chain in Kano State

Source: Field work, 2013

4.4 TECHNICAL CAPACITIES OF ACTORS IN THE VALUE CHAIN

4.4.1 Farming Activity, Technology used and Sources by Actors

The examination of the technical capacities of the actors in the value chain is based on the production system, quality and types of inputs and machinery being used in the production system, as well as technical supports available to the various actors across the value chain (Figure 4.4).

Manual land preparation by the farmers and hired labourers is done by 15.4% of the respondents while 86.6% of them engage in mechanical land preparation. Mechanization of land preparation allows many hectares of land to be prepared for the cultivation of tomato in the study area.

The sowing of seeds and transplanting of seedlings are also carried out by a large majority of the respondents manually using hired labourers (95.4%) while the remaining farmers (4.6%) carried out sowing and transplanting of seedlings by themselves. It is obvious that planting and transplanting manually would slow down the process of tomato in the study area.

Weeding task is done manually by 89.2% of the farmers surveyed using hired labourers supplied locally or migrants from neighbouring villages in the state. Weed control is carried out by the remaining farmers with the use of herbicides which they source from agro-dealers and marketers in the study area.

Over 90% of the respondents use chemical fertilisers which they obtain from agro-dealers and marketers. The remaining farmers use farmyard manure. Both chemical fertilisers and farmyard manure are applied manually by labourers hired from neighbouring villages, towns and states. The application of fertilizer and manure to the tomato farms in the study areas result in high yield of products in the state. The more fertilizers is applied in the tomato farms, the more yield of products. The less application of fertilizers in the farms the

less yield and harvest of the farms. The high cost of fertilizers in the study area constraints the tomato farmers in applying the required quantity of fertilizers per hectare. This means that the farmer could not reach the optimal level of tomato production that is possible with adequate application of the right of fertilizers.

The application of water to the tomato farms by 78.5% of the actors is mechanized. That involves the use of pumps to lift water from the canals into the farms. The water pumps are sourced from agro-leaders and marketers in the state. Some 21.5% of the farmers use the manual technology of lifting water into their tomato farms. This is done directly by supplying the water from a nearby canal into the farm directly through an opening. The availability and application of water into the tomato farms is highly commended by the farmers in the study area except in a few cases where there is blockage of the canals and water ways in the farm areas.

Pest control is highly mechanized in the study area. Some 95.4% of the farmers surveyed use pesticides which are sprayed on the farms. Both herbicides and sprayers are sourced directly from the agro-dealers and marketers of farm machinery in the state. The control of pest by the farmers usually resultsin high tomatoyields in the study area.

Harvesting of tomato is done manually, using hired labour by 84.6% of the farmer and 15.4% of the farmers who pick their own tomato by themselves. Preparation of harvested tomato for market is done manually through grading and sorting by hired labourers from neighbouring villages and states. Only 67.7% OF the farmers sort and grade their tomato while the remaining 32.3% do not sort and grade theirs at all. Sorting and grading of the harvested tomato lead to uniformity of tomato in a basket which in turn leads to better prices for the produce.

The preservation of unsold tomato in the study area is achieved by sun drying. About 24.6% of the farmers engage hired labourers to cut the tomato and dry them on roadside

using the sun energy (Plate 4). Majority of the tomato farmers (75.4%) do not preserve their tomato at all. They have no technology to use and the traditional method of sun drying is very slow and lower the quality of the produce.

Figure 4.4: Farming tasks, technology used and sources by actors

Farming Activity	Technology Used	Sources of Technology	Percentage
Land preparation	Manual	Self/Labourers	15.4
	Mechanized	Hired	84.6
Sowing	Manual	Hired labourers	95.4
	Household	Household	4.6
Weeding	Spraying	Agro-dealers/ market	10.8
	Manual	Hired labourers	89.2
Fertilizing	Manual	Market/Agro dealers	90.8
	Household	Farmyard manure	9.2
Watering	Mechanized	Market/Agro dealers	78.5
	Manual	Direct supply from the canal	21.5
Pest control	Mechanized	Market/Agro dealers	95.4
	Pest control	Nil	4.6
Harvesting	Manual	Hand picking by hired labourers	84.6
	Self/ Household-collection	Household	15.4
Preparation for market	Grading/ sorting	Hired labourers	67.7
	No grading/ sorting	Nil	32.3
Preservation of harvested tomato	Sun drying	Self/hired labourers	24.6
	Unpreserved	Nil	75.4
		Total	**100**

Source: Field work, (2013)

4.4.2 Use of Fertiliser by the Farmers Surveyed

The following are the types of fertilizers normally used by tomato farmers, their costs and sources in the study area.

Table 4.5: Types of Fertilizers, Sources, Price and Quality

Type of Fertilizer Used by Farmer in the Last Farming Season	No. of Fertilizer Bag Used (50kg)	Percentage of Farmers that Use such Fertilizer Bags	Sources of the Fertilizer Used (50kg)	Price of Fertilizer per Bag (50kg)
Urea	1 to 5 bags	80%	Market	N4,500.00 to N5,600.00
	6 to 10 bags	15.4%		
	11 to 15 bags	0%		
	16 to 20 bags	3.1%		
	21 to 25 bags	1.5%		
N.P.K.	1 to 5 bags	70.8%	Market	N5,400.00 to N6,000.00
	6 to 10 bags	16.9%		
	11 to 15 bags	6.2%		
	16 to 20 bags	1.5%		
	21 to 25 bags	3.1%		
	26 and above	1.5%		
SSP	1 to 5 bags	20%	Market	N4,000.00 to N4,500.00
	6 to 10 bags	0%		
	11 to 15 bags	0%		
	16 to 20 bags	0%		
	21 to 25 bags	0%		
Manure	10 to 40 bags	81%	Homes	N200 to N300
	41 to 80 bags	4%		
	81 to 100 bags	1%		
	101 to 140 bags	0%		
	141 to 180 bags	1%		

Source: Field survey, (2013)

From table 4.5, the fertilizers mostly used by farmers in 2013 farming season are Urea, N.P.K., and manure, only very few farmers uses SSP as fertilizer for tomato production in the study area. Most of the fertilizers are bought from the market except manure that is sourced locally from the homes of the farmers (29.2%). The prices of Urea ranges from N4,500 to N5,600 per bag. About 16.1% of the users complained that the price is too high and too costly for the farmers, while a nearly three fifths of the farmers (58.1%) said the price

is good and affordable. The prices of N.P.K. ranges from N5,400 to N6,000 per bag as at 2013 (12.5%) of the users complained of the high price of the product, which is too high for the tomato farmers.46% of the tomato farmers recommend the product as good and the price is affordable by the farmers. The more inputs of fertilizers application in the farms, the more yield is expected.

The amount spent on labour is usually between ₦75,000 and₦125,000 per hectare. Yield of tomato product ranges between 200 and 375 baskets per hectare, depending on the inputs. Majority of the tomato farmers (83.1%) expectedhigher yield and harvest in 2013 (survey year) compared to the previous farming season. This is because more fertilizers, chemicals, new technologies, improved seeds, extension worker services, more money are invested in the tomato farms with better care and management.

The prices at which farmers sell their tomatovaries from time to time. The fluctuation of the prices is a great threats to the tomato farmers in the state. The prices fluctuate between N300 per basket to N4000 per basket (30kg) depending on situation and circumstances. Majority of the tomato farmers (57%) are satisfied with the sales prices of tomato, while the rest (43%) of the tomato farmers are dissatisfied with the sales prices of tomato in the study areas.

4.4.3 Technical Supports Available to Tomato Farmers in the Study Area

Presented here is the farmers' assessment of the conditions of infrastructural facilities that serve the tomato farms:

a) Road linking the farms: Over 43% of the tomato farmers in the study area indicate that the roads linking tomato farms and markets are good while nearly 37% of them indicated that the roads were bad. Many of the roads linking the farms are feeder roads and untarred roads. The effectiveness of the roads affects the movement of the people (workers of all category) to the farms and from the farms to market places. This also affects the

movement of the tomato product from the farm gate to the market centres, and other destinations of tomato across the state and the country in general.

b) Transport services: The transportation services available in the study areas are (i) animal transportation which include bullock-carts, horse-carts, and camel-carts, donkey; (ii) motorized transportation which include mini-buses, trucks, tractors, tricycles and motor cycles, and (iii) non-motorized transport which involves bicycles and walking.

Field survey,(FGD) discussion and field observation, shows that 47.7% of the respondents indicated that transport services in the study area is satisfactory. While 27.7% of them indicated that the transportation services is very poor and bad in the tomato producing areas. It is also observed that the motor cycle, popularly called "*achaba"* is the most efficient means of transportation in the farm areas. The motor cycle is widely used to transport people (workers from one part of the farm to another), and also widely used to carry goods and other services within the tomato farms.

c) Water supply: The abundant water resources available in the study area allow for the irrigation of over 160,000 hectares. A number of man-made dams are constructed all over the state to encourage dry season farming (irrigation). Some of the major dams constructed in the study area for irrigation purposes include the famous Tiga dam, Bagauda dam, Challawa Gorge dam, Thomas Dam and Watari dams. While majority of the farmers surveyed (78.5%) claimed that water is made available in the study area for irrigated tomato production, 21.5% of them indicated that although water is available in the study areas, it is in short supply to the farms. This may be as a result of untimely release of water to the farms by the officer in-charge.

d) Electricity supply: A reliable power supply is important for the overall economic growth and essential for the operation of health and utility support services such as water supply,

sewage pumping stations, lighting, et cetera. In addition, reliable power supply generate employment opportunities which in turn create income generating opportunities as a source of taxation, while unreliable power supply increases the cost of production due to additional cost of installing and maintaining generators, which result in the reduction of employment opportunities (Adamu, 2006). Electricity supply is needed in the study area for storage facilities and processing of tomato products, and other related activities in the study area. Electricity supply in the study area is rated very poor by 35.4% of the farmers surveyed. Apart from the very poor nature of the supply, it should be pointed out that 55.4% of the respondents indicate that there is no electricity supply at all in many parts of the tomato farms.

e) The sources of credit for farm operation – Credit facilities is very important in any business operations. Tomato production need credit facilities for successful operation in the study area. Lack of credit facilities affect the production of the business directly or indirectly in the study area. From the field survey, it is clear that majority of the tomato farmers in the study area have no access to any kind of loan (74.6%). The farmers therefore rely on self-financing to produce the commodity.

f) Storage facilities – Tomato become abundant during the harvest period in the study area and in many parts of the country. However, they became scarce not long after the season is over, mostly as a result of post-harvest losses. This is due to lack of storage facilities on ground to store the products. More than 50% of the tomato produced in Kano state are lost to post harvest spoilage annually (Yusuf, 2011; Usman, 2012; Vincent, 2013; Eyo, 2015). From field survey and focus group discussion (FGD), it is clear that modern storage facilities are not available on ground in the study area (80%). The local method of

sun drying is the only option left for the tomato farmers (20%). This method is slow and time wasting and add little value to the product.

g) Extension services – The tomato farmers in the study area enjoy the services of agricultural extension officers from time to time. The extension workers visit the tomato farmers periodically. The average number of times visit are made is 3 times. The visit allows the tomato farmers to benefit from the advices given to them by the workers to enhance the production of tomato in the state. The extension workers service focuses on:

i. Advising the tomato farmers on new methods and techniques of tomato farming
ii. Demonstrating new skills and innovations to tomato farmers
iii. Technical advice to tomato farmers
iv. Organizing the tomato farmers to form groups, so that they can access government assistance, banks loan, NGOs and other agricultural agencies assistance on tomato production.
v. Teaching tomato farmers on the appropriate and right time for planting tomato for higher yield and profit making.
vi. Guiding and showing tomato farmers the various sources of inputs, seeds, technical advice, chemical, fertilizers, et cetera. for cheap tomato production in the state.
vii. Training and given orientation to tomato farmers on land preparation, and capacity building in the state.
viii. Supervision and monitoring of the tomato farms in the study areas.

The services of the extension workers have greatly improved the quality of tomato produced in the state. The tomato farmers now use:

i. Improved quality seeds and seedling for high productivity in the study area,
ii. Early planting and early transplanting for better quality yields.

iii. Use of adequate quantity and quality fertilizers and constant spraying of the farms for better yield and productivity in the study area.

iv. Practicing modern techniques of tomato farming and appropriate tomato farm management practices.

4.5 THE ECONOMIC PERFORMANCE OF THE VALUE CHAIN

The assessment of the economic performance of irrigated tomato value chain presented here entails a measurement of all the costs, gross margins, added value and share of each actor as irrigated tomato in Kano State move from production to the consumer, and a comparison of the result obtained with reported best practices in small holder tomato production and marketing.

4.5.1 The Cost of Irrigated Tomato Production in Kano State

The expenditure items for irrigated tomato production in the study area are land preparation, (land clearing and harrowing), planting of tomato, weeding, water charges, costs of fertilizer, spraying, harvesting, loading, baskets, transportation and land rent. Input costs, yield and output price, data generated from the field surveys were used to assess the economic performance of the value chain. Analyses were undertaken for minimum and maximum output to determine performance of irrigated tomato production in the study area as shown in Table 4.6.

