

UNIVERSITY FOR DEVELOPMENT STUDIES

**SOCIO ECONOMIC FACTORS INFLUENCING TOMATO SUPPLY AND
CONSUMPTION IN THE TAMALE METROPOLIS, GHANA**

YAKUBU HAMZA

2017



UNIVERSITY FOR DEVELOPMENT STUDIES

**SOCIO ECONOMIC FACTORS INFLUENCING TOMATO SUPPLY
AND CONSUMPTION IN THE TAMALE METROPOLIS, GHANA**

BY

YAKUBU HAMZA (BA. IDS – ECONOMICS

AND ENTREPRENEURSHIP OPTION)

(UDS/MEC/0029/14)

**THESIS SUBMITTED TO THE DEPARTMENT OF AGRICULTURAL
AND RESOURCE ECONOMICS, FACULTY OF AGRIBUSINESS AND
COMMUNICATION SCIENCES, UNIVERSITY FOR DEVELOPMENT
STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE AWARD OF MASTER OF PHILOSOPHY DEGREE IN
AGRICULTURAL ECONOMICS**

JANUARY, 2017



DECLARATION

Candidate's Declaration

I hereby declare that this dissertation is the result of my own original work and that no part of it has been presented for another degree in this University or elsewhere.

Candidate's Signature Date

Yakubu Hamza

Supervisors' Declaration

We hereby declare that the preparation and presentation of this thesis was supervised in accordance with the guidelines on supervision of thesis laid down by the University for Development Studies.

Principal Supervisor's Signature: Date

Dr. Samuel A. Donkoh

Co-Supervisor's Signature: Date

Madam Edinam Dope Setsoafia



ABSTRACT

This study assesses the socio economic factors influencing tomato supply and consumption in the Tamale Metropolis. Specifically, the study sought to determine the factors influencing the adoption of dry season tomato production, estimate the gross margins at each stage of the tomato value chain and analyze the perceptions and factors influencing consumers' choice of the type of tomato, among others. A cross sectional data was collected from three hundred and fifty major actors during the 2015 farming season. The method of analysis involved an estimation of a probit model, the use of simple mathematical computations and descriptive statistics. Results from the probit estimation revealed that, access to irrigation facilities and credit positively influenced farmers' decision to go into dry season tomato farming. However, age, farm size, among others negatively influenced farmers. Along the chain, wholesalers made GHC 3,600 per season, the highest gross margin. Closely followed are farmers from Techiman and its surroundings with an estimated GHC 3,195.42 gross margins per farm. The retailers and farmers from Upper East made the lowest gross margin of GHC 1,260 and GHC 1,246.08 respectively and yet recorded the highest post-harvest losses. Among consumers, the fluctuating nature of prices of fresh tomatoes with seasons greatly influenced their choice and preference for the varieties and types of tomatoes. The study concludes, by arguing that; the wholesalers' involvement in the chain is crucial to the survival of the trade. It recommends that government should increase farmers' access to credit and irrigation by building more irrigational facilities.



ACKNOWLEDGEMENTS

I give thanks to the almighty Allah for his guidance and protection throughout this research. My sincere and deepest gratitude goes to my principal supervisor, Dr. Samuel A. Donkoh, for his guidance and support through the entire course. You will forever remain an inspiration to me.

To my co-supervisor, Madam Edinam Dope Setsoafia, I say a big thank you for the attention and patience! Your supervision and guidance print an indelible mark of remembrance. I will forever be grateful. To all the senior and junior members of the department, I am grateful for your moral support.

My appreciation would be incomplete without thanking Urban FoodPlus (UFP) for the financial and technical support. To Miss Hanna Karg and Mr. Edward Danso, I say thank you for your useful and instrumental comments!

My very final appreciation goes to my family for their support and care throughout this research period.



DEDICATION

This work is dedicated to my supervisors, my family and all friends.



TABLE OF CONTENTS

DECLARATION	i
ABSTRACT	ii
ACKNOWLEDGEMENTS	iii
DEDICATION	iv
TABLE OF CONTENTS	v
LIST OF TABLES	ix
LIST OF FIGURES	x
ACRONYMS	xi
CHAPTER ONE	1
INTRODUCTION	1
1.0 Background of the Study	1
1.1 Problem Statement	2
1.2 Research Questions	3
1.3 Research Objectives	4
1.3.1 Main Objectives	4
1.3.2 Specific Objectives of the Research	4
1.4 Justification	4
1.5 Organization of the Study	5
CHAPTER TWO	6
LITERATURE REVIEW	6
2.0 Introduction	6
2.1 Overview of the Tomato Industry	6
2.2 Tomato Production	8
2.2.1 Global Tomato Production	8
2.2.2 Tomato Production in Ghana	9
2.2.3. Dry Season Tomato Production in Ghana	12
2.3 Tomato Marketing Systems	12
2.3.1 Marketing System in Ghana	14
2.4 Tomato Consumption in Ghana	17
2.4.1 Domestic and Public Consumption of Tomatoes in Ghana	18



2.5.1 Factors Influencing Consumer Choice of the type of Tomato	18
2.5.2 Consumer Behaviour.....	19
2.5.3 Consumer Perception	20
2.5.4 Consumers' Choice of Tomatoes	20
2.6.0 Actors along the Tomato Value Chain	21
2.6.1 Tomato Producers	22
2.6.2 Tomato Market Queen	23
2.6.3 Tomato Retailers	24
2.6.4 Tomato Consumers	25
2.7 Post Harvest Losses in the Tomato Industry	25
2.7.1 Tomato Pricing	27
2.7.2 Gross Margins	28
2.8 Tomato Value Chain.....	30
2.8.1 Inputs Supply along the Value Chain	32
2.8.2 Tomato Processing Along the Value Chain	33
2.8.3 Sale Outlets of Fresh and Processed Tomato Products along the Value Chain.....	36
CHAPTER THREE.....	37
STUDY METHODOLOGY.....	37
3.0 Introduction.....	37
3.1 Study Area	37
3.1.1 Tamale Metropolis	38
3.1.2 Techiman and its Surroundings.....	39
3.1.3 Kassena Nankana and Bongo Districts	40
3.2 Data Collection	41
3.2.1 Sample size.....	41
3.2.2 Sampling Tools and Techniques	42
3.2.3 Data Collection Procedure	43
3.2.4 Pre-testing Data collection Tools	44
3.2.5 Data Cleansing	44
3.3 Data Analyses	45
3.4 Theoretical Framework of Qualitative Choice Modeling.....	45
3.4.1 The Probit Model	47



3.4.2 The Empirical Model of Factors Influencing the Adoption of Dry Season Farming of Tomatoes.....48

3.4.3 Empirical Model of Factors Affecting a Consumers preference of the type of Tomatoes to Buy with Season.....50

CHAPTER FOUR52

RESULTS PRESENTATION AND DISCUSSIONS52

4.0 Introduction.....52

4.1 Demographic Characteristics of Respondents52

4.1.2 Sex of respondents52

4.1.3 Educational level of respondents53

4.1.4 Marital status of respondents53

4.1.5 Age of respondents.....54

4.2 Factors Affecting the Adoption of Dry Season Tomato Farming56

4.3 Sources of Tomato Supply into the Tamale markets.....58

4.3.1 The Upper East and Burkina Faso Supply Source59

4.3.2 The Techiman and its Surroundings Season60

4.3.4 Tamale and its adjoining communities’/ Domestic Supply source61

4.3.5 Tomato Marketing in the Tamale Metropolis63

4.3.5.1 Marketing characteristics of wholesalers in the Tamale Markets63

4.3.5.2 Marketing characteristics of Retailers in the Tamale Markets .64

4.4 Gross Margins of Actors along the Tomato Value Chain66

4.4.1 Producer Gross Margins.....67

4.4.2 Wholesalers Gross Margins69

4.4.4 Gross Margins of the Actors along the Chain.....71

4.5 Magnitude of Post-Harvest Losses among Actors.....72

4.5.1 Partial losses.....72

4.5.2 Complete losses.....73

4.5.3 Post-Harvest Losses among Farmers73

4.5.4 Post-Harvest Losses among Wholesalers.....74

4.5.6 Post-Harvest Losses among Retailers75

4.5.7 Effects of Post –Harvest Losses on Gross Margins78



4.6 The Rationale for a Regulated Tomato Market	79
4.6.1 The Queens Organized Routine trade trips	79
4.6.2 Demand and Supply of Tomatoes	79
4.6.3 The Risk associated with uncertain Demand	80
4.6.4 The Instrumental Role of the Queen in the Entire Chain.....	80
4.6.5 Does the Consumer Benefits during Gluts/excess supply?.....	81
4.6.6 Queens and Farmers' Relationship	82
4.7 The Perceptions and Factors Influencing Consumers' Choice and preference.....	82
4.7.1 Consumer Perception	82
4.7.2 Consumer Perception Based On Quality.....	83
4.7.3 Perception of consumers based on price	84
4.7.4 Factors Influencing Consumer Choice.....	85
4.7.5 Frequency of Tomato consumption	86
4.7.5.1 Frequency of Consumption across Seasons.....	86
4.7.6 Fresh and Tin Tomatoes as substitutes and complements	87
4.8 Consumer Choice or Preference between Fresh and Tin Tomatoes.....	88
CHAPTER FIVE	91
SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS	91
5.0 Introduction.....	91
5.1 Summary of Findings	91
5.2 Conclusions	93
5.3 Policy Recommendations	94
REFERENCES	95
APPENDICES.....	100
Appendix I Questionnaires.....	100
Appendix II Pictures from the field.....	117



LIST OF TABLES

Table 2.1: Transaction Cost, Average Wholesale Prices and Arbitrageur Profit Margins	30
Table 3.1: Study Area, Sample size and Technique.....	43
Table 4.1: Summary of the demographic characteristics of respondents.....	55
Table 4.2: Marginal effects After Probit Estimation of the factors influencing a farmer's decision to adopt dry season farming	58
Table 4.3: Producer variable cost, revenue and Gross Margins by Region per hectare	68
Table 4.4: Cost and Gross margins of Wholesalers	70
Table 4.5: Cost, revenue and gross margins of retailers	71
Table 4.6: Total Variable Cost, Revenue and Gross Margins of all Actors per season	72
Table 4.7: Post-harvest losses incurred by each Actor along the chain	75
Table 4.8: Perception of price of local tomatoes compared with the imported	84
Table 4.9: Marginal effects after probit estimations (consumers choice of the types of tomatoes i.e. the tomato paste and fresh tomatoes) ...	89



LIST OF FIGURES

Figure 2.1. Trend of Tomato Import in Ghana from 1991 to 2012.	14
Figure 2.2 Value chain of Tomato Industry.....	35
Figure 3.1 Map of the producing districts and Tamale metropolis.....	39
Figure 4.1 Supply Chain of Tomatoes into the Tamale Market	59
Figure 4.2 Sources of tomato supply into the Tamale markets all year	63
Figure 4.3 Gross Margins Among Actors.....	71
Figure 4.4 Categories of post-harvest losses among farmers.....	74
Figure 4.5 Categories of post-harvest losses Among Retailers.....	77
Figure 4.6 Magnitude of post-harvest losses among actors along the chain.	77
Figure 4.7 Effects of Post-Harvest losses on Margins.....	78
Figure 4.8 Perception of Consumers Based on Quality.....	84
Figure 4.9 Characteristics consumers consider when buying fresh tomatoes	86
Figure 4.10 Frequency of consumption of tomatoes per season	87



ACRONYMS

ACP	African Caribbean and Pacific
ERP	Economic Recovery Programme
FAO	Food and Agricultural Organisation
FAOSTAT	Food and Agricultural Organization Statistics
GSS	Ghana Statistical Service
GM	Gross Margin
ICOUR	Irrigation Company of the Upper Region
IFPRI	International Food Policy Research Institute
ILO	International Labour Organization
IRIN	Integrated Regional Information Network
MoFA	Ministry of Food and Agriculture
SAP	Structural Adjustment Programme
SRID	Statistical Research and information Directorate
TR	Total Revenue
TVC	Total Variable Cost
UNCTAD	United Nations Conference on Trade and Development



CHAPTER ONE

INTRODUCTION

1.0 Background of the Study

Tomato is one of the most important vegetables in the world, the production of which is believed to promote food and cash security. According to the FAOSTAT (2015), China is the leading producer of tomatoes, followed by the United States of America. Donkoh et al. (2013) noted that, the commercialization of the tomato industry was born out of the economic reforms and trade liberalization policy pursued by Ghana in early 1980's and stressed that, the commodity still remains one of the most important income generating vegetable crop in the country. The crop is cultivated continuously throughout the year because; apart from the rain-fed system that normally spans between June and November in the southern part of the country, there is the dry-season cultivation system between October and April. Despite the fact that the commodity is produced throughout the year, supply falls short of demand, resulting in importations to supplement the shortage.

The administration of the marketing systems is largely controlled by wholesalers described as the 'Market Queens'. According to Amikuzuno et al. (2015), these market queens determine the amount of tomato at all markets at any given time to enable them rip the benefits of scarcity of the products. Yakubu (2009) stressed that the market queens are the most powerful in the value chain of the product, determining the prices of the product at all levels. The market queens do not just control the farm gate prices but also the retail prices and for that matter the table/dinning prices of the products. These market queens act in a form of a cartel with very strong links in the marketing chain.



Like many other Ghanaian markets, prices of tomatoes in Tamale Markets peak at May-June and decline continuously until November (Amikuzuno and Donkoh, 2012). The seasonal variation in price is a direct result of the seasonal production of the product. The seasonal hikes in the price of the commodity lead to the substitution of the products by the relatively cheap tomato paste from China and other countries by consumers. Consumers prefer the paste to the fresh tomatoes during the dry season when prices are high. Inusah et al. (2013) estimate that the country imports 27,000 tonnes of tomato paste annually to augment the growing needs of the population.

Along the marketing chain, sorting and grading are done at the retailer levels where the consumers exhibit their choices and preferences (Yakubu, 2009), who intend express that to the market queens. The long chain eventually distorts the real choices of the consumer before it gets to the Ghanaian farmer. Signals from consumers with respect to quality, price, and quantities demanded, are not transmitted back along the value chain to the farmers (Robinson and Kolavalli 2010).

The Brong Ahafo Region is one of the most important tomato producing regions in the country (Amikuzuno et al., 2015). Techiman and its surrounding are the major suppliers of tomatoes to the Tamale Metropolis in the wet season while the Upper East Region and Burkina Faso supply the metropolis during the dry season.

1.1 Problem Statement

The agricultural production in the country mainly depends on the rain fed system. This affects various products in varied ways. For highly perishable products like tomatoes, the consistent existence of a mechanism to keep production all year round remains a necessary tool in keeping fresh tomatoes at the markets all year round. During the dry season the commodity is produced by a number of dry season



farmers in the country with majority of the produce imported from the Burkina Faso dry season irrigated farms to supplement the country's demand (Ihle and Amikuzuno 2009).

The prices of tomatoes from the farm gate to the markets and the extent to which an individual stakeholder in the value chain benefits largely varies with seasons as well as the power/influence in the commodity transmission across space/ distance to the final consumer (Amikuzuno et al 2015). It is often postulated that the queens exploit the fragile marketing system. However, the market queens deny this, stressing that, they do not get any substantial profit from their trade (Adimabuno, 2010).

Among consumers, Causse et al (2010) in a study of consumer preference for fresh tomatoes in Europe, discovered that different taste and texture was necessary in satisfying consumers. Although there are numerous studies around the globe on consumer preference, the consumption pattern and consumer preference remains largely uninvestigated in the Tamale Metropolis. The study therefore seeks to investigate the production, marketing and consumption aspects of the tomato value chain in the Tamale Metropolis.

1.2 Research Questions

The following research questions have been raised.

1. What factors influence the adoption of dry season tomato production?
2. What are the sources of tomato supply in the Tamale Metropolis?
3. What are the gross margins at each stage of the tomato value chain?
4. What is the magnitude of post-harvest losses at each stage of the chain?
5. What perceptions and factors influence consumers' choice of the type tomato?



1.3 Research Objectives

1.3.1 Main Objectives

To carry out a Socio economic analyses of factors influencing tomato supply and consumption in the Tamale Metropolis.

1.3.2 Specific Objectives of the Research

The specific objectives are to:

1. Determine the factors influencing the adoption of dry season tomato production;
2. Investigate the sources of tomato supply in the Tamale Metropolis;
3. Estimate the gross margins at each stage of the tomato value chain;
4. Assess the magnitude of post-harvest losses at each stage of the chain; and
5. Analyse the perceptions and factors influencing consumers' choice of the type of tomato.

1.4 Justification

Many research works have delved into the commodity's transmission, price differentials across markets as well as power and influence of actors along the chain. This research goes beyond the market actors to include consumers and the implications of the power along the chain among the actors. The work brings to the attention of policy makers and development practitioners some of the real challenges that affect the chain of transmission of the commodity from the farm gate to the consumers (dining table). The work would expose the powers embedded in the markets queen's cartel and its general implication on the future of the entire industry .The work help reveals the factors behind the decisions of consumers in their choices and the gross margins that the various actors make along the chain. The research is



expected not only to contribute to the policy direction in the implementation of strategic marketing systems in the industry but also to add to the existing literature.

1.5 Organization of the Study

The work was put into five chapters. Chapter one (as discussed earlier) included the background of the study, problem statement, research questions, research objectives and justification. Chapter two consist of literature review, this looks at both theoretical and empirical reviews relevant to the study. Chapter three embodied methodology used for the study. This included brief descriptions of the study area, sampling, theoretical framework and method of data analysis. Chapter four covered results presentation and discussions while the major findings, conclusions and recommendations are presented in Chapter five.



CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter presents a review of the theoretical and empirical literature related to the study. It specifically reviews literature on tomato production, globally and locally. It also reviews literature on the tomato marketing system with focus on the itinerant market queens and the retailers. Furthermore, literature related to human behaviour and perceptions of consumers are reviewed. The chapter ends with a review of literature on the tomato value chain.

2.1 Overview of the Tomato Industry

Tomato (*Solanum lycopersicum*) is a commodity produced, marketed and consumed worldwide. Tomato, popularly regarded as a vegetable, is classified by botanists as a fruit but nutritionally falls within the well-known vegetable class (Agriculture, Forestry and Fisheries Ministry, 2012). Globally, trade has grown over the last few decades (since 1960) largely in favour of non-traditional exports commodities in the agricultural sector. Trade among nations has largely grown in commodities such as fish, fruits, vegetables etc. in volume and value (Briones, 2013).

Developing economies throughout the globe are noted to be dependent on a rain fed agricultural system. Majority of African countries and for that matter Ghana, have their agricultural sector working below its potential (MoFA, 2013). In the case of Ghana, the introduction of Structural Adjustment Programme (SAP) had a big impact on the agricultural sector. Asuming-Brempong and Bruce (2004) reported



that, the programme impacted positively on traditional agricultural export sector, while the rest of the sectors suffered badly.

The most affected were the non-traditional agricultural products, with the worst hit being the tomato industry.

Donkoh et al. (2012) reported that, the liberalization of agricultural markets led to the collapse of the tomato sector. The importation of cheap tomato paste into the market eventually led to collapse of many tomato factories which could not withstand competition from abroad. The collapse of the industry led to a new regime described as the two stage marketing system. Ngeleza and Robinson, (2011) maintained that, in an effort by farmers to get their produce sold, the work of Market queens came in handy. This was because the collapsing factories had lost the capacity to give industry the “big demand” it badly needed to avoid gluts.

The emergence of the two stage marketing system was introduced to avert losses that may result due to delays. By this system, the commodity did not have to go through the usual agricultural commodity assembly markets where it took time to get to consumers. The commodity is thus assembled at farm gate and then transported directly to consumers without delays (Robinson and Kolavali, 2010). The earlier studies of Orchard and Suglo (1999) affirmed the importance of the two stage system for such highly perishable commodity but believes the fragmented price system lead to a faulty price adjustment across distance.

The supposed simple marketing system led to the concentration of power in the hands of middle actors described as itinerant market Queens (Ihle and Amikuzuno, 2009). The work of Yakubu (2009) cited by Robinson and Kolavalli (2010) revealed that, the queens are perceived to be the most powerful along the value chain. The



Tamale market remains the second largest destination for fresh tomatoes from Burkina Faso (Amikuzuno et al., 2015). Situated along the main Burkina-Ghana Trans highway, the metropolis, under a highly controlled Market queen cartel system receives tomato supplies from Burkina Faso in the lean season but conveniently shift to Brong Ahafo Region, Techiman and its surrounding to be precise during the May-December season when production picks up and trade becomes cheaper.