Table 4.6: Cost of irrigated tomato production per hectare

Farm Activity	Minimum Cost of Activity	Maximum Cost of Activity
Land Preparation:		
a) Land clearing	₦6,875.00	₦9,375.00
b) Harrowing	₦10,000.00	₦15,000.00
Planting of tomato	₦5,000.00	₦6,250.00
Weeding	₦21,250.00	₦42,500.00
Water charges	₦2,500.00	₦2,500.00
Fertilizer cost	₦33,750.00	₦42,000.00
Fertilizer application and watering	₦5,000.00	₦5,000.00
Cost of spraying	₦13,875.00	₦20,625.00
Harvesting	a) ₦8,000.00 b) ₦15,000.00	a) ₦12,000.00 b) ₦22,500.00
Baskets	a) ₦16,000.00 b) ₦30,000.00	a) ₦20,000.00 b) ₦37,500.00
Transportation	a) ₦20,000.00 b) ₦37,500.00	a) ₦40,000.00 b) ₦75,000.00
Land rental charges	₦25,000.00	₦37,500.00
Total cost	a) ₦157,250.00 b) ₦198,875.00	a) ₦237,750.00 b) ₦306,875.00

Source: Fieldwork, (2013).

The expenditure incurred by farmers in tomato production per hectare in Kano state is shown in Table 4.6. The cost of production is of two types, that is minimum cost of production and maximum cost of production. The total cost of production also varies within the minimum and maximum cost of production. This is due to the fact that tomato output per hectare ranges between 200 baskets of tomato to 375 baskets of tomato. The more inputs the farmers use on their tomato farms, the more yield of tomato is expected. The variations of inputs by the farmers and the labour cost at the beginning and middle of the production system give rise to the different output of the products. These factors affect the cost of harvesting as well as the cost of transportation of tomato produced by the farmers. These

factors are attributed to the variations in the total cost of production as indicated in Table 4.6. The more inputs invested on the tomato farm, the more yield is expected from the farm.

4.5.2 Farm gate prices of tomato per 30kg basket

The price of selling tomato by farmers varies between peak and slack periods of tomato production in Kano state. The minimum sales price of tomato per 30kg basket and the maximum sales price of tomato per 30kg basket in the months of March to May are shown in Table 4.7. Between 200 and 375 baskets of tomato can be derived from one hectare of tomato farm. The variation of the output is as a result of the inputs of the individual farmers. The more inputs invested on the farm the more outputs is expected. From the field surveys, it was gathered that most farmers in the study areas get an output of 200 baskets, when the inputs is less, but when the input is high they get up to 375 baskets of tomato from an hectare of land.

Table 4.7: Average farm gate price of tomato per basket (30kg) and per hectare by Farmers

S/N	Month	Minimum Selling Price Per Basket	Maximum Selling Price Per Basket
1	March	₦400 per basket	₦900 per basket
		a) ₦80,000.00	a) ₦180,000.00
		b) ₦150,000.00	b) ₦337,500.00
2	April	₦1,000 per basket	₦1,200 per basket
		a) ₦200,000.00	a) ₦240,000.00
		b) ₦375,000.00	b) ₦450,000.00
3	Early May	₦1,500 per basket	₦2,000 per basket
		a) ₦300,000.00	a) ₦400,000.00
		b) ₦562,000.00	b) ₦750,000.00
4	Late May	₦2,500 per basket	₦4,000 per basket
		a) ₦500,000.00	a) ₦800,000.00
		b) ₦937,500.00	b) ₦1,500,000.00

Source: Field work, (2013).

In March and early April, during the peak period of the product the prices of tomato is very low, and sometimes lower than the value in Table 4.7. During this period a lot of the product is available in the market, and sometimes there would be no buyers of the product at all. During this period, farmers, usually allow the tomato to perish in their farm without harvesting, so as to avoid additional expenditures. About 65% of the tomato produced in the state are harvested during this period, and a lot of loses are recorded by the tomato farmers.

In May, the price of tomato appreciates quite reasonably. But as the slack period approaches, the price of commodity goes higher and higher. Unfortunately majority of the product has already perished in the farms. The yield per hectare ranges between 200 and 375 baskets of tomato, depending on the inputs of the farmer. This variation gives rise to two values in Table 4.7, computed as (a) and (b). (a) for minimum harvest of 200 baskets of tomato per hectare; and (b) stands for maximum harvest of 375 baskets of tomato per hectare.

4.5.3 Gross Margins of farmers per hectare of irrigated tomato

The gross and net revenue of tomato farmers per hectare are shown in Table 4.8. During the peak period of tomato in March a lot of losses are recorded by farmers. The cost of production is higher than the sales price from the business. For example, the minimum cost of production of 200 baskets and 375 baskets is ₦157,250 and ₦198,875 respectively per hectare. This cost of production is far higher than the selling prices of ₦80,000 and ₦150,000 respectively, giving rise to a deficit of –₦77,250 and –₦48,875 respectively.

Table 4.8: Gross margins of tomato farmers

Month	Minimum Cost of Production (N)	Maximum Cost of Production (N)	Minimum Selling Price (N)	Maximum Selling Price (N)	Minimum Margin in (N)	Maximum Margin in (N)
March	a) ₦157,250	₦237,750	₦80,000	₦180,000	– ₦77,250	– ₦57,750
	b) ₦198,875	₦306,375	₦150,000	₦337,500	– ₦48,875	₦31,125
April	a) ₦157,250	₦237,750	₦200,000	₦240,000	₦42,750	₦2,250
	b) ₦198,875	₦306,375	₦375,000	₦450,000	₦176,125	₦143,625
Early May	a) ₦157,250	₦237,750	₦300,000	₦400,000	₦142,750	₦162,250
	b) ₦198,875	₦306,375	₦562,000	₦750,000	₦363,125	₦443,625
Late May	a) ₦157,250	₦237,750	₦500,000	₦800,000	₦342,750	₦562,250
	b) ₦198,875	₦306,375	₦937,500	₦1,500,000	₦738,625	₦1,193,625

Source: Field work, (2013)

In late May and June, (slack period) of tomato, the selling prices are much higher. Tomato farmers make a lot of profit but only few farmers survive this period and have tomato to sell. Generally, 57% of the tomato farmers said that they were satisfied with the price they got while 43% of the farmers were not satisfied with the price they got for their product. The main reason of dissatisfaction was their low share in consumer Naira and huge losses recorded during the peak period of tomato.

4.5.4 Tomato Marketing and Value Addition in Kano State

The marketing of agricultural commodities embraces all operations and institutions involved in moving farm products from farms to consumers. Marketing covers assembling, transporting, storing, packaging, wholesaling, financing, retailing, market information, pricing, market organization and bargaining,(Musa, 2011). In Kano state, a large proportion of the populace is into agricultural activities either as producers or as marketers given the agrarian nature of the state economy (Musa, 2011).

Tomato marketing embraces all the activities involved in the flow of tomato from the point of initial production until they are in the hands of the ultimate consumer. Tables 4.9 and 4.10 show the cost of buying irrigated tomato per basket from the farm gate between the

months of March to late May- the minimum and maximum cost of buying tomato as well as the minimum and maximum investment of marketers. The Tables also show some marketing activities and actors involved in marketing of irrigated tomato in the state. Buying, grading, loading and transportation are marketing activities while the marketers, graders, loaders, and transporters are key actors in the marketing of irrigated tomato in the state. As these actors perform their functions, value is been added to the tomato.

Table 4.9 is specifically on the buying and marketing of irrigated tomato in Kano State, while Table 4.10 is on buying and marketing of the commodity in other states, especially the Southern Nigeria. For example, the minimum and maximum investments of a marketer in Table 4.9 is ₦108,000 and ₦232,000, while the minimum and maximum investments of marketers in table 4.10 is ₦292,000 and ₦494,000 respectively. The variations in the two tables is mostly from the value addition in terms of loading and transportation cost.

Table 4.9: Buying and marketing irrigated tomato perhectare and value addition in Kano State

Month	Marketing Activity	Minimum Cost of Buying Tomato	Maximum Cost of Buying Tomato
March	Buying tomato	₦80,000.00	₦180,000.00
	Grading of tomato	₦4,000.00	₦6,000.00
	Loading of tomato	₦4,000.00	₦6,000.00
	Transportation	₦20,000.00	₦40,000.00
	Sub-Total	₦108,000.00	₦232,000.00
April	Buying tomato	₦200,000.00	₦240,000.00
	Grading of tomato	₦4,000.00	₦6,000.00
	Loading of tomato	₦4,000.00	₦6,000.00
	Transportation	₦20,000.00	₦40,000.00
	Sub-Total	₦228,000.00	₦292,000.00
Early May	Buying tomato	₦300,000.00	₦400,000.00
	Grading of tomato	₦4,000.00	₦6,000.00
	Loading of tomato	₦4,000.00	₦6,000.00
	Transportation	₦20,000.00	₦40,000.00
	Sub-Total	₦328,000.00	₦452,000.00
Late May	Buying tomato	₦500,000.00	₦600,000.00
	Grading of tomato	₦4,000.00	₦6,000.00
	Loading of tomato	₦4,000.00	₦6,000.00
	Transportation	₦20,000.00	₦40,000.00
	Sub-Total	₦528,000.00	₦652,000.00

Source: Field work, (2013).

Table 4.10: Buying and marketing irrigated tomato per hectare and value addition in southern Nigeria

Month	Marketing Activity	Minimum Cost of Buying Tomato	Maximum Cost of Buying Tomato
March	Buying tomato	₦80,000.00	₦180,000.00
	Grading of tomato	₦4,000.00	₦6,000.00
	Loading of tomato	₦8,000.00	₦8,000.00
	Transportation	₦200,000.00	₦300,000.00
	Sub-Total	₦292,000.00	₦494,000.00
April	Buying tomato	₦200,000.00	₦240,000.00
	Grading of tomato	₦4,000.00	₦6,000.00
	Loading of tomato	₦8,000.00	₦8,000.00
	Transportation	₦200,000.00	₦300,000.00
	Sub-Total	₦412,000.00	₦554,000.00
Early May	Buying tomato	₦300,000.00	₦400,000.00
	Grading of tomato	₦4,000.00	₦6,000.00
	Loading of tomato	₦8,000.00	₦8,000.00
	Transportation	₦200,000.00	₦300,000.00
	Sub-Total	₦512,000.00	₦714,000.00
Late May/June	Buying tomato	₦500,000.00	₦600,000.00
	Grading of tomato	₦4,000.00	₦6,000.00
	Loading of tomato	₦8,000.00	₦8,000.00
	Transportation	₦200,000.00	₦300,000.00
	Sub-Total	₦712,000.00	₦914,000.00

Source: Fieldwork, (2013).

4.5.5 Marketers' Selling Prices of Irrigated Tomato

The prices of selling irrigated tomato by marketers and their margins in the months of March, April and May are shown in Tables 4.11 and 4.12. Table 4.11 shows the prices of selling irrigated tomato in Kano State to other buyers and users, while Table 4.12 shows the prices of other buyers and users in Southern Nigeria. The tables shows the minimum and maximum

investment of marketers in Naira and the minimum and maximum of price of selling the products as well as their minimum and maximum margins.

In March, the minimum margin is higher than the maximum margin. This is because during the peak period in March, there is a large quantity of tomato on ground with fewer buyers. The price of tomato at this period is very low and so is the profit.

Table 4.11: Minimum and maximum selling prices of irrigated tomato and margins of marketers within Kano State

Months	Minimum Investment of Marketers (₦)	Maximum Investment of Marketers (₦)	Minimum Price of Selling in (₦) (200 baskets)	Maximum Price of Selling in (₦) (200 baskets)	Minimum Margin in (₦) (200 baskets)	Maximum Margin in (₦) (200 baskets)
March	₦108,000	₦232,000	₦200,000	₦240,000	₦92,000	₦8,000
April	₦228,000	₦292,000	₦300,000	₦400,000	₦72,000	₦108,000
Early May	₦328,000	₦452,000	₦500,000	₦600,000	₦172,000	₦148,000
Late May	₦528,000	₦652,000	₦700,000	₦900,000	₦172,000	₦248,000

Source: Fieldwork, (2013)

Table 4.12: Minimum and maximum prices of selling irrigated tomato and margins of Marketers in Southern Nigeria

Months	Minimum Investment of Marketers (₦)	Maximum Investment of Marketers (₦)	Minimum Price of Selling in (₦) (200 baskets)	Maximum Price of Selling in (₦) (200 baskets)	Minimum Margin in (₦) (200 baskets)	Maximum Margin in (₦) (200 baskets)
March	₦292,000	₦494,000	₦400,000	₦600,000	₦108,000	₦106,000
April	₦412,000	₦554,000	₦700,000	₦900,000	₦288,000	₦346,000
Early May	₦512,000	₦714,000	(₦1,000,000)	₦1,300,000	₦488,000	₦586,000
Late May	₦712,000	₦914,000	₦1,600,000	₦2,000,000	₦888,000	₦1,086,000

Source: Fieldwork, (2013)

4.5.6 Gross margins of irrigated tomato farmers and marketers in the study area

The gross margins of farmers and marketers of irrigated tomato are shown in Tables 4.13 and 4.14 respectively. Table 4.12 shows the margin of tomato farmers and marketers within Kano State, while Table 4.14 shows the margins of tomato farmers within Kano State and marketers selling tomato to buyers and other users in southern Nigeria. In Table 4.13, during the peak period of tomato in March farmers make no gain at all from their production, while marketers make gains. In April, farmers make little gain from their tomato production. Tomato ripe in the farms with a few or no marketers at all to buy them. Many of the tomato are left to rot and perish in the farms without picking them so as to avoid additional expenses and losses having to pay pickers and other labourers working in the farms.