2.2 Tomato Production

This section looks at the tomato production from the global perspective to the local arena.

2.2.1 Global Tomato Production

The increased production of tomatoes has been as a result of diversification of many economies into production of non-traditional exports (Briones, 2013). Between 2000 and 2009, total production of tomatoes in the world had risen from 110,017,019 metric tonnes to 152,956,115 metric tonnes (UNCTAD, 2015). In the last few years, production of the commodity has received more attention resulting in a global increase in production. According to FAOSTAT (2015), global production of tomatoes stood at 163,963,770 metric tonnes in 2013. Today, China has emerged as the leader in tomato production, closely followed by the USA, Turkey, India and Egypt. The United Kingdom however, has the highest output per hectare in the world (FAOSTAT, 2015).

In Africa, an estimated 18,648,548 metric tonnes was produced in 2013 representing about 12% of the world's production. North Africa recorded the highest production, with an estimated 12,753,255 metric tonnes, out of which Egypt produced an



estimated 10, 000,000 metric tonnes. Till today, Egypt remains the leading producer in the continent. West Africa placed second, producing 2,744,905 tons, East Africa, Central and Southern African followed with 1,544,766, 1,026,113, 579,509 metric tonnes respectively (FAOSTAT, 2015). According to UNCTAD (2015), Nigeria is the leading producer of tomatoes in West Africa, producing between 1,000,000 - 2,000,000 tons of tomatoes in 2009 and placing first among the African, Caribbean and Pacific (ACP) countries whilst Ghana placed eighth.

2.2.2 Tomato Production in Ghana

Agricultural production in Ghana is generally characterized by small scale farming with high incidence of market failures and other negative factors which lead to low yields. The Ministry of Food and Agriculture reported that, tomato is cultivated on an estimated 50,000 hectares of land with its production standing at 48% of its achievable yield (MoFA, 2013). In Ghana, emphasis on non-traditional exports became prominent after the Structural Adjustment Programmeme (SAP) had greatly affected the sector (Asuming-Brempong and Bruce, 2004). Ghana, produced approximately 200, 000 to 250, 000 metric tonnes of tomatoes between 2008 and 2009 (UNCTAD 2015). By the close of 2013 season, Ghana had hit a production level of 340,218 metric tons (FAOSTAT, 2015).

Although information on general yields in the sector is sketchy, it is obvious the sector records low yields (Al-hassan and Diao, 2007). A study by IFPRI (2008) revealed that, although natural hindering factors generally affect agriculture in Ghana, the vegetable sector suffers the most. Surprisingly, the recent work of Donkoh et al. (2012) revealed that, tomato producers in the Upper East Region of



Ghana are technically efficient. Although technical efficiency does not generally mean high yield, the former leads to the latter.

The history of commercial tomato production in Ghana dates back to the 1960s (Donkoh et al., 2012), for instance, the Veia Irrigation Project was built in 1965 to enable commercial production of many agricultural commodities including tomatoes. By 1980, Ghana had constructed a number of tomato processing factories for its expanding industry. Donkoh et al., (2012) again observed that, the move had strategically reduced power and exploitation by the market Queens, since many of the farmers were engaged in contract farming with these factories.

The establishment of the Pwalugu Tomato Factory was to strategically give the Tono and Veia irrigation scheme a ready market for its output (ICOUR, 1995). In the same vein, the establishment of the Tomacan tomato factory at Wenchi was to help boost production at Brong Ahafo and its catchment areas likewise the Techiman Tomato processing factory.

Ochieng and Sharma (2005) as cited by Adimabuno (2010), argued that the sector was so viable that people in the Upper East Region preferred tomato production to other crops such as maize, rice, groundnuts, yam among others. Many communities that were engaged in tomato farming generally had increased access to commodities such as motorbikes, bicycles etc. (Laube, 2005). Adimabuno (2010) observed that the cultivation of tomatoes was hailed by all in the community and remained an attractive venture. In view of the numerous benefits that accompanied tomato production, described as the red gold of Upper East Region, many other communities, even without access to water sources, had to engage in shallow wells dug out just to benefit from the industry (Blench, 1999).



The tomato industry remained an enviable sector until the nation under the pressure of economic meltdown signed unto the Structural Adjustment /Economic Recovery Programme (SAP/ERP). The introduction of SAP/ERP, which led to the eventual privatization of many state enterprises including the tomato factories marked the beginning of the failure of the tomato industry (Asuming-Brempong and Bruce, 2004; Robinson and Kolavalli 2010, Donkoh and Amikuzuno 2012).The scraping of tariffs led to flooding of the Ghanaian markets with cheap tomato paste, it is estimated that between 1993 and 2003, tomato paste imports had increased by 628% from 3,713 tonnes to 27,015 tonnes (Donkoh et al., 2012).

Konings (1981), remarked that, many of these factories began to face technical problems, input shortages, which badly affected productions. The removal of import tariffs and scraping of subsidies further worsen the woes of the industry. Farmers had to produce at a high cost, while the factories which were no longer protected faced stiffer competitions. This led to a massive reduction in the aggregate demand for the fresh product as well as production. The end result was the collapse of many of these factories, leaving peasant farmers to the mercy of any trader willing to buy this highly perishable product. The farmers had produce but the factories which one time provided the “big demand” could not buy any more, leading to huge losses on the part of farmers.

A documentary by Aljazeera (2008), shockingly revealed that, Aolja Tenitia - 2007 Best farmer was no longer into tomato production because of the deficient demand for the produce at farm gate level. She explains,



"I don't grow tomatoes anymore. I wouldn't know who to sell them to." The one time best farmer award winner was now reduced to a mere subsistent farmer, buried in debt.

2.2.3. Dry Season Tomato Production in Ghana

Generally, due to the lack of storage facilities for tomatoes in the country, coupled with its highly perishable nature, the product is usually marketed and consumed immediately after harvesting. However, due to the rain fed dependent nature of the agricultural system in the country, the commodities production is highly seasonal. During the raining season the country has enough rainfall to produce to meet the demand of the domestic markets.

During the dry season, the country depends on the few irrigated schemes across the country for tomatoes. Robinson and Kolavalli (2010a) asserted that, the country heavily relies on the Upper East and Burkina Faso irrigation schemes to supply the product between January and May. The southern belts dual (bi modal) raining season, (i.e. First season) then picks up the supply needs of the country after the Upper East/Burkina Faso season fades. In the Northern Region however, which has a single raining season, production and supply of the product starts in July/August to September. The second raining season of the southern belt together with the greater Accra Region irrigated schemes continue to supply the country later in the year until the Upper East and Burkina Faso season sets in again.(ibid).

2.3 Tomato Marketing Systems

The liberalization of markets has led to a worldwide increased market access and trade among nations. Exports and imports of the commodity have since been increasing. Mexico, the world's largest exporter of tomato as at 2011, exported

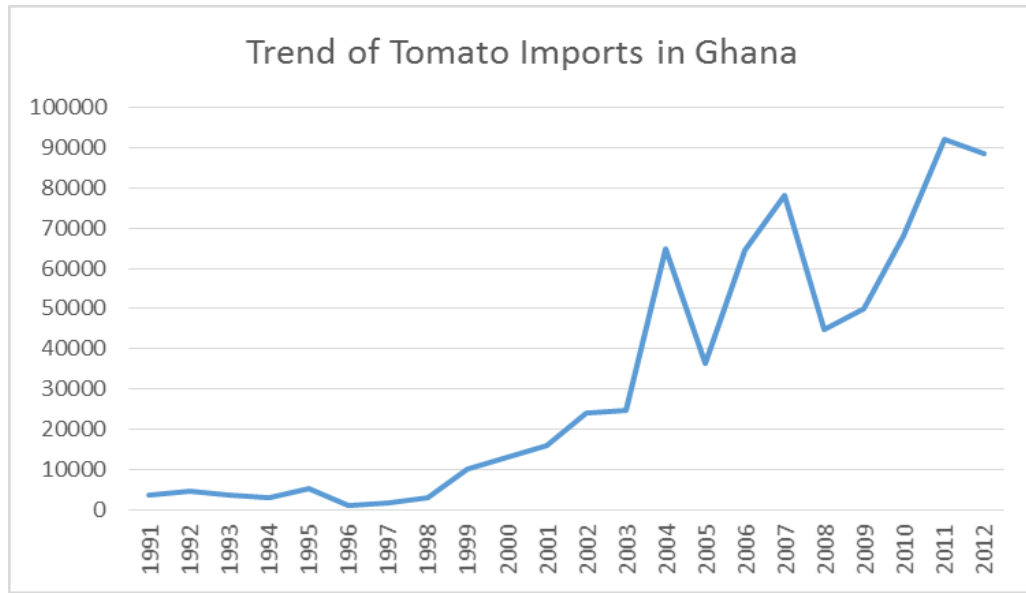


1,493,316 tonnes representing 25.2% of the world's tomato export market share. Accordingly, Netherlands and Spain followed with 18.5% and 14.1% of the world market share respectively (Agriculture, Forestry and Fisheries Ministry, South Africa, 2012). Morocco placed fourth in the chart, although had lost its share from an initial 7% down by 1.6%. Despite this decline, Morocco still remains the leading exporter of the product in Africa (ibid).

The emergence of the Chinese tomato market is however worth mentioning. Between 1989 and 1999, the Chinese tomato market contributed about 3% to the total tomato export industry. By 2005, the Chinese share of the world's export market had more than triple to an estimated 10% (FAOSTAT, 2005). The trade in fresh tomatoes is however more among neighboring countries. Due to the perishable nature of the product, it pays to trade within relatively short distances. In addition, trade among neighboring countries stimulates tariff advantages as well as foster friendly relationship among trading countries. For instance, South Africa remains the leading exporter of tomatoes to its neighbour Mozambique, Kenya exports as well to Tanzania. In the West African sub Region, Burkina Faso, is another exporter to Ghana (UNCTAD, 2015). The imports of tomatoes into the country, has been on a rise since 2001. The removal of import tariffs triggered the flooding of Ghanaian markets with tomato paste. Between 1991 and 1999 the country imported less than 10,000 tonnes of tomato paste. The importation of the product began to rise steadily between 2001 and 2005. Between 2003 and 2004, the country recorded a very sharp rise in tomato imports, only to fall drastically in 2005, since then, the importation has been quite unstable, although it continues to rise generally. Figure 2.1 below, describes the pattern of tomato paste imports into the country between 1991 and 2012.