In one BBC (Hausa) Radio Programme at Kwanar Gafan Tomato Market on 9th April, 2013, and a field survey undertaken for this study during the period, many of the tomato farmers complained of spending about ₦40,000.00 in tomato farms and managed to get back only ₦2,500 of the amount. Other farmers complained of spending about ₦150,000 on tomato farm and managed to get back only ₦40,000 of the amount (Muhd Al-Nuru, 2013). In the early period of May, the minimum gain of farmers for 200 baskets of tomato is ₦142,750 and the maximum gain is ₦162,250 respectively, while marketer's gain is between ₦172,000 to ₦148,000 respectively. During this period, the maximum gain of the marketers is higher than that of the farmers. In late May to June, the minimum margin of farmers is ₦342,750 and the maximum margin is ₦567,250 for 200 baskets of tomato sold, while the minimum and maximum of marketers ranging between ₦172,000 to ₦148,000 respectively. This is the only period where tomato farmers make good and reasonable profit from their produce, but only very few farmers survive this period because the product has already rotten and perished in the farm.

Finally, Tables 4.13 and 4.14 tend to suggest that tomato marketers earn more profits than tomato farmers in the study area.

Table 4.13: Gross Margins of Farmers and Marketers within Kano State in Naira

Months	Minimum margin of farmers	Maximum margin of farmers	Minimum margin of marketers	Maximum margin of marketers
March	– ₦77,250	– ₦57,750	₦92,000	₦8,000
April	₦42,750	₦2,550	₦72,000	₦108,000
Early May	₦142,750	₦162,250	₦172,000	₦148,000
Late May	₦342,750	₦562,250	₦172,000	₦248,000

Source: Field work, (2013).

Table 4.14: Gross Margins of Farmers and Marketers in southern Nigeria in Naira

Months	Minimum margin of farmers	Maximum margin of farmers	Minimum margin of marketers	Maximum margin of marketers
March	– ₦77,250	– ₦57,750	₦108,000	₦106,000
April	₦42,750	₦2,250	₦288,000	₦346,000
Early May	₦142,750	₦162,250	₦488,000	₦586,000
Late May	₦342,750	₦562,250	₦888,000	₦1,086,000

Source: Field work, (2013).

4.5.7 Comparison of Tomato Production and Marketing in Kano State and Egypt

Nigeria is the 2nd in Africa and 1st in West Africa in tomato output. It is estimated that Nigeria produces 65% of all the tomato in West Africa, and much of it are produced in Kano State and over 45% of it rot away for lack of preservation and processing facilities (Shehu, 2013; Lami, 2013; Vincent, 2013).

In 2011, Nigeria produced 1,861,900 metric tons from cultivated land area of 264,100 hectares. In the same year, Egypt cultivated about the same land areas of 216,400 hectares to produced 8,547,200 metric tons which is 4.6 times the Nigeria and Kano output. This is simply because the estimated annual average tomato yield per hectare in Nigeria and Kano is much lower than the average output of 7.1 tons per hectare in Egypt. This is as a result of dysfunctional tomato production value chain in Kano that is characterized by the problems listed below which result in about 50% produce loss (Vincent, 2013).

- High post harvest losses in Kano State due to lack of storage facilities.
- Unlike in Egypt, tomato farmers in Kano State are forced to sell to the marketers at very low prices because they cannot keep the product for long.
- Marketers are the ones who now sell it at higher prices, thus making huge profit at the expense of the farmers.
- In Egypt, tomato are packaged in protective plastic crates and special cartons, while in Kano State tomato are packaged in baskets.

Other problems of tomato production in Kano State include high cost of production, during the irrigation period.

Tomato farmers in the study area (80%)said, that the problem of tomato farming in Kano and Nigeria originates from the inability of the government to provide farmers with the required tomato seeds due to massive corruption in the system. This is due to the fact that the officials responsible to supply the hybrid seed quality goes for the less expensive and cheaper one (Shehu, 2013).

Tomato farmers in Kano State and Nigeria are still using UC82B variety of seed for irrigation. This variety of seed is outdated and has since been abandoned by farmers in Egypt and other parts of the world. UC82B variety of seed is associated with very low yield and

produces low puree, which makes it unsuitable for tomato paste manufacturing companies. The UC82B tomato contains a lot of water, has a very short shelf life and can perish easily.

Tomato farmers in Egypt are using the hybrid seeds. The outdated UC82B variety comes in tins with about 100,000 seeds in one tin. The hybrid seed packet contains 1000 seeds and their yield is several times higher than UC82B. The tomato they produce have a longer shelf life, produce more puree which make them the manufacturers' delight.

The National Horticultural Research Institute, Ibadan, is responsible for producing high quality vegetable seeds that include tomato seeds but has not been forthcoming in this direction despite the huge resources allocated to it annually. (Vincent, 2013; Shehu, 2013). Between 2012 and 2013, over N39 million is appropriated for tomato seeds development and yet nothing to show on ground (Shehu, 2013). Egypt has a lot of storage facilities on ground for the storage of tomato while in Nigeria and Kano lacks storage facilities on ground for the storage of tomato. Egypt has processing industries for the making of tomato paste while in Kano, there is no single tomato processing industry.

The Dangote Group of Companies is building a tomato factory industry near Kadawa Irrigation Scheme to partner with tomato growers in Kano State and to see how the Company can empower and encourage those who have abandoned the farming of tomato due to perennial losses, and also to see how the group can create self-sufficiency in tomato paste production in Kano State and in Nigeria so as to reduce the importation of the paste into the country (Plate 5).

It is hoped that when this company is finally established in the area, the tomato farmers will be empowered and encouraged and this will add great value to tomato production, marketing and processing in the state.

In conclusion, the weak links in the value chain are seed supply, transport, access to credit, storage, packaging, lack of or inadequate power and lack of large scale users such as

tomato processing industries. These constraints weaknesses requires institutional (government) approaches to solve them.

4.6 POLICY INTERVENTION NEEDS OF THE VALUE CHAIN OF IRRIGATED TOMATO IN KANO STATE

In order to determine the policy intervention needs of irrigated tomato in Kano State, a SWOT analysis was carried out amongst actors in the commodity's value chain. The list of the strengths, weaknesses, opportunities and threats identified by the actors are shown in Tables 4.15 to 4.18.

Table 4.15: Strengths

S/N	Description
1	Skilled young men and women working as farmers and labourers
2	Good working relationship among some of the key actors in the irrigated tomato value chain- farmers, middlemen and marketers
3	Existence of various tomato farming associations in the state

Source: Field work, 2013

Table 4.16: Weaknesses

S/N	Description
1	Lack of good quality tomato seeds in the market
2	Seeds available are suitable for dry season planting only
3	Low prices at peak periods of tomato
4	High cost of labour
5	Lack of storage facilities on ground to keep tomato fresh for a long time
6	Lack of processing industries in the study area to add value to the products
7	High cost of transportation of tomato and the slow movement of vehicles from one place to the other as a result of bad roads
8	Periodic shortage of water supply to irrigate the tomato farms
9	Very poor access to cheap credit facilities
10	High cost of tomato farming inputs
11	Low level of Western education and communication skills by tomato farmers and marketers, especially for business transaction with southern and other buyers.
12	Poor access roads within the tomato farm areas and bad road across the country.
13	Poor packaging of tomato in stick baskets.

Source: Field work, 2013

Table 4.17: Opportunities

S/N	Description
1	Favourable weather conditions throughout the year. But the available seeds are suitable for dry season planting only, making the need to develop tomato seeds suitable for all-year-round planting an imperative.
2	Fertile soils for tomato production and abundant water supply
3	Abundant supply of potential labour for the tomato industry
4	High population in Nigeria which translates to high demand for tomato in the country
5	The establishment of tomato processing industries at Kadawa irrigation scheme by Dangote group of companies This is a good opportunity for tomato farmers and marketers in Kano State and Nigeria in general when completed.
6	The recent establishment of mechanized institute at Kadawa by the Kano State Government in the irrigation areas. The institute will serve as an avenue for skills training for tomato farmers in the state and adult literacy classes.
7	Kwanar Gafun tomato market in Garun Malam Local Government, more of these markets should be established in the state for tomato sellers.
8	High demand during festivity periods, especially during Sallah and Christmas
9	Abundant land for tomato production in the state

Source: Field work, 2013

Table 4.18: Threats

S/N	Description
1	Frequent insecurity threats in the State and in the country affect inter-regional movement/marketing of tomato which in turn affect its production and marketing
2	Inadequate supply or lack of electricity to power proposed tomato processing factories on a sustainable basis
3	Bad roads and frequent accidents involving vehicles conveying tomato on inter-regional movement
4	Frequent fire incident at Kwanar Gafan tomato market
5	Illegal revenue collection on the roads by the police, touts, and other security agencies add to final thecost consumers pay for the tomato
6	The perishable nature of tomato
7	Over flooding of some farms with water
8	Harsh weather conditions, especially during the hot season and early in the rainy season
9	Continuous farming of the tomato farmlands sometimes lead to soil degradation
10	Competition from imported tomato paste

Source: Field work, 2013

Table 4.19: Identified policy needs of the value chain

Weakness, opportunities or threat component of the SWOT analysis	Policy action
W_1	Problem area: (The federal and state governments should stop supplying the outdated tomato seed of UC82B to farmers in the state and in the country in general. The hybrid tomato seeds should be supplied at a subsidized rate)
W_2, T_8	Problem area: (Tomato seedlings that can produce at all season of the year should be introduced to farmers in the state by government, NGOs, individuals and marketers to boast the production throughout the year.
W_3, T_6, O_5	The surplus tomato will be absorbed by the processing industry when completed. This will raise and standardized the prices of tomato at peak periods.
W_4, O_3, S_1	High human resources on ground for tomato production and marketing in the state. Abundant supply of labourers and their cordial relationship in the tomato farms will reduce this problem.
W_5, T_6, O_4, O_5, O_8	The establishment of processing industries at Kadawa by Dangote Group of companies will take care of this problem, when completed. Festivity periods and high population demand of the products is also a great advantage to the tomato farmers and marketers. The factory is building a storage facility on the study area. This will reduce glut.
W_6, T_{10}. O_5	The Dangote tomato processing industry at Kadawa under construction will buy the product from the farmers and this will reduce the glut and stabilize the price.
W_7, W_{12}, $T_{3,}$ T_6	Problem area: (the federal government should help in dualizing the major roads linking all state capitals in the federation, especially the roads linking the north and south. When this is done, the cost of transportation will reduce and there will be free and quick movement of tomato between the two regions

Weakness, opportunities or threat component of the SWOT analysis	Policy action
W_8, T_7, S_2, O_2	Good climatic weather condition, fertile soils, good water management, adequate land, good working relationship between tomato farmers, middlemen and marketers are all advantages and opportunities for tomato farmers in the state. Soil quality should be sustained by constant use of quality fertilizers. Periodic water shortage should be eliminated by frequently clearing the water ways and canals.
W_9	Problem area: (Bank loan is difficult to access and the interest rate is too high for the tomato farmers and marketers in the state. Governments, NGOs, international donors, companies, banks and individuals, should assist the tomato farmers to access loans with one digit interest rate). The Federal Government Fadama Programme should be extended to tomato farmers in the state. The Federal Government Programme of Small and Medium Scale Industries (SME) should also be extended to tomato farmers to boost the production and access to funds.
W_{10}, T_6	Problem area: (Tomato farming inputs available in the markets are costly. Government and other agricultural agencies should help in supplying and making tomato farming inputs available at a subsidized rate to tomato farmers at all time of the year.
W_{11}, O_6	The recent establishment of mechanized institute in tomato producing areas at Kadawa will help in this direction. The institute will serve as an avenue for skills training and acquisition for tomato farmers. The institute can also help in organizing adult literacy classes for the tomato farmers.

Weakness, opportunities or threat component of the SWOT analysis	Policy action
W_{13}	Problem area: (The government and private organizations and individuals should intervene by helping farmers and marketers to get access to tomato crates or special cartons for packaging of tomato. This process will add value of the products and competitiveness for export. From field surveys and focus group discussion (FGD), it was gathered that the introduction of crates and cartons for packaging is a new investment area that need to be undertaken in the production system. However, the introduction of crates may be a little bit difficult now because of retrieving back of crates. The actors recommend the use of special cartons that can easily be disposed as in the case of baskets. The Standard Organization of Nigeria (SON) should approve a standard packaging device to reduce damage to tomato.
T_1, T_5	Problem area: (This is a problem area for the production and marketing of tomato in Kano state. Quick action should be taken by security agents and other concerned organizations. The Inspector General of Police should help in this direction by stopping the police and other securities from collecting bribery and illegal fees from tomato marketer and drivers along the major roads.

Source: Field work, (2013)

4.6.1 Discussion on the Categories of Policy Intervention Needs of the Value Chain

i) Sustaining the natural endowment: The climate of Kano state and favourable weather conditions on ground in the state is an advantage for the tomato growers. Agricultural land is available and the soil is fertile for tomato production in the state. All these are natural endowment which serves as strengths and opportunities for the tomato

growers in the state. However, harsh weather condition experiences during the hot season and early part of rainy season are threats to the tomato growers in the state. Also the continuous farming of the tomato farm land sometimes leads to soil degradation in the state. The degradation of the tomato farmland needs to be corrected by the use of high quality fertilizers. This is not always available at all times of the year. The available fertilizers on ground are costly. Although the e-wallet programme of the Federal Government fertilizer distribution is on ground, but is not adequate for the tomato growers. The Government should increase the quantity of the e-wallet fertilizer distribution to tomato growers in the state. The federal government, state government, NGOs, individual investors, and marketers should help in supplying and making tomato inputs and fertilizers available at a subsidized rate to tomato farmers in the state at all time of the year.

ii) Improvement of infrastructure: These are the basic facilities, services and installations needed for the functioning of tomato production industry in the state. Some of these infrastructures are available on ground for the production of tomato in the study area, and some are not available on ground at all for the production of the crop. The available infrastructures on ground have their strengths, weakness, opportunities and threats for the production of tomato in the state. For example, water resources is abundantly available in the study area, which serve as a strength and opportunities for the production of tomato in the state and in the country generally. The periodic shortage of this resource to irrigate the tomato farms as a result of blockage of water ways is a weakness to the tomato grower in the study area. The over flooding of some tomato farms with water as a result of over release of water is a threats to the grower of the industry.

The establishment of mechanized institute and irrigation training school at Kadawa irrigation area is an opportunity which will strengthen the production of tomato in the study area. The school will equally serve as an avenue for skills training for the tomato farmers in the state and adult literacy classes. This will eliminate the low level of Western Education and communication gap between tomato farmers and marketers in the state, and their Southern counterpart. The elimination of this weakness will boost the marketing of tomato business in the state.

The Kwanar Gafan tomato special market, Liberia tomato special market, Yankaba tomato special market, and several other markets in the state and Southern part of Nigeria are good opportunities for the tomato grower in the state. The frequent fire incident at Kwanar Gafan tomato special market is a serious threats to the growers and marketers of the tomato in the state. Electricity should be provided to the markets by the government to reduce the use of lamps and private generators. The establishment of tomato processing industries at Kadawa irrigation scheme by Dangote Group of companies is a good opportunity for tomato farmers and marketers in the state and Nigeria in general when completed. The company will buy tomato products from farmers and the excess (glut) experiences yearly will be reduced or eliminated completely in the state. This process will add value to the tomato products (Plate 5).

Bad roads and frequent accidents involving tomato conveying in inter-regional movement is a serious threats to the industry. Poor access roads within the tomato farm areas are also weakness to the industry. High cost of transportation of tomato and the slow movement of vehicles from one place to the other as a result of bad roads is weakness of the industry. The federal and state government should help in

dualizng the major roads linking all state capitals in the federation, especially those linking the northern state and the southern part of the country. This will reduced the cost of transportation, reduced frequent accidents and easy quick movement.

Inadequate supply of electricity to power the proposed tomato processing industries in sustainable basis is a serious threats to the tomato growers in the state. Electricity supply should be provided by both governments, individual and organization for smooth and easy production of tomato in the state. This will encourage investors to the study areas and invest in the industry.

Lack of storage facilities on ground to keep tomato fresh for a long time is a weakness of the industry. Processing industry is also lacking in the state. The establishment of processing industry at Kadawa by Dangote Group of companies will take care of these problems when completed. Festivity periods and high population demand of the products is a great advantage to the tomato farmers and marketers in the state. The Governments, tomato farmers and individual investors should help in maintaining and improving the present conditions of infrastructures that are on ground. Dangote group of Companies should hastening the completion of the tomato industry under construction in the study area. Also both the Governments and private investors should help in establishing storage and preservation facilities of tomato in the study area.

iii) Socio-economic factors:Skilled young men and women working as farmers and labourers is a great strength of the tomato industry in Kano state. Good working relationship among the actors in the irrigated tomato value-chain, i.e. farmers, middleman and marketers are all great strengths to the tomato industry in the state. Festivity periods, especially Sallah and Christmas are periods of high demand of tomato in Kano and Nigeria as a whole. This is a good opportunity for the tomato

growers in the state. The existence of various tomato farming association in the state strengthens the production of tomato in the study area. The process helps in organizing the farmers into groups so as to access the available loans and other assistance from agricultural organizations, NGOs, government and international donors. The good working relationship of the tomato actors should be further strengthen and sustained in the state by the actors. This could be achieved through the various existing associations of the actors in the study area. Good packages of tomato in a protective plastic crates or special cartons by the marketers will make the products to last longer and attract buyers. (Appendix II).

iv) Enhancing institutional support services: There are many institutions in the study area providing support to extension activities of the Agricultural Development Projects. Extension services at the study area are provided by KNARDA and other agencies in the state. The Kano State Agricultural and Rural Development Authority (KNARDA) is responsible for providing extension services to tomato farmers in the state. Tomato farmers access inputs from the Kano State Input Supply Company (KNISC) or private dealers in the study area. Other agencies providing support services to tomato growers in the study area include the International Institute of Tropical Agriculture (IITA), Institute of Agricultural Research (IAR), United State Agency for International Development (USAID), Non-governmental Organization (NGOs), Food and Agricultural Organization (FAO), and Hadejia Jama'are River Basin Development Authority (HJRBDA). The existence of these agencies is a great opportunity to tomato growers in the state. These opportunities strengthen the production of tomato in the state. The agencies assist in research development, inputs supply, search for markets, and advice the tomato farmers on new techniques and methods of production and marketing of the crop. Although many of these international agencies do not deal

with the farmers directly but they assist the state government to assist the tomato farmers. Although the impact and benefit of these organizations are felt by the tomato growers in the State to some extent as observed during the field survey and focus group discussion (FGD), they should be empowered to perform much better. The activities of these agencies need to be strengthen so as to enhance the production of tomato in the study area. One of the needs of the tomato farmers is availability of quality seeds, some of these institutions could be mandated to research into and develop high quality seeds. Then an out grower scheme can be developed for the mass production of the seeds on an annual basis for sale to farmers at a reasonable price.

4.7 THE IMPLICATIONS OF THE STUDY FOR RURAL DEVELOPMENT

Agriculture is the principal source of food and livelihood in Kano state, and employed nearly three-quarter of the state workforce. Sustaining agricultural productivity should be a critical component of programmes that seek to reduce poverty and attain food security in the state and Nigeria in general. Irrigated tomato production can be used as a pathway to transform the lives of people living in the rural areas.

Irrigation development in rural communities has a great role to play in increasing agricultural productivity by brining vast area into profitable cultivation which otherwise may be idle or marginally productive. Irrigated tomato production increases income of individuals and provide employment to many. This kind of development has a great benefit to rural communities. Rural development in the real sense involve improvement of living conditions of rural people through some factors that will stimulate changes and bring higher incomes, better living conditions and improve rural environment. Irrigated tomato production in Kano state has affected the rural and urban life of many Nigerians economically, socially and politically.

From the economic point of view, the per capita income of tomato growers would positively increase through intensive production of the crop and increase in the average yield of tomato crops. The benefit of irrigated tomato production in the state is not limited to the farmers within the irrigation schemes. People from other states and neighboring countries benefit from the scheme. For example, hundreds of vehicles are seen loading tomato produce in the state to different parts of the country and beyond. This project has made farmers of the study area healthy and wealthy which in the pre-irrigation period were the poorest people in the state.

Employment opportunities ison the increase as a result of irrigated tomato production in rural areas of the state. The increase demand for skilled and unskilled labour has increased employment opportunity for many professionals, such as mechanics, electricians, engineers, operators, retailers, intermediaries, traders, et cetera.

Nigeria is currently importing large quantities of food items in many forms. The country has all the potentials to be an agriculturally developed nation and capable of producing these food items to the satisfaction of the country and beyond. Unfortunately every government comes with its own policy different from the other. These inconsistent policies is a serious setback in promoting more productive irrigation agriculture in Kano State and in the country. This is why Kano State and Nigeria could not attain self-sufficiency in food production up till today. Increased tomato and other food production would reduce importation rate substantially and this will save money to provide other social services and infrastructural facilities to the rural and urban communities in the State and the nation at large.

Tomato and their byproducts can be a source of raw materials for establishment of agro-allied industries in the rural areas of the state. For example, tomato processing industries can be established in the major areas of tomato production in the state, as in the case of

Dangote tomato processing industry at Kadawa. This industry was established recently and still under construction, the industry will provide employment opportunities for people both in the rural and urban areas of the state. The byproduct of the industry can be used as livestock feeds and develop livestock industries in the rural areas of the state.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 SUMMARY OF FINDINGS

5.1.1 The Irrigated Tomato Farms

The findings indicated that the irrigated tomato farms are located at the Watari irrigation scheme and Kadawa irrigation scheme in Kano state (Table 4.1). The basic requirements for the production of irrigated tomato are land, improved seeds, fertilizers, insecticides, chemicals, water supply, capital and market demand are largely met in the study area.

Majority of the tomato farmers in the state hired their farmland (55.3%), while 37% of the farmers owned their land outright. Only 7.7% of the farmers had their lands allocated to them by government (Figure 4.1)

5.1.2 The Value Chain of Irrigated Tomato in the Study Area

The study reveals that the Watari scheme has 3,800 tomato farmers, while the Kadawa Scheme has 4,500 tomato farmers. The two schemes have a total of 8,300 tomato farmers. The study reveals that a total employment generation of the irrigated tomato was 142,541 people across the State at the time of the survey.

The organization of irrigated tomato production entails a farmer to possess some special skills in land preparation, harrowing, levelling, watering and transplanting of tomato. The acquisition of these skills enable the tomato farmers to have an insight into all the operational processes involved in the production of tomato in the state. These skills are acquired as a result of continuous practice and participation in the farming activities in the study area.

There are many tomato associations in the study area, although membership is not compulsory, 95.4% of the tomato farmers surveyed indicated that they belong to one association or another. Membership of an organization requires a registered member to attend

meetings when called upon to do so, and pay the monthly due to the association. In returns the association assists members to acquire new skills in tomato production, access needed information, inputs, equipments, loans, especially from government, NGOs and Banks.

The groups of actors that have been identified in the study to contribute in different ways to make the business of tomato production possible in the state are, government and its agents (i.e. KNARDA, Extension Workers, Research Institutes, Irrigation Infrastructure), Non-governmental organization (NGOs), development partners such as the United States Agency for International Development (USAID), extension workers, agro-chemical dealers, farmers, labourers, transporters, agents, middlemen, retailers and consumers.

5.1.3 Technical Capacities of Actors in the Value Chain

The study reveals that the farming activities such as land preparation are done manually by the farmers and hired labourers (15.4%), while 86.6% of the work is done mechanically. The mechanization allows timely preparation of many hectares of land to be prepared for the cultivation of tomato in the study area for growing tomato.

The sowing of seeds and transplanting of seedlings are carried out by majority of the respondents manually by hired labourer (95.4%) while the remaining farmers (4.6%) carried out sowing and transplanting of seedlings by themselves in the state. The planting and transplanting manually slow down the process of tomato production in the study area. Weeding activity is done manually by (89.2%) of the tomato farmers surveyed using hired labourers from neighbouring village in the state. Weed control is carried out by the remaining 10.8% farmers with the use of herbicides which is sourced from agro-dealers and marketers in the study area. (Figure 4.5).

Over 90% of the farmers use chemical fertilizers which they obtain from agro-dealers and marketers. The remaining 9.2% farmers use farmyard manure. Both chemical fertilizers and farmyard manure are applied manually by labourers hired from neighbouring villages,

towns and states. The application of fertilizers and manure to the tomato farms in the study area result in high yield of products in the state. The more fertilizers applied in the tomato farms, the more yield of products. The less application of fertilizers in the farms, the less yield and harvest of the farms. The high cost of fertilizers in the study area constraints the tomato farmers in applying the required quantity of fertilizers per hectares.