Figure 2.1. Trend of Tomato Import in Ghana from 1991 to 2012.



Source: FAO, 2015

Currently, the country imports over 90,000 tonnes of tomato paste (FAO, 2015). China is the leading exporter of tomato paste into the country, exporting about 45,342 tonnes, closely followed by Italy (ibid), which until 2007 had dominated the Ghanaian tomato export markets occupying the number-one position for about a decade. Portugal and Netherlands follow respectively (FAOSTAT 2015). While there are very scanty records on exports of the products in the country, Robinson and Kolavali (2010) discovered that, out of the 99 farmers interviewed during their study, only one farmer sold to traders from Cote D’voire whilst seven had ever sold to a trader from Togo. Majority of the product produced in the country is therefore consumed locally in the country.

2.3.1 Marketing System in Ghana

The marketing system of agricultural products in Ghana, goes through the assembly markets and through a number of relay market before it gets to the final consumer. However, many vegetables are by nature perishable, hence the need for ready



demand system. Before Ghana joined SAP/ERP, the tomato factories operated quite well demanding/buying off what was produced all the time.

The sudden collapse of the immediate demand side of the industry led to the dominance of market queen from Southern Ghana. These traders were like “Messieurs” to producers since their intervention rescued the ailing markets system. The producers at the time were ready to give out their harvest at any price to the market queens than to allow it rot.

As time passed, these traders established strong acquaintances that eventually evolved into the cartel system today (Ngezela and Robinson, 2011). The intervention of Market Queens led to what is described by Robinson and Kolavalli (2010) as the two stage marketing system. By this system, the queen took the risk and pain of locating farms and subsequently bearing the entire risk after harvest, all the way back to consumers at urban markets. By this process, risk allotment was much more directed to wholesalers as they travel long hours back to consumers. Risk is however closely linked to price and profit. The high risk involved in transportation of the product is a justification for high prices at urban markets (ibid).

The tomato traders form associations with effective administrative system. Lyon’s (2005) work on tomatoes in the Kumasi market, as cited in Adimabuno (2010) attributed formation of trader’s associations to information distribution among themselves, retailers and farmers as well as to protect the interest and integrity of the association by holding members responsible for wrong acts. Ngeleza and Robinsons (2011) reported that, tomato traders’ association formed in 1980 was in response to some perceived problems in the industry. This association has evolved to be a force to reckon with in the analyses of market power and control in the agricultural



commodity market in the country. The well-organized tomato traders' association teamed up with transport unions (ibid) giving them absolute control of the market. Amikuzuno et al. (2014) revealed that, market queen determine how much of tomato should be brought to each of these urban markets. The association has an organized activity time table and all members adhere to it accordingly. The association justifies their restriction to access, as a move to ensure that there are no gluts and to protect their investments (Ngeleza and Robinsons, 2011). "Barriers to entry are justified on the grounds that, it reduces excessive fluctuations in price and the bankruptcy of traders from a sudden fall in price" (Orchard and Suglo, 1999, p. 74)

The local market system work in a uniform and orderly manner in most of the five (5) known tomato markets (Navorongo, Tamale, Techiman, Kumasi and Accra Markets). In order to protect demand for their produce, farmers have formed serious links with the Queens, so much that a farmer may be willing to let a product rot than to sell to a strange buyer. This has rather strengthen the powers embedded in the queens (Ihle and Amikuzuno, 2009).The wholesalers have specific farmers around whom they buy from, with such bond being stronger at the peak of production season. The tomato traders' association operate within specified farming locations, markets, dealing with specified retailers and as well as specified transports unions. This has over the years made them grown stronger and formidable. Till today, market queens are still the sole distributors of the products to the five most important tomato markets in Ghana (Ihle and Amikuzuno, 2009).

The direction and flow of marketing channels is seasonally determined. According to Robinson and Kolavali (2010) cited in Agyekum, (2015), during the period of January to February, Upper East Region is the major supplier of tomatoes and



between February to May, Burkina Faso takes over the market. However, between May to August, the rain fed agricultural zone at Greater Accra as well as Brong Ahafo Region dominates the markets. Between August and December, Brong Ahafo Region (i.e Techiman and its catchment area) as well as the irrigated Greater Accra zone take the supply responsibility of the country until the Upper East starts again and the cycle continuous.

2.4 Tomato Consumption in Ghana

The Statistical Service Department (SRID) of the Ministry of Food and Agriculture (MoFA, 2013) reported that, the country spends approximately GHC 1.4 million importing tomatoes. Importation of the commodity is to help augment increasing demand for the product. The domestic production level is woefully unable to match its demand, especially during the off peak season. Demand for the commodity is very high at the household level constituting many Ghanaian meals. “In Ghana, it is almost an indispensable ingredient in the daily diet of people across all Regions. Tomato alone accounts for 38% of total vegetable expenditure in Ghana” (Agyekum, 2015, p.7).

According to Agyekum (2015), about 90% of tomatoes produced in the country is consumed locally. Consumption of tomatoes in the country is a daily affair in the lives of many Ghanaians as it is present in virtually all meals. In 2008, the high demand necessitated importation of about 35,000 metric tonnes of fresh tomatoes from Burkina Faso to augment the demand deficit in the country during January and June a period, when production levels remain dependent on irrigations (IRIN Africa, 2009). About 70,000-80,000 tonnes of tomatoes are currently imported from



neighboring Burkina Faso, into the country to augment increasing demand for fresh tomatoes (Agyekum, 2015).

2.4.1 Domestic and Public Consumption of Tomatoes in Ghana

Consumption of the product like many other agricultural commodities occurs at two distinct places or categorization, namely; consumption at individual/ household level and at public/restaurant levels. This categorization brings to bear a two sided demand systems.

Although there is no much literature to ascertain the category that consumes much, it is quite obvious that household consumption is larger than public/restaurant demand. The attribute of these two categories differs in many ways (Adimabuno, 2010). For instance whilst a buyer may be mindful of health implications of purchasing a commodity for a household consumption, the restaurant manager is mindful of how to make profit and keep customers.

Media¹ report revealed that majority of the people who patronized the rotten products are the restaurant and chop bar operators. These chop bar operators, used the rotten product for the public meals. These dishes are served to the unsuspecting public consumer who consumes without noticing.

2.5.1 Factors Influencing Consumer Choice of the type of Tomato

There are several factors that influence a consumer when choosing a commodity. These factors however differ with commodity, time, place etc. Adama (2009) believes that the perception of consumers about the quality and comparative prices of the product are the most influential. Henson, (1996) described the choices consumers make to be based on the increasing awareness of consumer on the

¹ Tv3 prime time news 24th May 2015.



technology of production and other risk related factors accompanying the production process. Whilst characteristics of commodity might be of more importance than any other thing to one consumer, it could be the season that matters to another consumer. Bello and Calvo, (2000), maintains that, perceived quality of a product could be based on intrinsic and extrinsic qualities, His work described the extrinsic characteristics as issues related to brand name and the intrinsic as issues that had to do with the qualities (characteristics) of the product. Similarly consumers in the Tomato markets look out for some specific characteristic in a fresh or a tomato paste to help inform them on the decision to make about the product.

2.5.2 Consumer Behaviour

Adama (2009), describes consumer behaviour as the study of individuals, groups and the process involved in selection, securing as well as use or disposal of products and services to satisfy their needs and its impact on consumers and society at large. Consumers go through psychological assessment as to what they need, when and how to acquire them as well as the place to purchase from. Several factors make up human choice; whilst human beings remain scientifically unpredictable, social scientists have models to help explain the behaviour of mankind.

Contrary to the expectation that consumers would reject rotten tomatoes, a section of the consumers still buy them, this is based on some unexplained/hidden traits of the product as explained by Lars (2009), who believes consumers' choices are based on or are influenced by experience. Lars (2009) again opines that the history of consumer's decision to still purchase these rotten tomatoes could be attributed to some hidden benefits associated with it, as consumers experience with the rotten product increases.



According to FAO (1996), majority of Africans do not give attention to food safety but rather are concerned with satisfying hunger. This implies that consumers are more interested in what is popularly known in Ghanaian parlance as quantity but not quality. Contrary to this observation, the work of Adama (2009) revealed that, consumers of groundnuts in the country are particular about the aflatoxin rate in the product.

2.5.3 Consumer Perception

Human behaviour remains highly unpredictable due to the role perception plays in determining the decision criterion of a person. Perception remains an issue of specificity, hence differs with persons, products or services and time. This explains the reason for the difficulty in finding an accurate measure of perception (Steenkamp, 1989). Satish (2001) contended that, consumers usually do not have enough knowledge in assessing a product attributes hence rely on brand, advertisement and others to make judgment.

Parasuraman et al., (1998), hold the view that, a measuring scale can be developed to measure perception based on some explained parameters. But Levitt (1981) disagrees and argues that, such a move would be in vein and useless since quality is specific to a product, at different times and places.

2.5.4 Consumers' Choice of Tomatoes

Reeves and Bednar (1994) explained that the concept of quality can best fit a four dimensional framework as superiority, value, conformity with specification as well as meeting consumer expectation. Hence for a consumer to select a tomato, it must have been perceived to be superior, of value, falls in line with the consumer's specification and expectation. Steenkamps (1989) attempts in his work to reconcile



the possible gap between an objectives (quality) attributes as well as perceived quality suggesting that, these could differ. This is because; perceived quality is personal and often based on incomplete information (Holme and Kildvang, 1996). Bonner and Nelson (1985) discovered that, perceived high quality of products are associated with great flavours, good aroma, fresh taste, looks, and perceived appetizing.

In Ghana, consumers' assessment of tomato is not different. For instance, Ihle and Amikuzuno (2009), discovered that, products assessment is largely based on, how ripe it is, how hard, how long it can be stored and how tasty it is. The diversion of trade reported by Donkoh and Amikuzuno (2012), revealed that consumer perceive the Burkinabe variety of tomatoes to be of a good quality, taste goods and stores for a longer period compared with the variety cultivated in the Upper East Region of Ghana.