The application of water to the tomato farms by 78.5% of the actors is mechanized. That involves the use of pumps to lift water from the canals into the farms. The water pumps are sourced from agro-dealers and marketers in the state. Some 28.5% of the farmers use the manual technology of lifting water into their tomato farms. This is done directly by supplying the water from a nearby canal into the farm directly through an opening. (Figure 4.5).

Pest control is highly mechanized in the study area. Some 95.4% of the farmer surveyed use pesticides which are sprayed on the farms. Both herbicides and sprayers are sourced directly from the agro-dealers and marketers of farm machinery in the state.

The control of pest by the farmers usually result in high yield tomato in the study area. Harvesting of tomato is done manually involving the use of hired labourers by 84.6% of the farmers and 15.4% of the farmers pick their own tomato by themselves. Preparation of harvested tomato for market is done manually through grading and sorting by hired labourers from neighbouring villages and states. 67.7% of the tomato farmers sort and grade their tomato, while the remaining 32.3% do not sort and grade their tomato. Sorting and grading of the harvested tomato, lead to uniformity of tomato in a basket, which in turn leads to better prices for the produce. The preservation of harvested tomato in the study area is achieved through sun drying. 24.6% of the farmers preserve their tomato through sun drying on roadsides while the remaining 75.4% do not preserve their tomato at all. (Figure 4.5).

The fertilizer used by the farmers are shown in table 4.3. The fertilizers mostly used by the tomato farmers in the study area are urea, NPK and farmyard manure. The fertilizers

are bought from the market except the farmyard manure that is locally sourced from the homes of the farmers.

The prices of urea ranges between ₦4,500 to ₦5,600 per bag, while the prices of NPK ranges between ₦5,400 to ₦6,000 per bag. The amount spent on labour is usually between ₦75,000 and ₦125,000 per hectare. The yield of tomato ranges between 200 to 375 baskets per hectare, depending on the inputs. The prices at which farmers sell their tomatovaries from time to time. The fluctuation of the prices is a great threats to the tomato farmers in the state. The prices fluctuate between ₦300 per basket to ₦4,000 per basket of 30kg, depending on situation and circumstances. Majority of the tomato farmers are satisfied with the prices of selling tomato (57%), while 43% of the tomato farmers are dissatisfied with the prices of selling tomato in the study area.

On the condition of the infrastructural facilities that serves the tomato farms; 43% of the tomato farmers indicate that the roads linking the farms and markets are good, while 37% of them indicated that the roads were bad.

The effectiveness of the roads affects the movement of the people (workers of all category) to the farms and from the farms to market places. This also affect the movement of the tomato product from the farm gate to the market centres and other destinations of tomato across the state and the country in general.

The transportation services identified by the study are (i) animal transportation which include bullock-carts, horse-carts, and camel-carts, donkey; (ii) motorized transportation which include mini-buses, trucks, tractors, tricycles and motorcycles; and (iii) non-monitorized transport which involves bicycles and walking. The study also shows that 47.7% of the respondents indicated that transport services in the study area is satisfactory. While 27.7% of them indicated that the transportation services is very poor and bad in the tomato

producing areas. Field survey also shows that the motorcycles, popularly called "*achaba*" is the most efficient means of transportation in the farm areas.

The abundant water resources available in the study area allow for the irrigation of over 160,000 hectares. Many manmade dams are constructed all over the state to encourage dry season farming (irrigation). Some of the major dams constructed for irrigation purposes include the famous Tiga dam, Bagauda dam, Challawa Gorge dam, Thomas dam and Watari dam. Majority of the tomato farmers surveyed (78.5%) claimed that water is made available in the study areas for irrigation tomato production.

Electricity supply in the study area is rated very poor by 35.4% of the tomato farmers surveyed. Apart from the very poor nature of the supply, it should be pointed out that 55.4% of the respondents indicated that there is no electricity supply at all in many parts of the tomato farms. Electricity supply is needed in the study area for storage facilities and processing of tomato products, and other related activities in the study area.

From the field survey, it is clear that majority of the tomato farmers in the study area have no access to any kind of loan. The farmers rely on self-financing to produce the commodity.

Storage facilities are lacking in the study areas. More than 50% of the tomato produced in the state are lost to post harvest spoilage annually. Modern storage facilities are not available on ground in the study area (80%). The local method of sun drying is the only option left for the tomato farmers. This method is slow and time wasting and also reduces the value of the product.

The services of extension workers and agricultural officers is available on ground in the study area. The extension workers visit the tomato farmers to benefit from the advices given to them by the workers to enhance the production of tomato in the state.

5.1.4 The Economic Performance of the Value Chain

The examination of the economic performance of irrigated tomato value chain entails a measurements of all the costs, gross margins, added value and share of each actor as irrigated tomato in Kano State move from production to the consumers and a comparison of the result obtained with reported best practices in small holder tomato production and marketing.

The expenditure items for irrigated tomato production in the study area are: land preparation (land clearing and harrowing), planting of tomato, weeding, water charges, costs of fertilizer, spraying, harvesting, baskets, transportation and land rent. Input costs, yield and output price. Analysis were undertaken for minimum and maximum output to determine performance of irrigated tomato production in the study area

The cost of production is of two types, i.e. minimum and maximum cost of production. The total cost of production also varies within the minimum and maximum cost of production. This is due to the fact that tomato output per hectare ranges between 200 baskets of tomato to 375 basket of tomato. The more inputs the farmer uses on their farms, the more yield of tomato is expected.

The price of selling tomato by farmers varies between peak and slack periods of tomato production in the study area. The minimum and maximum selling price of tomato per basket (30kg) in the month of March and May are shown in table 4.7. From the study, it was gathered that farmers in the study areas get an output of 200 baskets, when the inputs is less, but when the inputs is high they get up to 375 baskets of tomato from an hectare of land.

In March and early April, during the peak period of the product the prices of tomato is very low, and sometimes lower than the value in table 4.7. During this period a lot of the product is available in the market, and sometimes no buyers of the product at all.

During this period, farmers usually allow the tomato to perish in their farm without harvesting, so as to avoid additional expenditures. About 65% of the tomato produced in the state are harvested during this period, and alot of loses are recorded by the tomato farmers.

In May, the price of tomato appreciates quite reasonably. But as the slack period approaches, the price of the commodity goes higher and higher. Unfortunately, majority of the product has already perished in the farms.

During the peak period of tomato in March a lot of losses are recorded by farmers. The cost of production is higher than the profit from the business. For example, the minimum cost of production of 200 baskets and 375 baskets is ₦157,250 and ₦198,875 respectively per hectare. The cost of production is far higher than the selling prices of ₦80,000 and ₦150,000 respectively, given rise to a deficit of – ₦77,250 and – ₦48,875 respectively.

In late May and June (slack period) of tomato, the selling price are much higher. Tomato farmers make a lot of profit but only few farmers survive this period and have tomato to sell. Generally, 57% of the tomato farmers are satisfied with the price they got, while 43% of the farmers were net satisfied with the price they got for their product.

Tomato marketing embraces all the activities involved in the flow of tomato from the point of initial production until they are in the hands of the ultimate consumers. The minimum and maximum cost of buying tomato as well as the minimum and maximum investment of marketers. Buying, grading, loading and transportation are marketing activities, while the marketers, graders, loaders and transporters are key actors in the marketing of irrigated tomato in the state. As these actors perform their functions, value is been added to the tomato .For example, the minimum and maximum investments of a marketer in Table 4.11 is ₦108,000 and ₦232,000, while the minimum and maximum investments of marketers in table 4.12 is ₦292,000 and ₦494,000 respectively. The variations in the two tables is mostly from the value addition in terms of loading and transportation cost.

The prices of selling irrigated tomato by marketers and their margins in the months of March, April and May are shown in table 4.11 and 4.12. The tables show the minimum and maximum investment of marketers in Naira and the minimum and maximum price of selling the products as well as their minimum and maximum margins.

The marketers' margins are higher than those of the producers during both peak and slack period of tomato output. For example, in the early period of May, the maximum gain of farmers for 200 baskets of tomato is ₦142,750 and the maximum gain is ₦162,250 respectively, while marketer's gain is between ₦172,000 to ₦148,000 respectively. During this period, the maximum gain of the marketers is higher than that of the farmers. In late May and June, the minimum margin of farmers is ₦342,750 and the maximum margin is ₦562,250 for 200 baskets of tomato sold, while the minimum and maximum of marketers ranging between ₦172,000 to ₦248,000 respectively. This is the only period where tomato farmers make good and reasonable profit from their produce, but only very few farmers survive this period because the product has already rotten and perished in the farm.

In 2011, Nigeria produced 1,861,900 metric tons from cultivated land area of 264,100 hectares. In the same year, Egypt cultivated about the same land areas of 216,400 hectares to produced 8,547,200 metric tons of tomato which is 4.6 times the Nigeria and Kano output. This is simply because the estimated annual average tomato yield per hectare in Nigeria and Kano is much lower than the average output of 7.1 tons per hectare in Egypt. This is as a result of some dysfunctions identified in the tomato production value chain in Kano.

5.1.5 Policy Intervention needs across the Value Chain

The policy intervention needs of the chain: A SWOT analysis were used across the tomato value chain. The analysis listed and identified all the strengths, weaknesses, opportunities and threats of the value chain of irrigated tomato production in the state (Tables 4.15 to 4.18). The policy needs of the value chain for the production system of irrigated tomato in the study area are drawn from the list of the strengths, weaknesses, opportunities and threats that were identified. Specific weakness (W), opportunities (O) and threat (T) are listed first followed by the specific strength (S), weakness or opportunities that may impact the policy intervention. The combination of strengths and opportunities lead to the action plan to improve the weakness and threats (Table 4.19). It should be noted that there are some weaknesses and threats identified, that do not have any strengths or opportunities that will make improvements. In this case, these weaknesses and threats are considered problem areas/challenges and suggestion were made on how to solve such problems.

5.2 CONCLUSION

In assessing the value chain of irrigated tomato in Kano State with a view to identify strong and weak links in the chain. One can conclude that in respect of its strong aspects of the value chain, the study area possesses a natural environment that is favourable for irrigated tomato production.

There is in existence in the study area abundant skilled labour that works in a harmonious relationship with the farmers in all aspects of tomato production and distribution. The irrigation infrastructure runs efficiently, making water available as and when required, though with some hitches once in a while. Extension service are adequately provided for the farmers by agencies such as the Kano State Agricultural and Rural Development Authority (KNARDA). There was a size employment generated (142,541) in all aspects of irrigated tomato production across the State.

The weak aspects that were identified with the value chain of irrigated tomato in the study area include the dominance of manual labour in all areas of tomato production and distribution except land clearing, a phenomenon that slows down the processes. The absence of storage facilities and processing industries in the study area lead to severe glut of tomato at the peak of the season which leads to a drastic fall in the price of the commodity. Most parts of the tomato producing areas are poorly served with regular electricity supply and circulation roads. The farmers have no access to seeds of improved tomato species, they are forced to continue using the UC82B variety seeds with low yield and short shelf life. Packaging of tomato in baskets for transportation over long distances results to in lot of damages and losses. Transportation costs are high and movement of vehicles from one place to another is slow as a result of bad roads The very bad nature of the roads plied by trucks hauling fresh and perishable tomato to distant markets often result in accidents and great losses in the value chain. Also, Lack of access to cheap credit facilities left those in irrigated tomato business to rely solely on self-financing which is a major constraint to growing their business.

5.3 CONTRIBUTIONS TO KNOWLEDGE

i) Like most small scale farmers across this country, the irrigated tomato farmers in the study area are doing their best to use the meagre resources available to them very efficiently.

ii) The constraints they face are infrastructures (poor electricity supply, bad roads, lack of storage facilities), financial (lack of access to cheap credit) and technical (lack of effective research and development to produce high quality tomato species, light tools that take drudgery out of farming).

iii) These are beyond what the farmers can manage by themselves. They require the collaborative intervention efforts of local, state and federal governments.

iv) The glut of tomato in the market in the month of March appears to arise from tomato earlier grown with residual moisture (rain-fed) from November overlapping into March when irrigated tomato are coming up for harvest. Avoiding this overlap requires better time-spacing in the planting of rain-fed and irrigated tomato.

v) There is dominance of manual labour in all areas of tomato production and distribution except land clearing, a phenomenon that slows down the processes.

5.4 RECOMMENDATIONS

The following recommendations are offered here for greater efficiency in irrigated tomato production industry in Kano State:

i) Introduction of high yield seeds for all year production in the study area. One of the needs of the tomato farmers is availability of quality seeds in the state. The extension officers, research institutions, NGOs, International Organizations could be mandated to research into and develop high quality seeds. Then an out grower scheme can be developed to mass production of the seeds on an annual basis for sale to farmers with a reasonable price.

ii) Yield of tomato per hectare could be greatly improved by applying the required quantity and amount of fertilizers on the farms. This could be enhanced by the government especially through the e-wallet fertilizer distribution to the farmers. Enough quantity should be distributed to them at a subsidized rate.

iii) The establishment of tomato processing industries and storage facilities on ground in the study area. The establishment of processing industry for tomato paste manufacturing and storage facilities on ground will boost and encourage the tomato farmers and other actors to produce more of the crop in the state. This could be facilitated by government through enacting enabling laws and policies that will encourage the private investors to come in and invest in the sector. Although the

Dangote Group of Company have started this move by establishing one at Kadawa irrigation area. The completion of the project should be hasten.

iv) Regular power supply is needed in the farm areas. The availability of electricity in the farm areas will encourage investors to the areas for the establishment of processing factories and storage facilities on ground. This could be initiated by the governments and private investors. The Kano state government have started the construction of electricity project at the famous Tiga Dam and Challawa Gorge dam for industrial use in the state. The project should be hasten and completed for use in the areas.

v) Modern Technological innovation for tomato production should be introduced in the state. Most of the farming activities in the study area are done manually. This slow down the processing of production. When modern technology is introduced, most of the activities will be done by machines. In this process, the activities of the actors will be faster and more production will be on ground. This process could be initiated by the government through enacting enabling laws and policies that will encourage private investors and marketers to invest in the system.

vi) The introduction of protective plastic crates or special cartons. The packaging of tomato is one of the problem affecting the quality and marketability of the product in the study area. The stick baskets used in packing tomato pierce through the tomato thereby making them to rot easily. The introduction of protective plastic crates or special cartons will eliminate this problem. The introduction of this, is a new investment areas for businessmen and women and private sectors in the state and country. One businessman (Alhaji Aminu Muhammad from Bauchi State) has already started negotiating with some plastic companies in Kano State for this project as observed during the study. Quick action should be taken on this matter for effective implementation in the state.

vii) Introduction of cargo railway transportation of tomato to southern states. The rehabilitation of the railway lines in the country should be targeted towards this direction. This will reduce frequent accident involving vehicles conveying tomato in inter-regional movement as a result of bad roads. Equally, high cost of transportation of tomato and the slow movement of vehicles from one place to the other will be reduced. The Federal Government of Nigeria should facilitate this process by making the railway transportation effective in the country. The tomato farmers associations, tomato marketer associations, NGOs and the state government should negotiate with the Nigeria Railway Transport Authority for this process and actualization.

viii) The Federal Government should enact laws for easy and quick access of bank loans to farmers with one digit figure in the country.

ix) The government should enact a law to establish commodity marketing board in order to eliminate middlemen and enable the tomato farmers to have value for their tomato produce.

x) The activities of each actor along the chain add value to the product. This should be further strengthened by the various actors, NGOs, International Agencies and the State Government, through organizing seminars and workshops for the participants from time to time.

xi) As rainy season begins and drop on the flowering of irrigated tomato, the crop dries up. This area should be further investigated and further studies carried out on this aspect of tomato production in the state.

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Appendix I[A]

TOMATO FARMERS QUESTIONNAIRE

To Whom It May Concern

Greetings. My name is Ibrahim Adamu Kabuga. I am a doctoral student in the Department of Geography of AhmaduBelloUniversity, Zaria. I am carrying out a research on the "value chain of irrigated tomato in Kano Sate". I humbly solicit your kind assistance by requesting you to provide as accurately as possible the information required in the questionnaire below. I give an undertaking that all the information you provide will be treated with strict confidentiality and will be used for academic purposes only.

Thank you for your anticipated support.

_____

Ibrahim Adamu Kabuga

Section A: The Irrigated Tomato Farms

1) Location of the farms _____

2) Indicate how you got the plot of land for farming tomato?
   a. Government allocation
   b. Leased from someone
   c. Others (please specify) _____

3) Indicate the number of farms you own:_____

4) State the average total hectares of land on which you grow tomato annually:___

5) Identify what you consider to be the basic requirements for successful irrigated tomato production._____

_____

_____

Section B: Organization of Irrigated Tomato Production

6) Explain the process one goes through in becoming an irrigated tomato farmer:
_____
_____

7) Is there a "tomato farmers' association" in this area?
   a) Yes ( ) b) No ( )

8) If yes to (7) above, what is the name of the associations?_____
_____

9) Is membership compulsory for all tomato farmers in this area?
a) Yes ( ) b) No ( )

10) What does membership of the association involve?
a) What do members do for the association?_____
_____

b) What benefits do member derive from the association? _____
_____

11) How many tomato farmers are in this area? _____

12) In Table 1 are some tomato production activities. Please indicate the technologies you normally use in carrying out each activity and where you get them from.

Table 1: Irrigated tomato production activities and technologies used

S/No.	Farming activity	Technology used	Source of technology
1	Land preparation		
2	Sowing		
3	Weeding		
4	Fertilising		
5	Watering		
6	Pest control		
7	Harvesting		
8	Preparation for market		
9	Security of harvested tomato before sale, et cetera.		
10	Others (specify)		

13) Indicate in Table 2 different categories of people that contribute in different ways to make your business of tomato production possible.

Table 2: Categories of contributors to my irrigated tomato production

S/No.	Types of contributor	Specific things they do	Remarks (Sequence of their Activities and Relationship)
1			
2			
3			
4			
5			

14) Are the sequence of activities of these categories of people and their relationship working effectively?
a) Yes ( ) b) No ( )

15) If no, what do you think is missing in the sequence of activities of actors and relationship? _____
_____

Section C: Tomato Output And Productivity

16) Please indicate in Table 3 the types of fertilizer you normally use, their costs and sources

Table 3: Fertiliser used in the last farming season

S/No	Types of fertilizer used last farming season	No. of bags used last farming season	Sources of the fertilizer used	Price per bag	Remarks (Cost and Quality)
1	Urea				
2	NPK				
3	SSP				
4	Manure				
5	Others (specify)				

17) How much did you spend on labour in the last tomato farming season?_____

18) How many basket of tomato did you get from your farm last year?_____

19) How much tomato to do you expect to harvest this year compared with last year?
a) Same as last year ( ); b) more than last year ( ); c) less than last year ( )

20) Why do you feel that way? _____
_____

21) How much did you sell a basket of tomato last farming season?_____

22) What is your own assessment of the quality of your tomato?
a) Very good ( ); b) Good ( ); c) Fair ( ); d) Poor ( )

23) What are the things that can be done to improve the quality of the tomato you produce on this farm?_____
_____

24) How many people do you have working on your farm besides yourself at
a) peak farming period: _____; b) slack farming period: _____

Section D: Sale and Marketing of Tomato Produced

25) Tick the appropriate option below that best represents how you dispose of the tomato you grow on your farm.
a) I take my tomato to the market for sale by myself ( ).
b) Buyers come to my farm to buy tomato ( ).
c) I sometimes take my tomato to the market and buyers also sometimes come to my farm to buy ( ).

26) Can you sell your tomato to just anyone directly, or you have to sell them through an appointed agent?
   a) I can sell to anyone directly ( ); b) I must sell through an appointed agent ( )

27) If you must sell through an agent, who appoints the agent, and do you have an input into the appointment of such agents? _____
   _____

28) Explain the advantages of selling your tomato directly by yourself._____
   _____
   _____

29) Explain the disadvantages of selling your tomato directly by yourself. _____
   _____
   _____

30) Explain the advantages of selling your tomato through an agent._____
   _____
   _____

31) Explain the disadvantages of selling your tomato through an agent. _____
   _____
   _____

32) Indicate below how your buyers pay for the tomato they buy from you.
   a) On a cash and carry basis, i.e. on the farm or at the market/point of sale ( )
   b) Payment is deferred, i.e. not on the farm or point of sale, but through a broker who pay sometime later in cash or through the bank ( )

33) Indicate who the major buyers of your tomato are.
   a) Consumers ( ) ; b) traders who resell the tomato ( ); processors ( )

Section E: Infrastructural and Institutional Support

34) Describe the present condition of the following infrastructural facilities that serve your farm:
   a) Roads: _____
   b) Transport services: _____
   c) Water supply infrastructure: _____
   d) Electricity supply: _____

35) Indicate the sources where you obtain credit for your farm operations annually.
   a) Bank (government assisted bank loans): ( )
   b) Bank (cooperative society assisted bank loans) ( )
   c) Direct cooperatives society loans ( )
   d) Others (Explain)_____
   e) No access to credit of any kind ( )

36) How many times a year do agricultural officers or extension workers normally visit your farm? _____

37) What types of services do the agricultural officers or extension workers undertook for you on your farm? _____

38) Do the services of the extension officers improve your tomato production?
a) Yes ( ) b) No ( )

39) Describe the measures being taken to ensure your tomato are of a high quality:_____

40) Describe the condition of the storage facilities available to you:_____
_____

Section F: SWOT

41) Strength: Describe the physical and human conditions that you consider to be favourable for tomato production in your area:_____
_____
_____

42) Weakness: Describe the physical and human conditions that you think may hinder tomato production in your area: _____
_____

43) Opportunities: Describe the things that are happening in this area, within Kano State and Nigeria at large that tomato farmers can take advantage of to boost their farming business_____
_____
_____

44) Threats: Describe the things that may hinder you as a tomato farmer from taking advantage of these opportunities: _____
_____
_____

45) Explain how can these problems be solved: _____
_____
_____

Appendix 1[B]

TOMATO MARKETERS QUESTIONNAIRE

To Whom It May Concern

Greetings. My name is Ibrahim Adamu Kabuga. I am a doctoral student in the Department of Geography of Ahmadu Bello University, Zaria. I am carrying out a research on the "value chain of irrigated tomato in Kano Sate". I humbly solicit your kind assistance requesting to you to provide as accurately as possible the information required in the questionnaire below. I give an undertaking that all the information you provide will be treated with strict confidentiality and will be used for academic purposes only.

Thank you for your anticipated support.

_____

Ibrahim Adamu Kabuga

Section A: Organization of Irrigated Tomato Marketing

1) Describe the specific functions you perform in the marketing of irrigated tomato: _____

_____

2) Describe the process one must go through in becoming a tomato trader performing the same functions like your own:_____

_____

_____

3) Do you have a tomato traders association in this area?

a) Yes ( ) b) No ( )

4) If yes above, what is the name of the association? _____

_____

5) Is membership of the association compulsory for all tomato traders performing your kind of functions?

a) Yes ( ) b) No ( )

6) What does membership of the association involve?

a) What do members do for the association?_____

_____

b) What benefits do member derive from the association? _____

_____

7) How many tomato traders do you think are in this area? _____

8) Indicate in Table 1 the various activities you perform in marketing tomato and types of technology you use in your work of marketing of tomato and their sources.

Table 1: Tomato marketing activities and technologies used

S/No.	Marketing activity	Technology used	Source of technology
1			
2			
3			
4			
5			

8) Indicate in Table 2 different categories of people that contribute in different ways to make your tomato marketing business successful.

Table 2: Categories of contributors to my irrigated tomato marketing

S/No.	Types of contributor	Specific things they do	Remarks (Sequence of their Activities and Relationship)
1			
2			
3			
4			
5			

9) Are the sequence of activities of these categories of people and their relationship working effectively?

a) Yes ( ) b) No ( )

10) What do you think is missing in the sequence of activities of actors and relationship?

_____

11) Where do you normally get your tomato you sell?

a) At farm ( ) b) In the market/bulking centre ( )

12) Name the places where do you sell your tomato?_____

13) How many baskets of tomato do you normally sell per day? _____

14) Explain how the business of tomato marketing is organized- the process of acquiring the tomato, different forms of organizing payment, organizing transportation, the link between marketers and farmers at the point of production or bulking centers and those in distant markets, et cetera: _____ _____

15) Explain the difficulties associated with marketing irrigated tomato: _____
_____

16) Who are the buyers of your tomato and where are they located? _____
_____

17) Indicate the price of buying tomato at the farm per basket?
a) At peak period of tomato _____
b) At slack period of tomato _____

18) What are the prices of selling to other buyers away from the farm?
a) At peak tomato period _____
b) At slack tomato period _____

19) How many people do you have working for you in your tomato marketing business?_

Section B:SWOT

20) Strength: Describe the physical and human conditions that you consider to be favourable for tomato marketing in your area:_____
_____
_____

21) Weakness: Describe the physical and human conditions that you think may hinder tomato marketing in your area: _____
_____

22) Opportunities: Describe the things that are happening in this area, within Kano State and Nigeria at large that tomato marketers can take advantage of to boost their marketing business_____
_____
_____

23) Threats: Describe the things that may hinder you as a tomato marketers from taking advantage of these opportunities: _____
_____
_____

24) Explain how these problems can be solved. _____
_____
_____
_____

Appendix I[C]

IRRIGATED TOMATO LABOURERS QUESTIONNAIRE

To Whom It May Concern

Greetings. My name is Ibrahim Adamu Kabuga. I am a doctoral student in the Department of Geography of AhmaduBelloUniversity, Zaria. I am carrying out a research on the "value chain of irrigated tomato in Kano Sate". I humbly solicit your kind assistance by requesting you to provide as accurately as possible the information required in the questionnaire below. I give an undertaking that all the information you provide will be treated with strict confidentiality and will be used for academic purposes only.