Robinson and Kolavali (2010) noted that, consumers' demand are not satisfied by producers in the Upper East Region, hence with the help of the "lead boys" , traders divert trade to Burkina Faso where products are perceived to be of good quality and has ready markets. Probing further into the rationale for trade diversion to Burkina Faso, the market women explained that, they are not running a charity trade and hence would switch to production zones where they can make profit.

2.6.0 Actors along the Tomato Value Chain

Although the marketing system has been reduced to a two stage marketing activity, there are a lot of actors involved. According to Agyekum (2015), an estimated 90,000 farmers are involved in tomato production with over 30,000 traders directly involved in the marketing process in Ghana. An estimated 25 people are involved in



getting tomatoes from a farm to the dining table (Robinson and Kolavali 2010). These actors include market queens, retailers, farmers, lead boys, loading boys as well as transport operators. While some of the activities of these people are repeated, others are not. For instance, whilst the work of loading boys is involved at the farm gate, it is again needed at the destination urban market. The work of lead boys however, occurs only at the farm gate.

2.6.1 Tomato Producers

According to FAOSTAT (2015), an amount of 340,000 tonnes of tomatoes was produced in Ghana during the 2012 farming season. It is placed first among the chart of vegetables in terms of quantity produced annually in the country (MOFA 2013). The production of the product is generally a rural based activity. Production is mostly done on family or hired land between 1 to 3 acres (Monney et al., 2009 cited in Agyekum, 2015). Farmers continue to farm on the same piece of land until crop yield becomes unbearable. Producers rely on family labour and occasionally hire labour during harvesting when the product is needed usually at once for onward transportation (Adimabuno, 2010).

In an effort to secure ready markets for their produce, farmers form small holder groups to help them secure good prices for their produce. Awiti Kuffour (2009) revealed that, although these organizations exist, they have little bargaining power to help them influence prices in their favour. The weak bargaining power of these groups is attributed to the loosely affiliated and uncoordinated nature of these tomato farmers' unions.



2.6.2 Tomato Market Queen

Yakubu (2009) confirmed the widely accepted literature, that, market queens are the most powerful in the tomato value chain in the country. The queens are the only direct link between farmers and urban markets, hence their lead role and importance in the chain (Robinson and Kolavali, 2010). There is an estimated 5,000 market queens across the country, 85% of whom are women within the ages of 21 and 65 years. The role of these queens easily passes on to relative or sibling in the event of old age or death. As a queen ages, a sibling, in most cases the likely successor is introduced into the business (Tomato traders report to IFPRI 2009; Trading Up).

Robinson and Kolavali (2010) report that 30% of queens have special and bonding relations upheld by providing inputs to farmers on credit. These farmers have ready markets and communicate directly with the traders they deal with without relying on the lead boys. The remaining 70% rely on lead boys' work to get them buyers and hence sell to any buyer who comes their way. The queens come with their boxes well labeled and identified by all; including the illiterate traders who are the majority. Adimabuno (2010) noted that, the queens fill their oversized boxes after it has been quickly sorted for rotten, punctured and unripe ones.

The traders are so organized that they have a well-structured marketing time schedule for all their members. In Accra, for instance, a trader is allowed into the markets once a week with 10-20 crates, depending on cash availability to the trader as well as products availability (ibid). The queens have evolved and grown in strategic relationships to form serious bonds and understanding among themselves. This is justified by the nature of products they are dealing with which requires serious collaboration in order to avoid major gluts/losses. The unstructured and



unorganized nature of the Ghanaian markets is a direct necessitation for the queen's actions. The association helps one another during social events such as funeral, accidents among others. The association raise funds from levying trucks each time it unload at urban markets for funding its activities (Adimabuno, 2010).

2.6.3 Tomato Retailers

The activities of retailers serve as the single most important link between wholesalers and consumers. Retailers give ample time to grading of produce. At this point, each crate is inspected before it is bought from the wholesalers. Before the arrival of the tomato truck, retailers assemble at the destination market. The wholesaler gives priority in selling the product to their regular retailers before any other retailer (Robinson and Kolavali, 2010).

At this purchasing point, buying is done on the bases of crates, however, retailers who are unable to buy the full crate team up to buy a crate and share accordingly/proportionally. These retailers sell at the urban market as well as other adjoining markets. Retailers neatly sort and grade the product for consumers to buy. The grading is done according to sizes and the state of product (that is, rotten, soft or firm). At this stage, the unit of measurement is quality not weight (ibid).

Based on the various categories, the retailers set prices for each of them based on existing market conditions and season. Sorting and grading is the outmost concern of retailers because it is at this point that the product is sold in bits. Here, quality of the product cannot be hidden from the consumer. The retailers who buy from wholesalers oversized or over loaded boxes carefully pick out the spoilt ones. By the time the sorting is done, the boxes would have been reduced to the standard box (IFPRI, 2009).



2.6.4 Tomato Consumers

The consumer is the last actor in the tomato value chain. The consumption of tomatoes like many other agricultural products can be categorized into the individual /household consumer and the chop bar /public consumer. Usually household consumption can take a day before the tomato is fully used whilst the restaurant /chop bar's demand, often is for immediate use. Robinson and Kolavali (2010), reported that, the almost rotten tomato is sold to the chop bar operators who usually use immediately. The household consumers usually prefer harder varieties. Whilst this argument in favour of the use rotten tomatoes seems acceptable, the health implication of its use is largely relegated to the background.

Consumers do not have control over prices. The consumer who finds the fresh tomato expensive looks for alternatives, in many cases resort to the tomato paste which is relatively price stable. The consumer affects the value chain by expressing his/her choices at the retailer level, who then transmits it to the wholesaler who eventually transmits it to farmers (Ihle and Amikuzuno, 2009). For instance, the retailer's choice at the whole sale level is based on the choice of the consumer, whilst the wholesaler expresses that, at the farm gate level. This transmission chain, although quite long, is active. The confrontation by the Upper East farmers and traders in 2006 was a direct result of the expression of consumers' choice and preference for Burkinabe variety compared with the Upper East variety (Robinson and Kolavali, 2010).

2.7 Post Harvest Losses in the Tomato Industry

Agricultural commodities are generally characterized by high post-harvest losses. But the most affected sector is the vegetable and fruit industry. It is reported that, the



vegetable and fruit sector records about 20% of post-harvest losses. The Tomato industry is the worst affected, recording as much as 50% post-harvest losses (Agyekum, 2015).

The tomato is by far one of the most perishable agricultural commodities. While a lot of products are unable to get access to the large markets because of the monopolization of the market, many losses arise as the product is transported long hours to the urban center.

A survey by Robinson and Kolavali (2010) revealed that, farmers in the Upper East Region recorded 50% post-harvest losses due to restricted access to markets for their produce. The Greater Accra and the Brong Ahafo recorded post-harvest losses of 16% and 12% respectively due to restriction by the itinerate queens. Inadequate storage facilities makes the industry even more susceptible.

The move by queens in developing the two stage marketing system has helped reduce the incidence of post-harvest losses that otherwise would arise due to delay at the usual assembly markets. The market queen bears the post-harvest losses along the risky transportation route while the farmer bears the immediate farm gate post-harvest losses. The major justification for the queens' dominance of the market and the huge variation in the farm gate price is an attempt to cater for post-harvest losses that usually occur along the long distances to the urban centers (Ihle and Amikuzuno, 2009).

While a product may be deemed as unacceptable for purchasing at the farm gate, the same product could be sold without much problems in the urban centers. The long journey is factored in by traders before purchasing the product at the farm gate level (Adimabuno, 2010), For instance, if a queen believes that a product cannot last two



more days without rotting, then the trader who still has three days journey to the urban center would reject such a product.

Post-harvest losses may be categorized into partial and complete losses. When a tomato is rotten depending on the degree to which it is spoiled, it still has some level of use. For instance the urban profit-oriented chop bar operators are interested in buying the relatively rotten but cheap tomatoes. Such a product has lost some value but it's still useful and it is therefore classified as partial post-harvest loss. For a commodity to be considered as a complete loss, it should reach a stage where it is of no use. Even the unusable tomato has seed which is usually washed, dried and parceled for the farmers to use as seedlings in the next farming season (Adimabuno, 2010). Therefore the term post-harvest losses is a matter of degree at any stage along the value chain.

2.7.1 Tomato Pricing

Tomato pricing depends largely on the season (Adimabuno, 2010). The findings of Ihle and Amikuzuno (2009), revealed that, distance between farm gate and destination (urban markets), is a major contributing factor in tomato pricing. "Prices in the wholesale markets fluctuate considerably within a year, reflecting not only the spatial-temporal variation in production, influenced by weather patterns, access to irrigation, and supply from other countries such as Burkina Faso; but also associated costs of importing tomatoes from Burkina Faso such as tariffs, arbitrage delays, the exchange rate, corruption and harassments etc."(Amikuzuno et al., 2015). Risk remains the main justification for the huge disparities between farm gate prices and urban market wholesale prices.



The seasonal variability stems from the fact that during production season, prices become low attributable to the increased supply of the product in the market. During this period, adjoining farms in the area have unrestricted access to the market unlike the period of the lean season. The work of Ihle and Amikuzuno (2009), revealed that, there is a considerable variation of the prices of tomatoes across the season and distance from production zones. Prices of tomatoes in the country fall drastically during the period of August and December. In the Tamale market for instance, wholesale price can rise as high as 2.3 US\$/kg to as low as 0.8 US\$/kg (ibid). Ngeleza and Robinson (2011) argued that, the emergence of the cartel system in the tomato industry was to reduce risk by limiting access to the market, but maintained that, these traders have over compensated themselves for the risk.

2.7.2 Gross Margins

It is common knowledge from literature that the market queens receive the highest margins across the country in the industry. This is confirmed by the empirical findings of Ihle and Amikuzuno (2009). Farmers in Ghana by the estimate of MOFA (2008), make a margin of GHC168 if the cost of family labour is included in the cost outlay on every acre of land farmed.

The recent field survey by Amikuzuno et al (2015), observed that, farmers in the Brong Ahafo Region received the highest margins receiving an amount of GHC 345 followed by the Greater Accra Region with GHC 117. The Upper East Region recorded a rate as low as GHC - 49 per tonne. Their work revealed that, although Burkina Faso was farer than Upper East from Accra, traders prefer to go to Burkina Faso. The findings revealed that, transport operators recorded a margin of GhC 0.022 per ton each day on the route. This happened to be same margin transport



operators make during trips to other production zones, hence a justification for the indifference in the trade switch among transport operators.