Thank you for your anticipated support.

_____

Ibrahim Adamu Kabuga

1) How many of you work on this farm? _____

2) Describe the process you went through to become a worker on this farm._____
_____
_____

3) Describe the types of work you do on this farm._____
_____

4) Do you work on other farms besides this one? Yes ( ); No ( )

5) How many hours do you work per day? _____

6) Are you paid hourly or daily? Hourly ( ); Daily ( )

7) Are you satisfied with the payment for your work? Yes ( ); No ( )

8) What areas do you consider need improvement to make your work satisfactory?
_____
_____

Appendix 1[D]

TOMATO PICKERS QUESTIONNAIRE

To Whom It May Concern

Greetings. My name is Ibrahim Adamu Kabuga. I am a doctoral student in the Department of Geography of AhmaduBelloUniversity, Zaria. I am carrying out a research on the "value chain of irrigated tomato in Kano Sate". I humbly solicit your kind assistance by requesting you to provide as accurately as possible the information required in the questionnaire below. I give an undertaking that all the information you provide will be treated with strict confidentiality and will be used for academic purposes only.

Thank you for your anticipated support.

_____

Ibrahim Adamu Kabuga

1) How many baskets of tomato can one person pick in one day?_____

2) How are you paid for your work, per day or per basket plucked?
   a) Per day ( ); b) Per basket ( )

3) How much are you paid
   Per day? (----------); or per basket (----------)

4) Are you satisfied with how much you are paid for you labour?
   a) Yes ( ); b) No ( )

5) Describe the challenges you face in the work you do._____
   _____
   _____

6) Explain any suggestions you have to improve your working condition ._____
   _____
   _____

Appendix 1[E]

TOMATO GRADERS QUESTIONNAIRE

To Whom It May Concern

Greetings. My name is Ibrahim Adamu Kabuga. I am a doctoral student in the Department of Geography of AhmaduBelloUniversity, Zaria. I am carrying out a research on the "value chain of irrigated tomato in Kano Sate". I humbly solicit your kind assistance by requesting you to provide as accurately as possible the information required in the questionnaire below. I give an undertaking that all the information you provide will be treated with strict confidentiality and will be used for academic purposes only.

Thank you for your anticipated support.

_____

Ibrahim Adamu Kabuga

1) Describe the professional training you have for the job of grading tomato _____ _

2) What methods/techniques do you use for the grading of tomato: _____ _____

3) How many baskets/tones of tomato can you grade per day?_____

4) How are you paid for the job, per hour or per day?
a) Per day ( ); b) Per day ( )

5) How much are you paid?
a) Per day (----------); b) Per hour (----------)

6) Are you satisfied with your pay?
Yes ( ); No ( )

7) What are the challenges you face in this work? _____ _____

8) Explain the suggestions you have to improve your working condition _____ _____

Appendix 1[F]

TOMATO LOADERS QUESTIONNAIRE

To Whom It May Concern

Greetings. My name is Ibrahim Adamu Kabuga. I am a doctoral student in the Department of Geography of AhmaduBelloUniversity, Zaria. I am carrying out a research on the "value chain of irrigated tomato in Kano Sate". I humbly solicit your kind assistance by requesting you to provide as accurately as possible the information required in the questionnaire below. I give an undertaking that all the information you provide will be treated with strict confidentiality and will be used for academic purposes only.

Thank you for your anticipated support.

_____

Ibrahim Adamu Kabuga

1) How many people does it take to load a 911 Lorry?_____

2) How many 911 Lorries can that number of people load in one day?_____

3) What technology do you use in loading tomato into Lorries? _____
   a. _____
   b. _____
   c. _____

4) How much are you paid per Lorry?_____

5) What months in the year would you consider as your busiest period for loading tomato?_____

6) How many Lorries does a group of loaders fill in a day in the busy months?_____
   _____

7) What months in the year would you consider as the slack period for loading tomato?
   _____

8) How many Lorries does a group of loaders fill in a day in the slack months? _____
   _____

9) Is there a difference in the amount paid for loading a Lorry in the busy and slack periods? _____

10) What aspect of tomato loading do you think need improvement?
    a. _____
    b. _____
    c. _____

11) What are your suggestions to improve the system?_____
    _____

Appendix 1[G]

TOMATO TRANSPORTERS QUESTIONNAIRE

To Whom It May Concern

Greetings. My name is Ibrahim Adamu Kabuga. I am a doctoral student in the Department of Geography of AhmaduBelloUniversity, Zaria. I am carrying out a research on the "value chain of irrigated tomato in Kano Sate". I humbly solicit your kind assistance by requesting you to provide as accurately as possible the information required in the questionnaire below. I give an undertaking that all the information you provide will be treated with strict confidentiality and will be used for academic purposes only.

Thank you for your anticipated support.

_____

Ibrahim Adamu Kabuga

1) Indicate the places you normally transport tomato to from here_____

2) How is the transport fare for transporting tomato from here to different destination fixed? _____

   a. _____
   b. _____
   c. _____

3) State how you are affected by these problem areas of transporting tomato:
   a. Cost of fuel _____
   b. Cost of spare parts _____
   c. Nature of roads _____
   d. Illegal taxes collected _____
   e. Others (specify) _____

4) What time of the day do you move your tomato and why? _____

5) What are your suggestions to improve the system?_____

Appendix 1^{H}

TOMATO EXTENSION OFFICERS QUESTIONNAIRE

To Whom It May Concern

Greetings. My name is Ibrahim Adamu Kabuga. I am a doctoral student in the Department of Geography of AhmaduBelloUniversity, Zaria. I am carrying out a research on the "value chain of irrigated tomato in Kano Sate". I humbly solicit your kind assistance by requesting you to provide as accurately as possible the information required in the questionnaire below. I give an undertaking that all the information you provide will be treated with strict confidentiality and will be used for academic purposes only.

Thank you for your anticipated support.

_____

Ibrahim Adamu Kabuga

1) Indicate the specific services you render to irrigated tomato farmers in Kano State

_____

_____

2) Who pays you for the services, the farmer or government? _____

3) In what specific ways have the tomato farmers benefitted from your services? ___

_____

_____

4) What challenges do you and the farmers face in making your services effective?__

_____

_____

5) What are your suggestions to make extension services to the tomato farmers more effective? _____

_____

_____

Appendix 1[I]

KNARDA AND HADEJIA JAMA'ARE RIVER BASIN DEVELOPMENT AUTHORITY QUESTIONNAIRE

To Whom It May Concern

Greetings. My name is Ibrahim Adamu Kabuga. I am a doctoral student in the Department of Geography of AhmaduBelloUniversity, Zaria. I am carrying out a research on the "value chain of irrigated tomato in Kano Sate". I humbly solicit your kind assistance by requesting you to provide as accurately as possible the information required in the questionnaire below. I give an undertaking that all the information you provide will be treated with strict confidentiality and will be used for academic purposes only.

Thank you for your anticipated support.

_____

Ibrahim Adamu Kabuga

1) How do you promote access of tomato growers to:
   a. Credit_____
   b. Herbicides_____
   c. Pesticides _____
   d. Fertilizers _____
   e. Modern farming equipments _____

2) What activities are you involve in to improve the practices of tomato farmers? ___
   _____

3) What are your efforts to improve the marketing of tomato grown in Kano State? __
   _____
   _____

4) What measures do you used in ensuring standard and quality control of the products?
   _____
   _____

5) Do you measure the quality and quantity of fertilizers used by farmers? _____
   _____

6) What are you doing to promote value addition to tomato grown in Kano State? ___
   _____

7) What are your suggestions to improve the business of growing and marketing of tomato in Kano State? _____
   _____

Appendix 1[J]

CHECKLIST QUESTIONS FOR FOCUS GROUP DISCUSSION WITH TOMATO FARMERS IN KANO STATE

To Whom It May Concern

Greetings. My name is Ibrahim Adamu Kabuga. I am a doctoral student in the Department of Geography of AhmaduBelloUniversity, Zaria. I am carrying out a research on the "value chain of irrigated tomato in Kano Sate". I humbly solicit your kind assistance by requesting you to provide as accurately as possible the information required in the questionnaire below. I give an undertaking that all the information you provide will be treated with strict confidentiality and will be used for academic purposes only.

Thank you for your anticipated support.

_____

Ibrahim Adamu Kabuga

1) What is the cost for clearing one acre of land? _____

2) What is the cost of harrowing one acre of land?_____

3) What is the cost of weeding an acre of land?_____

4) How many times do you weed an acre of land from planting to harvesting?_____

_____

5) What is the cost of spraying an acre of tomato?_____

6) How many times does it need praying before harvesting?_____

7) What are the periodic intervals of watering?_____

8) How many times does it need watering before harvesting?_____

9) What are the major transportation problems do you face as a tomato farmer?_____

_____

10) In what ways have scientific research findings benefitted your tomato farming business?_____

11) What are the contribution of research and development to your product? _____

_____

12) Indicate the specific Government policies that affected your tomato production activities: _____

13) Please indicate in the table below, the sources of the following farm inputs, their sources of supply quality and their prices.

Inputs	Source of suppliers	Quality	Prices
Tractors			
Urea			
NPK			
SSP			
Manure			

14) Do you consider the consumers' interest for your product?_____

15) What are the roles of middlemen in the marketing of your product? _____

16) What are the major obstacles to production and marketing of tomato do you face here?_____
_____

Appendix 1^{K}

CHECKLIST QUESTIONS FOR FOCUS GROUP DISCUSSION WITH TOMATO MARKETERS IN KANO STATE

To Whom It May Concern

Greetings. My name is Ibrahim Adamu Kabuga. I am a doctoral student in the Department of Geography of AhmaduBelloUniversity, Zaria. I am carrying out a research on the "value chain of irrigated tomato in Kano Sate". I humbly solicit your kind assistance by requesting you to provide as accurately as possible the information required in the questionnaire below. I give an undertaking that all the information you provide will be treated with strict confidentiality and will be used for academic purposes only.

Thank you for your anticipated support.

_____

Ibrahim Adamu Kabuga

1) What are the major problems of transportation of tomato in Kano State? _____

_____

2) How do government policies affect your tomato marketing business? _____

_____

3) In what ways do you consider the interest of tomato consumers in your tomato marketing decisions?_____

4) Identify the roles middlemen play in the marketing of tomato in Kano State: _____

_____

5) What are the major obstacles to the marketing of tomato in this area where you operate? _____

Appendix II

Names of Tomato Farmers Association

Below are some of the existing tomato farmers associations in the study areas:

- Karfi Tomato Fadama Users Association, Baure
- Bunkure Water users Cooperative Society Ltd., Watari
- Kunyu Sahara Water users Cooperative Society Ltd., Watari
- Janruwa Water Users Association, Watari
- Baujen Gabas Farmers Association, Watari
- Baujen Yamma Farmers Cooperative, Watari
- Baure Tomato Farmers Association
- Dadin Kowa Tomato Farmers Association, Watari
- Kai-da-naka Social Group
- Zango Dinya Farmers Cooperative, Watari
- Yan Rumfa Tomato Farmers Association
- Gargari Water Users Cooperative Society Ltd
- Bunkure Tomato Farmers Association
- Kulun Baki Producers Association
- Garun Malam Tomato Producers Association Cooperative
- Dandagana Farmers Cooperatives Society
- Lantage Tomato Farmers Cooperative Society
- Kanyan Adam Tomato Farmers and Dealers Association
- Fankurum Tomato Association Producer
- Turba Farmers Cooperative Society
- Farmers D. Kanya Cooperative Society
- Kura Development Area
    - Karfi ‘A’ Fadama Users Association
    - Karfi ‘B’ Fadama Users Association
    - Karfi ‘C’ Fadama Users Association
    - Karfi ‘D’ Fadama Users Association
    - Karfi Water Users Association
    - Karfi Kwarin Dangana Fadama Users Association
    - Kawa Rugar Duka Fadama Users Association
    - Bawar Kwari Fadama Users Association

- Gundutse Zango Fadama Users Association
- Gundutse Gidan Harama Fadama Users Association
- Gundutse Zango Fadama Users Association
- Gundutse Rimi Fadama Users Association
- Gundutse Sabon Gari ‘A’ Fadama Users Association
- Gundutse Sabon Gari ‘B’ Fadama Users Association
- Gamadan Rimi ‘A’ Fadama Users Association
- Gamadan Rimi ‘B’ Fadama Users Association
- Yan Nafake Fadama Users Association
- Tofa Karofi Fadama Users Association
- Gwabare ‘A’ Fadama Users Association
- Gwabare ‘B’ Fadama Users Association
- Gwabare ‘C’ Fadama Users Association
- Dukawa Sabuwar Ganuwa Fadama Users Association
- Kunshama Kwari Fadama Users Association
- Kunshama Kuka Fadama Users Association
- Dan Hassan Shimar Fadama Users Association