In factoring the days required to transport the product from Burkina Faso to Accra and Upper East to Accra, one could easily come to such a conclusion. On the contrary, transport operators are motivated by the huge margins per trip not the margin per tonne and per day. This is because transport officers, similar to the queens operate with activity schedule and hence are very much interested in the gross margin they make from a trip and not a margin per tonne per day. There is usually no guarantee that the extra day they spend outside the tomato trip could give a margin enough to cover the days they spend outside the tomato route. Logically, transport officers prefer Burkina Faso trade with more travel days to the Upper East since they can be guaranteed a GHC 890 compared to the GHC 470 from the Upper East Region, with a smaller number of days.

Amikuzuno et al (2014) revealed that, Although traders make a margin of GhC344 during the Burkina trade compared to GhC 571 when trading with farmers in the Upper East Region, the traders prefer the lesser margin because, the Burkinabe variety attracts a premium. Although the Upper East variety attracts more in terms of margins to the traders, they (traders) prefer to make a sizeable income with very little risk. The Navorongo market, the nearest market to Burkina Faso, records GhC7.98 gross margins, whilst Tamale records GHC 16.23. The Accra markets, the farthest from Burkina Faso, records the highest profits as is depicted in table 2.1 below



Table 2.1: Transaction Cost, Average Wholesale Prices and Arbitrageur Profit Margins

Trade Flow	Distance (Km)	Transaction Cost (GHC)	Wholesale Price (GHC)	Profit Margin (GHC)
Ouahigouya - Navrongo	331.91	14.44	77.91	7.98
Tamale	495.97	27.44	99.17	16.23
Techiman	668.9	37.94	110.91	17.48
Kumasi	771.07	51.44	121.17	14.23
Accra	925.27	60.44	158.27	42.33

Source: Amikuzuno et al. (2014)

Based on the above findings, Amikuzuno et al (2014) concluded that, the farther a production zone is from the destination market, the higher the margins that accrue to the traders. These findings reinforce the relationship between risk and profits. Longer journeys in the tomato trade involve higher possibilities of product perishability, and for that matter, high risk. Hence higher margins are the reward of traders who take the risk of transporting the product through such long distances to the market.

2.8 Tomato Value Chain

The term value chain refers to the addition of value to preliminary products as it goes through a combination of facilitating resources to the final consumer (ILO, 2014). As the product passes through the value chain, the product appreciates in value until it gets to the final consumer.

Basically, in the analyses of tomato value chain, there are four main stages, namely, inputs stage, farming, marketing and processing (ibid). The chain constitutes a series of activities that lead a product from its production to the consumption stage.



A study conducted by the ILO (2014) revealed that, there exist five drivers of any tomato value chain development. The five dimensional framework include, system efficiency, product quality, product differentiation, social and environmental standards as well as the business environment. These are discussed below.

System Efficiency: The need for communication and cooperation comes in handy in developing a resilient and efficient system. The essence of such a system is to help reduce production cost, cost of service delivery, flexibility and on time delivery. The fragile nature of the product requires such efficient systems to enable all actors benefit. In Ghana, the market queens are the major actors who stimulate systemic efficiency at the marketing of the product.

Product Quality: The quality of any product is responsible for its demand effectiveness. Product quality helps to set market conditions, standards and values. Attributes such as packaging becomes necessary in keeping product quality. Consumers in the tomato market have the luxury of time to access product quality before purchasing and hence the need for product quality.

Product Differentiations: The perception buyers hold in accessing the quality of a product, is a necessary tool for developing a product differentiated market. Products compete among themselves at this stage in the value chain. Access to market gives some actors competitive advantage over others. This explains why actors in the tomato industry compete feverishly for large market share. Whilst this product differentiation exists, it is very rare among the fresh tomato products in Ghana. The tomato paste industry is a classical arena where there exist so many differentiated products from different countries competing for the consumer's income.



Social and Environmental Standards: Traders, farmers and any other actor in this chain are bound by the trade. This system helps facilitate the social cohesion resulting in some degree of fair trade. Cultural underpinnings directly affect the way the actors deal with their environment. The code of conduct and trust is developed to help regularise the system.

Business Environment: The business environment represents the space in which operation and transaction of marketing and other activities take place. At this stage informal rules and regulations are set up to govern the system. In Ghana the market queens have the most formidable rules and regulations that are strictly adhered to. All these are very necessary in building and enhancing the tomato value chain.

2.8.1 Inputs Supply along the Value Chain

The supply of inputs is the first stage in the tomato value chain. The input dealers, usually private business men, supply inputs such as seeds, fertilizers, tractors, pesticides, weedicides etc. to farmers. In many developing countries like Ghana, majority of farm inputs are imported. In an effort to help boost agriculture, successive government had to use input subsidies to enable farmers have access to the right quantities needed for production (MoFA, 2013). As discussed earlier, this was the case as far back as the immediate post-colonial rule until the tenants of SAP demanded the scrapping of subsidies.

Some farmers rely on input dealers to purchase the inputs on credit. Between 2010 and 2012 the Government of Ghana briefly re-introduced the fertilizer Subsidy Programme to support farmers. An estimated amount of GH¢ 284.3 million was spent in subsidizing fertilizers to farmers in the country in the year 2012 (MoFA, 2013). These subsidies were however scrapped in 2013.



2.8.2 Tomato Processing Along the Value Chain

Processing tomatoes is one of the most important activities along the value chain. In the case of Ghana, the tomato factories have suffered a number of setbacks. “The Pwalugu Tomato Factory, closed in 1990 was re-opened in 2007 under new management and a new name – Northern Star Tomato Company” (Clotney, 2009, P. 3).

The processing industry however continues to suffer from unfair competition with the removal of tariffs on the imports of tomato paste into the country. In 2004, a tomato factory was established at Techiman by MoFA in collaboration with the Italian government. The factory was to cater for the huge tomato productions from the Brong Ahafo Region and its catchment area. It was also to help reduce poverty by reducing the losses to farmers and to create an immediate employment opportunity for Ghanaians. The idea was to assist the factories cater for the tomato paste needs of the country so as to enable the government save foreign exchange for the country. However, the factory could not withstand the complex competition in the sector and eventually closed.

On December 11th, 2012, the revamped Techiman Tomato Factory was commissioned, the facility was co-funded by the Italian food ministry and the Government of Ghana. The facility was expected to produce 50 metric tons per day (GNA, 2012). The Techiman Tomato Factory brings the number of tomato commercial processing to four in the country, namely, Northern Star Tomato Factory (formerly known as the Pwalugu Tomato Processing Factory), Afrique Link (Wenchi Tomato Factory), and OLAM (formerly Expoma Ghana Limited). Among the four processing plants in the country, the Northern Star Tomato Factory and the



OLAM processor have the highest capacity, producing 500 metric tonnes per day each, the Afrique Link factory has a capacity of 200 metric tonnes per day with the newly commission factory at Techiman coming fourth with a capacity of 50 metric tonnes per day. The total capacity of all the factories in the country stands at 1,250 metric tonnes per day.

In other to support these factories a number of irrigations schemes have been set up closer to these factories to enable an all year round processing of the product and to keep the facilities under maximum operations. Adimabuno (2010) reported that, as at 2009, the Northern Star Tomato Factory was still running a test run and not yet connected to the national electricity grid.

Agyekum (2015) reported that the country imports over 78,000 tonnes of tomato paste and puree per year, of which 12,000 tonnes is exported after being repackaged. The Italian establishment in the country imports some amount of tomato puree for further processing and onward exportation to neighbouring countries.

Adjusting the 12,000 tonnes re-exported, then a total of 66,000 tonnes is consumed in the country every year. If all these domestic factories together can produce an amount of 1,250 metric tons per day, all other things being equal, the country has a capacity to produce an amount of 400,000 metric tonnes annually. This implies that, the local industry has the capacity to produce to meet the tomato paste needs of the country. Unfortunately, the country continues to keep the factories under production because of strong competition abroad emanating from the WTO open trade conditionality's.

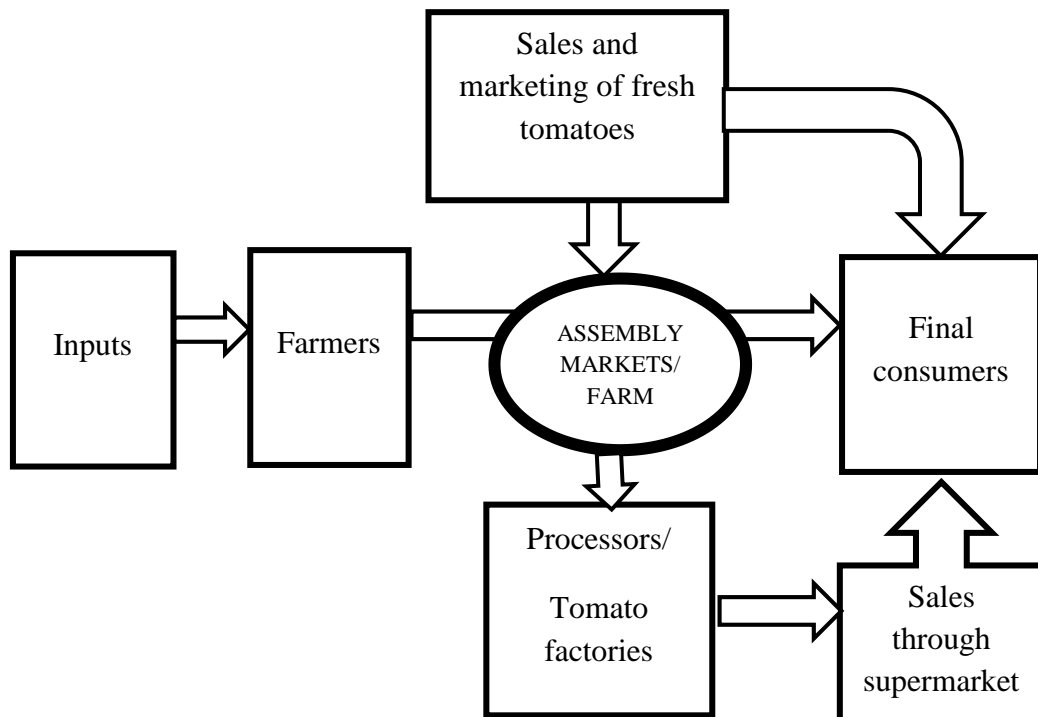
The government has rehabilitated and expanded a number of irrigation scheme to facilitate the supply of the product to these factories. It is important to note however,



that domestic production cannot sustain the raw materials needs of all the factories. Therefore it is currently relying on fresh tomatoes from Burkina Faso to augment the fresh market demand in the country during the lean season.