- Garun Malan Development Area

  - Garun Babba Cikin Gari Fadama Users Association
  - Yanaba Fankurun Fadama Users Association
  - Jobawa Cikin Gari Fadama Users Association
  - Lanjan Jobawa Fadama Users Association
  - Yaule Jobawa Fadama Users Association
  - Zango Jobawa Fadama Users Association
  - Yashin Maraya Fadama Users Association
  - Kadawa Kofar Fada Multipurpose Association
  - Kadawa Tsigi Multipurpose Association
  - Kadawa Koki Onion Fadama Farmers Association
  - Kadawa Elders Multipurpose Association
  - Kadawa Quarters Youth Farmers Association
  - Dakasoye Taimakon Water Users
  - Kadawa Fadama Farmers Association
  - Sabon garin Kadawa Fadama Farmers Association

- Kadawa Gate Fadama Farmers Association
- Kadawa Zango Water Users Association
- Yadakwari Chedi Fadama Farmers Association
- Chiromawa Kofar Arewa Fadama Farmers Association
- Unguwar Kasco (Chiromawa) Fadama Farmers Association
- Chiromawa Kwari Fadama Farmers Association

Source: Fieldwork, (2013)

Appendix III

Computation of the Cost of Irrigated Tomato Production Per Hectare

Farm Activity	Minimum Cost of Activity	Maximum Cost of Activity
Land Preparation: c) Land clearing d) Harrowing	₦6,875.00 ₦10,000.00	₦9,375.00 ₦15,000.00
Planting of tomato	₦5,000.00	₦6,250.00
Weeding	₦10,625.00 x 2 times (₦21,250.00)	₦21,250.00 x 2 times (₦42,500.00)
Water charges	₦2,500.00	₦2,500.00
Fertilizer cost	₦4,500.00 x 7½ bags (₦33,750.00)	₦5,600.00 x 7½ bags (₦42,000.00)
Fertilizer application and watering	₦5,000.00	₦5,000.00
Cost of spraying	₦4,625.00 x 3 times (₦13,875.00)	₦6,875.00 x 3 times (₦20,625.00)
Harvesting	₦40 x No. of Baskets Per hectare a) ₦40 x 200 baskets = (₦8,000.00) b) ₦40 x 375 baskets = (₦15,000.00)	₦60 x No. of Baskets Per hectare a) ₦60 x 200 baskets = (₦12,000.00) b) ₦60 x 375 baskets = (₦22,500.00)
Baskets	₦80 per empty basket a) ₦80 x 200 baskets = (₦16,000.00) b) ₦80 x 375 baskets = (₦30,000.00)	₦100 per empty basket a) ₦100 x 200 baskets = (₦20,000.00) b) ₦100 x 375 baskets = (₦37,500.00)
Transportation	₦100 x No. of Baskets Per hectare a) ₦100 x 200 baskets = (₦20,000.00) b) ₦100 x 375 baskets = (₦37,500.00)	₦200 x No. of Baskets Per hectare a) ₦200 x 200 baskets = (₦40,000.00) b) ₦200 x 375 baskets = (₦75,000.00)
Land rental charges	₦25,000.00	₦37,500.00
Total cost	a) ₦157,250 for 200 baskets	a) ₦237,750 for 200 baskets
	b) ₦198,875 for 375 baskets	b) ₦306,375 for 375 baskets

Source: Fieldwork, (2013)

Appendix IV

Computation of the Average Farm Gate Price of Tomato per Basket (30kg) and per Hectare by Farmers

S/N	Month	Minimum Selling Price Per Basket	Maximum Selling Price Per Basket
1	March	₦400 per basket a) ₦400 x 200 baskets = (₦80,000.00) b) ₦400 x 375 baskets = (₦150,000.00)	₦900 per basket i) ₦900 x 200 baskets = (₦180,000.00) ii) ₦900 x 375 baskets = (₦337,500.00)
2	April	₦1,000 per basket a) ₦1,000 x 200 baskets = (₦200,000.00) b) ₦1,000 x 375 baskets = (₦375,000.00)	₦1,200 per basket i) ₦1,200 x 200 baskets = (₦240,000.00) ii) ₦1,200 x 375 baskets = (₦450,000.00)
3	Early May	₦1,500 per basket a) ₦1,500 x 200 baskets = (₦300,000.00) b) ₦1,500 x 375 baskets = (₦562,000.00)	₦2,000 per basket i) ₦2,000 x 200 baskets = (₦400,000.00) ii) ₦2,000 x 375 baskets = (₦750,000.00)
4	Late May	₦2,500 per basket c) ₦2,500 x 200 baskets = (₦500,000.00) d) ₦2,500 x 375 baskets = (₦937,500.00)	₦4,000 per basket i) ₦4,000 x 200 baskets = (₦800,000.00) ii) ₦4,000 x 375 baskets = (₦1,500,000.00)

Source: Fieldwork, (2013)

Appendix V

Computation of the Buying and Marketing Irrigated Tomato per 30kg Basket and per Hectare and Value Addition in Kano State

Month	Marketing Activity	Minimum Cost of Buying Tomato	Maximum Cost of Buying Tomato
March	Buying tomato	₦400 per basket ₦400 x 200 baskets (₦80,000)	₦900 per basket ₦900 x 200 baskets (₦180,000)
	Grading of tomato	₦20 per basket ₦20 x 200 baskets (₦4,000)	₦30 per basket ₦30 x 200 baskets (₦6,000)
	Loading of tomato	₦20 per basket ₦20 x 200 baskets (₦4,000)	₦30 per basket ₦30 x 200 baskets (₦6,000)
	Transportation	₦100 per basket ₦100 x 200 baskets (₦20,000)	₦200 per basket ₦200 x 200 baskets (₦40,000)
	Sub-Total	**₦108,000**	**₦232,000**
April	Buying tomato	₦1,000 per basket ₦1,000 x 200 baskets (₦200,000)	₦1,200 per basket ₦1,200 x 200 baskets (₦240,000)
	Grading of tomato	₦20 per basket ₦20 x 200 baskets (₦4,000)	₦30 per basket ₦30 x 200 baskets (₦6,000)
	Loading of tomato	₦20 per basket ₦20 x 200 baskets (₦4,000)	₦30 per basket ₦30 x 200 baskets (₦6,000)
	Transportation	₦100 per basket ₦100 x 200 baskets (₦20,000)	₦200 per basket ₦200 x 200 baskets (₦40,000)
	Sub-Total	**₦228,000**	**₦292,000**
Early May	Buying tomato	₦1,500 per basket ₦1,500 x 200 baskets (₦300,000)	₦2,000 per basket ₦2,000 x 200 baskets (₦400,000)
	Grading of tomato	₦20 per basket ₦20 x 200 baskets (₦4,000)	₦30 per basket ₦30 x 200 baskets (₦6,000)
	Loading of tomato	₦20 per basket ₦20 x 200 baskets (₦4,000)	₦30 per basket ₦30 x 200 baskets (₦6,000)
	Transportation	₦100 per basket ₦100 x 200 baskets (₦20,000)	₦200 per basket ₦200 x 200 baskets (₦40,000)
	Sub-Total	**₦328,000**	**₦452,000**

Month	Marketing Activity	Minimum Cost of Buying Tomato	Maximum Cost of Buying Tomato
Late May	Buying tomato	₦2,500 per basket ₦2,500 x 200 baskets (₦500,000)	₦3,000 per basket ₦3,000 x 200 baskets (₦600,000)
	Grading of tomato	₦20 per basket ₦20 x 200 baskets (₦4,000)	₦30 per basket ₦30 x 200 baskets (₦6,000)
	Loading of tomato	₦20 per basket ₦20 x 200 baskets (₦4,000)	₦30 per basket ₦30 x 200 baskets (₦6,000)
	Transportation	₦100 per basket ₦100 x 200 baskets (₦20,000)	₦200 per basket ₦200 x 200 baskets (₦40,000)
	Sub-Total	**₦528,000**	**₦652,000**

Source: Fieldwork, (2013)

Appendix VI

Computation of the Buying and Marketing Irrigated Tomato per Basket (30kg) and Value Addition in Southern Nigeria

Month	Marketing Activity	Minimum Cost of Buying Tomato	Maximum Cost of Buying Tomato
March	Buying tomato	₦400 per basket ₦400 x 200 baskets (₦80,000)	₦900 per basket ₦900 x 200 baskets (₦180,000)
	Grading of tomato	₦20 per basket ₦20 x 200 baskets (₦4,000)	₦30 per basket ₦30 x 200 baskets (₦6,000)
	Loading of tomato	₦8,000 per lorry (flat rate)	₦8,000 per lorry (flat rate)
	Transportation	₦1,000 per basket ₦1,000 x 200 baskets (₦200,000)	₦1,500 per basket ₦1,500 x 200 baskets (₦300,000)
	Sub-Total	**₦292,000**	**₦494,000**
April	Buying tomato	₦1,000 per basket ₦1,000 x 200 baskets (₦200,000)	₦1,200 per basket ₦1,200 x 200 baskets (₦240,000)
	Grading of tomato	₦20 per basket ₦20 x 200 baskets (₦4,000)	₦30 per basket ₦30 x 200 baskets (₦6,000)
	Loading of tomato	₦8,000 per lorry (flat rate)	₦8,000 per lorry (flat rate)
	Transportation	₦1,000 per basket ₦1,000 x 200 baskets (₦200,000)	₦1,500 per basket ₦1,500 x 200 baskets (₦300,000)
	Sub-Total	**₦412,000**	**₦554,000**
Early May	Buying tomato	₦1,500 per basket ₦1,500 x 200 baskets (₦300,000)	₦2,000 per basket ₦2,000 x 200 baskets (₦400,000)
	Grading of tomato	₦20 per basket ₦20 x 200 baskets (₦4,000)	₦30 per basket ₦30 x 200 baskets (₦6,000)
	Loading of tomato	₦8,000 per lorry (flat rate)	₦8,000 per lorry (flat rate)
	Transportation	₦1,000 per basket ₦1,000 x 200 baskets (₦200,000)	₦1,500 per basket ₦1,500 x 200 baskets (₦300,000)
	Sub-Total	**₦512,000**	**₦714,000**

Month	Marketing Activity	Minimum Cost of Buying Tomato	Maximum Cost of Buying Tomato
Late May/June	Buying tomato	₦2,500 per basket ₦2,500 x 200 baskets (₦500,000)	₦3,000 per basket ₦3,000 x 200 baskets (₦600,000)
	Grading of tomato	₦20 per basket ₦20 x 200 baskets (₦4,000)	₦30 per basket ₦30 x 200 baskets (₦6,000)
	Loading of tomato	₦8,000 per lorry (flat rate)	₦8,000 per lorry (flat rate)
	Transportation	₦1,000 per basket ₦1,000 x 200 baskets (₦200,000)	₦1,500 per basket ₦1,500 x 200 baskets (₦300,000)
	Sub-Total	**₦712,000**	**₦914,000**

Source: Fieldwork, (2013)

Appendix VII

Computation of the Minimum and Maximum Selling Prices of Irrigated Tomato and Margins of Marketers within Kano State

Months	Minimum Investment of Marketers (₦)	Maximum Investment of Marketers (₦)	Minimum Price of Selling in (₦)	Maximum Price of Selling in (₦)	Minimum Margin in (₦)	Maximum Margin in (₦)
March	₦108,000	₦232,000	₦1,000 x 200 baskets (₦200,000)	₦1,200 x 200 baskets (₦240,000)	₦92,000	₦8,000
April	₦228,000	₦292,000	₦1,500 x 200 baskets (₦300,000)	₦2,000 x 200 baskets (₦400,000)	₦72,000	₦108,000
Early May	₦328,000	₦452,000	₦2,500 x 200 baskets (₦500,000)	₦3,000 x 200 baskets (₦600,000)	₦172,000	₦148,000
Late May	₦528,000	₦652,000	₦3,500 x 200 baskets (₦700,000)	₦4,500 x 200 baskets (₦900,000)	₦172,000	₦248,000

Source: Fieldwork, (2013)

Appendix VIII

Computation of the Minimum and Maximum Prices of Selling Irrigated Tomato and Margins of Marketers in Southern Nigeria

Months	Minimum Investment of Marketers (₦)	Maximum Investment of Marketers (₦)	Minimum Price of Selling in (₦)	Maximum Price of Selling in (₦)	Minimum Margin in (₦)	Maximum Margin in (₦)
March	₦292,000	₦494,000	₦2,000 x 200 baskets (₦400,000)	₦3,000 x 200 baskets (₦600,000)	₦108,000	₦106,000
April	₦412,000	₦554,000	₦3,500 x 200 baskets (₦700,000)	₦4,500 x 200 baskets (₦900,000)	₦288,000	₦346,000
Early May	₦512,000	₦714,000	₦5,000 x 200 baskets (₦1,000,000)	₦6,500 x 200 baskets (₦1,300,000)	₦488,000	₦586,000
Late May	₦712,000	₦914,000	₦8,000 x 200 baskets (₦1,600,000)	₦10,000 x 200 baskets (₦2,000,000)	₦888,000	₦1,086,000

Source: Fieldwork, (2013)