Generally, inputs dealers supply/ sell inputs to tomato farmers, these farmers after the application and harvest of their produce, proceed to sell their output at the assembly markets/ farm gates to traders. Depending on the particular production zone, some farmers supply directly to consumer, whilst others rely solely on traders and the factories to buy their product. These factories then sell their outputs to the consumers through the super markets. Figure 2.2 gives a graphical view of the value chain flow in the tomato industry discussed in this section.

Figure 2.2 Value chain of Tomato Industry



Source: ILO, 2014.



2.8.3 Sale Outlets of Fresh and Processed Tomato Products along the Value Chain

As discussed earlier the main sale outlet of fresh tomatoes in the country is through the itinerant market queens, operating in a controlled market system. Fresh tomatoes pass through the market system described earlier, from the production zones to the final consumer. Consumers buy very often from the Retail outlets. In Ghana the fresh product is not usually sold in super-markets and shops but mostly at open markets.

The processed product gets to the consumer, unlike the fresh tomato, through the super market and wholesale distributor who often supply to retailers on credit. The product with differentiated brands, comes into the markets through different wholesale outlets but can be found together at the retailer level, where consumers make their choice based on the brand.



CHAPTER THREE

STUDY METHODOLOGY

3.0 Introduction

This chapter provides information on the study area, research design, study population and sampling procedures used for the study. Information about the sample size, instrumentation and data collection as well as the data analyses are outlined.

3.1 Study Area

The study was conducted in the Tamale Metropolis in the Northern Region of Ghana. According to GSS (2012) report, Tamale is among the top five marketing centers for tomatoes in Ghana. The Brong Ahafo Region, (Techiman and it's surrounding to be precise), is the lead supplier of the product during the wet seasons to the Tamale Markets.

In late December through April/May, Ghana's Upper East Region and Burkina Faso supply almost all the fresh tomato consumed in Ghana (GSSP, 2010). The Tamale market is the second largest point of contact of the traders from Burkina Faso. The pricing mechanism as well as the consumer choice and preference for the Burkinabe variety of the product is dominant in the Tamale markets during the off season trade.

During the wet seasons, adjoining communities producing the commodity supply directly to the Tamale markets, complementing what the Techiman and its surrounding bring to the markets.

The study is thus centered in the Tamale metropolis but traces the supply chain of the commodity to the other Regions. Akumadan and Toubodom in the Brong Ahafo



Region, Buntanga and Golinga in the Northern Region and Tono, and Pwalugu in the Upper East Region were the other districts and communities in which the research was conducted.

3.1.1 Tamale Metropolis

The Tamale Metropolis is one of the six metropolises in the country. It lies between latitude 9.16° and 9.34° North and longitudes 00.36° and 00.57°. The metropolis has a total estimated land size of 646.901 sq. km (GSS, 2012). The metropolis is located at the heart of the Northern Region of Ghana (as shown in the map below) and shares boundaries with six other districts namely the Savelugu- Nanton to the North, Mion to the East, Tolon and Kumbungu districts to the West, Central Gonja to the South West and East Ganja to the South.. The total population of the Tamale Metropolis is 223,252 representing 9.0 percent of the total population of the northern Region (GSS 2012). This is made up of 111,109 males and 112,143 females constituting 49.8 percent and 50.2 percent respectively (GSS, 2012). The Metropolis has a predominantly urban population (80.8%). About 63.3 percent of the population aged 15 years and older in the metropolis are economically active. For those who are economically inactive, a larger percentage of them are students (56.0%). Out of the total number of actively employed population in the Metropolis (ibid), the highest proportion (33.0%) are engaged in services and sales sectors (including Tomato Traders). There are 115 communities in the metropolis. Most of the rural communities have a large expanse of land for agricultural activities and serve as the food basket for the metropolis (GSS 2012). A total of 9,251 households are engaged in agriculture in the metropolis, representing 56.7 percent of total households who are mostly into crop farming and rearing of livestock (ibid). The figure 3.1, is a map of the producing districts and the Tamale metropolis the consumption center.



Figure 3.1 Map of the producing districts and Tamale metropolis.



Source: District Maps of Ghana

3.1.2 Techiman and its Surroundings

The municipality lies between longitudes 10 49' East and 20 30' West and latitudes 80 00' north and 70 35' South. It shares common boundaries with Wenchi Municipality to the North and West, Kintampo south District to the North-East,

Nkoranza South District to the South-East and Offinso-North District (in the Ashanti Region) to the South. It has a total land area of 669.7 square kilometer. The municipality has an estimated population of 244,977 (projected 2010). The Municipality experiences both semi-equatorial and tropical conventional or savanna climates, characterized by moderate to heavy rainfall annually. The main raining season, start from April to July and the minor from September to October, then the only dry season which is highly pronounced in the savanna zone, starts in November and lasts until March.

The municipality is noted for several economic activities. It has one of the biggest tomato markets. The markets serve several parts of the country from October to December. Tomato traders and producers converge at the municipality to transact business. The tomato market queen all over the country, precisely traders from, Tamale, Bolgatanga, Accra and Kumasi buy from this market. Communities such as Akomadan, Twobodom, Wenchi, Kintampo, Tanoso among others serve the tomato needs of the Techiman markets during this time.

3.1.3 Kassena Nankana and Bongo Districts

The Kassena Nankana District within which the catchment of the Tono irrigation project is located covers an estimated land mass of 1,674 kilometers square. It is estimated that eighty percent of the land is arable while the remaining 20 percent is covered by forest, rivers, hills and eroded areas. The district falls approximately between latitude 11°10' and 10°3' North and longitude 10°1' West. The district shares boundaries with Burkina Faso to the North, Bongo and Bolgatanga Districts to the East, Builsa and Sissala East Districts to the West and West Mamprusi District to the South. On the other hand, the Bongo District under which the Tono



irrigation project is located has a land mass of 459.5 square kilometers and lies between longitudes 0.45° West and longitude 10.50° North. Bongo District shares boundaries to the North with Burkina Faso, Kassena Nankana District to the West and Bolgatanga Municipality and Talensi District to the South.

3.2 Data Collection

3.2.1 Sample size

Agyekum (2015) estimated that there are approximately 30,000 traders directly involved in the tomato business throughout the country. Following this estimates, the study adopted Yamane (1967) sample size formula stated below to compute the sample size.

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

Where;

n : is the sample size

N is the sample frame or population from which to sample.

e is the margin of error

Using 10% margin error, the sample size for tomato traders is calculated as

$$n = \frac{30,000}{1 + 30,000 (0.1)^2}$$

n= 99.66

Hence the number of sampled traders (retailers and wholesalers) were 100.

However, the 100 consumers and 150 farmers interviewed, was for convenience,



since the population consuming and supplying tomatoes in the Tamale Metropolis was unavailable for Mathematical computation.

3.2.2 Sampling Tools and Techniques

The multistage sampling, made up of stratified and simple random sampling techniques, was used to select the respondents from the study areas. In all, a total of 350 respondents were involved in the study. Out of these, hundred (100) were consumers from the Tamale Metropolis, seventy (70) were retailers sampled from the main Tamale markets and thirty (30) were wholesalers. The remaining 150 respondents were farmers sampled from the three main supply regions i.e. Brong Ahafo Region, Northern Region and The Upper East Region.

The first stage of the multistage sampling, purposely selected the major tomato producing districts, Communities producing tomatoes in the dry season were selected in the second stage, in the third stage, the study randomly selected tomato farmers in these communities. Retailers in the Tamale market were also randomly selected. In the selection of consumers in the Tamale Metropolis, the study adopted stratified sampling technique, i.e. the metropolis was put into two categories according to electoral/constituency demarcations. Among each category, the areas were again divided into sub categories, then communities randomly selected, before consumers were then randomly chosen. Table 3.1 summaries the study areas, sample size and the sampling techniques used.



Table 3.1 Study Area, Sample size and Technique

Region	District	Community	Sample size	Actor	Sampling technique
Brong Ahafo	Offinso North	Akumadan	25	Farmers	Purposive and Random
	Techiman North	Twobodom	25		
Upper East	Bongo	Pwalugu	25	Farmers	
	Kasena Nankana	Tono	25		
Northern	Tamale and its surroundings	Golinga Tolon (District)	25	Farmers	
		Buntanga Kumbungu (District)	25		
Total number of farmers					150
Northern	Tamale	Aboabo Market	30	Wholesalers	Random
Northern	Tamale	Aboabo market	40	Retailer	Random
		Central market (Dakurlini)	30		
Total number of traders					100
Northern	Tamale	Changli, Sabonjida, Zogbeli.	50	Consumers	Stratified and random
Northern	Tamale	Belpiela, Kapkagyili, Tugu yepala	50	Consumers	
Total number of consumers					100
Total sample size					350

Source: Authors' Estimate from Field Survey, January 2016.

3.2.3 Data Collection Procedure

The data used in this research was purely primary. The focus group discussion was done with a checklist and the questionnaires administered using semi structured questionnaires.



The research team also joined the tomato wholesalers on their usual routine trip to the producing centers to observe the trading between the farmers and the traders at the producing centers. This was done because Nachias, (1996) believes social research begins and ends with observation.

3.2.4 Pre-testing Data collection Tools

According to Neuman and Kreuger (2003), pre-testing data collection tools is the best practice for any research that requires quality data. It enhances quality data collection and thus easy and reliable analyses. The researcher thus, pre-tested the questionnaire in some of the sampled communities and markets (i.e. Twobodom, pwalugu, and the Tamale central markets, within two weeks before the start of the actual fieldwork. During the pre-testing stage, 5 farmers each, from the Upper East Region, Northern and the Brong Ahafo Region were interviewed. About Ten retailers and Wholesalers were as well interviewed in the pretesting stage of the research. During which difficulties in traders remembering sales (revenue) made within the last month resulted in the restructuring of the questionnaire to cover a week's sales, for accurate data collection

3.2.5 Data Cleansing

After each day's data collection, the researcher would go through the administered questionnaire, major problems were referred back to the field while the minor ones were used to guide the next day's methods of collecting better data. Before and during the data entry the researcher corrected some other mistakes, through the field assistants who with the aid of phone calls got back with the right information.



3.3 Data Analyses

The study relied on a statistical package known as STATA (version 11) in analyzing the data collected. Statistical tables, diagrams and flow charts were employed in examining the demographic and socio economic characteristics of major actors along the tomato supply chain, the perception of consumers' as well as the sources of tomato supply to traders in the Tamale Metropolis. The study estimated the probit model in analyzing the factors that influence a farmer's decision to adopt dry season farming. The same model was used to estimate consumers' preference among the types of tomatoes with the different seasons (tomato paste and fresh tomatoes). The magnitudes of post-harvest losses and margins at each stage of the tomato value chain were also computed.

3.4 Theoretical Framework of Qualitative Choice Modeling

The discrete choice model was developed to overcome the shortcomings of the quantitative choice models, frequently estimated with the Ordinary Least Square (OLS). The use of OLS which is to a large extent for continuous dependent variables becomes flawed when dealing with discrete choices. This is because the Gauss Markov assumptions are ultimately violated by the discrete choice dependent variable. The emergence of the qualitative choice model is in fact to address this by predicting a person's choice given some observed and unobserved characteristics.

The model builds on the fact that individuals choose among alternatives, that yields the greatest satisfaction. For instance, an individual who chooses to adopt a new variety is assumed to be doing so because, that new variety gives him or her the greatest satisfaction or utility. Discrete choice models are thus built on random utility models.



If an individual has a list of alternatives to choose from, that individual is expected to choose the alternative that has the most satisfaction. For instance a person is expected to choose alternative dry season irrigation over not farming in the dry season given that

$$U_A \text{ adopt dry season} > U_B \text{ not adopt dry season} \quad (1)$$

$$P_i = B_i X_{ki} + \epsilon_i \quad (2)$$

U_A = satisfaction or utility from choosing alternative; dry season irrigation

U_B = satisfaction or utility from choosing alternative; not farming in the dry season

P_i = probability of choosing and ith alternative

X_i = characteristics of the respondent making the choice

ϵ_i = The latent or unobserved characteristics

The probability of a person choosing an alternative over another is thus based on the X_i characteristics. However the assumption of $P_i = P(Y_i = 1/X_i)$ make the predictor variables linearly related to the P_i . The problem of non-normality and constant parameters requires a binary choice model capable of keeping X_i effects (whether increasing or decreasing) checked between 0 – 1 interval.

In addressing the above challenge, the cumulative distributive function (CDF) is best. The CDF is capable of keeping $-\infty$ to ∞ results from the X_i to a P_i interval of 0-1. This is necessary because probability falls only between 0-1 interval.



The CDF in itself has two distinct categories, one is the normal cumulative distributive function and the other the logistic cumulative distributive function. Hence in the transformation of the function there are two ways involved, in the use of the logistic cumulative distributive function transformation function, the logit model emerged while the probit emanated from the normal cumulative distributive function. The two are technically regarded as the same although they differ lightly along the various transformation process.

3.4.1 The Probit Model

The probit model with a normal CDF transformation functions assumes the existence of a latent unobserved variable Y_i^* . This Y_i^* is considered as a tendency in favour of the event of interest. This Y_i^* is assumed to be linearly related to the observed characteristics.

Following Greene (2003) the probit model is therefore given as follows:

Let:

$$Y_i^* = X_i^* z + e_{1i} \quad (3)$$

where

Y_i^* is the dependent variable.

X_i is a $(1 \times k)$ vector of independent variables

z is a $(k \times 1)$ vector of parameters to be estimated and

e_{1i} is the two sided error term with zero mean and constant variance.



In practice, Y_i^* is unobservable, what we observe is a dummy variable Y_i defined by $Y_i = 1$ if $Y_i^* > 0$ (farmer i adopted dry season tomato farming), and $Y_i = 0$ if otherwise.

Thus, in this formula

$$\begin{aligned} \text{prob}(Y_i = 1) &= \text{prob}(Y_i^* > -X_i'z) \\ &= \text{prob}(e_{1i} > -X_i'z) = 1 - F(-X_i'z) \end{aligned} \quad (4)$$

where F is the cumulative distribution function of e_{1i}

The likelihood function is thus,

$$L = \prod_{Y_i=0} F(-X_i'z) \prod_{Y_i=1} [1 - F(-X_i'z)] \quad (5)$$

Where $\prod_{Y=0}$ and $\prod_{Y=1}$ indicate multiplication over observations where $Y = 0$ and $Y = 1$ respectively. If we assume that the cumulative distribution of e_{1i} is normal we

have the probit model:

$$F(-X_i'z'X_i) = \int_{-\infty}^{-X_i'z_i/\sigma} \frac{1}{(2\pi)^{1/2}} \exp\left(-\frac{t^2}{2}\right) dt \quad (6)$$

where t is a standardized normal variable, i.e., $t \sim N(0,1)$.

3.4.2 The Empirical Model of Factors Influencing the Adoption of Dry Season Farming of Tomatoes

The empirical model that was used to determine the factors that influence a farmer's decision in the adoption of dry season farming of tomatoes is as follows:



$$Y_i = \beta_0 + \beta_1 Ag + \beta_2 Mstat + \beta_3 Hsize + \beta_4 Acc\ irri\ fac. + \beta_5 Dis\ far\ n\ wat + \beta_6 Yrs\ exp + \beta_7 Frm\ siz + \beta_8 Dis\ far\ n\ hom + \beta_9 Yrs\ Edu + \beta_{10} Acc\ credit + U_i \quad (6)$$

Y_i = Binary dependent choice variable; if $Y_i=1$ then the farmer adopts dry season farming but if $Y_i=0$, then the farmer does not adopt dry season farming. β_0 to β_{10} are the parameters to be estimated.

Table 3.2 Definitions of Variables used in the probit estimation of factors affecting farmer’s decision to adopt dry season farming.

Variable	Variable Acronym	Definition	Expected outcome	Measurement
Age	Ag	Age of the farmer	-	Years
Marital status	Mstat	Dummy; whether the household head is married or not	-/+	1 = if married 0 = if otherwise
Household size	Hsize	Number of people in a house(eating from the same cook pot)	+	Number of persons
Access to irrigation facility	Acc irri Fac	If the farmer has access to an irrigation facility (dummy)	+	1=Yes 0 =No
Distance between farm and water source	Dis far n wat	Distance in kilometer between farm and water source	-	Kilometers
Years of Experience	Yrs Exp	Number of years a farmer has been farming tomatoes	+	Years
Farm size	Frm siz	Size of the farm of the farmer	+	Acres/
Distance between farm and home	Dis far n hom	Distance in kilometers between a farmer home and farm	+	Kilometers
Years in education	Yrs edu	Number of years a farmer spends schooling	-/+	Years
Access to credit	Acc credit	Whether farmer has access to credit or not	+	Dummy 1= yes 0= no

Source: Field Survey, 2016



3.4.3 Empirical Model of Factors Affecting a Consumers preference of the type of Tomatoes to Buy with Season.

The empirical model that was used to determine factors affecting a Consumers preference of the type of Tomatoes to Buy with Season is as follows:

$$Y_i = \beta_0 + \beta_1 \text{sex} + \beta_2 \text{Hsize} + \beta_3 \text{Mstat} + \beta_4 \text{Exp tomat} + \beta_5 \text{Exp Veg} + \beta_6 \text{inc} + \beta_7 \text{Emp} + \beta_8 \text{Ag} + \beta_9 \text{Edu leve} + U_i \quad (7)$$

Y_i = Binary dependent choice variable; if $Y_i=1$ then consumer choose fresh tomato/local variety but if $Y_i=0$, then the consumer choose tomato paste / imported variety, β_0 to β_9 are the parameters to be estimated.

U_i Is the error term



Table 3.3 Definitions of Variables used in the probit estimation of factors influencing consumer's preference for the different types of tomatoes.

Variable	Acronyms of variables	Definition	Expected outcome	Measurement
Sex	Sex	Whether the consumer is a male or female	-/+	1=female 0= male
Household size	Hsize	Number of people in a house(eating from the same cook pot)	-/+	Number of persons
Marital status	Mstat	Dummy; whether the household head is married or not.	+	1 = if married 0 = if otherwise
Expenditure on tomatoes	Exp Tomat	Amount of money spend buying tomatoes	+	GHC
Expenditure on vegetable	Exp Veg	Amount of money spend buying vegetables	+	GHC
Income	Inc	Amount of money the consumer earns	+	GHC
Employment	Emp	Whether the consumer is employed or not	+/-	1=employed. 0=unemployed
Age	Ag	Age of the respondents	+	Year
Educational level	Edu leve	Whether the consumer is educated or not dummy	-/+	Literacy 1=educated 0= uneducated

Source: Field Survey, 2016



CHAPTER FOUR

RESULTS PRESENTATION AND DISCUSSIONS

4.0 Introduction

This chapter provides detailed analyses of the results obtained from the study conducted. These findings are categorized into three (3) broad sections (production, marketing and consumption of fresh tomatoes and tomato paste in the Tamale Metropolis). The various objectives are treated under these broad sections. The first section however, deals with the demographic characteristics of the respondents. The second section presents findings on the production of tomatoes, with emphasis on the dry season productions, while the third section extensively deals with the marketing systems and the relevance of the market queens in the entire marketing system. Other sections include; consumers choice and preference for the types and varieties of tomatoes.

4.1 Demographic Characteristics of Respondents

The examination of the demographic characteristics of respondents helps in exposing some of hidden characteristics of respondents such as education, sex etc. This is relevant to an extent that individual characteristics could meaningfully affects the results and also give an overview of the kind of actors in the industry

4.1.2 Sex of respondents

The results show that 90% of tomato farmers are male with the remaining 10% being female. This survey reflects men's perceived general cultural role as bread winners of the family. All thirty five (35) wholesalers in the Tamale markets are female. Agyekum (2015) estimated that, there are approximately 5,000 wholesalers in Ghana. This means that the Tamale markets contributes less than a percentage



(i.e. 0.7%) of the total wholesaler's population in the country. Baden (1998), in the analyses of gender and marketing systems in Ghana observed that females dominate the agricultural marketing system. In line with this, the findings show that, all retailers in the Tamale markets were female. This is attributed to the cultural underpinnings of the northern ethnic groups who see these businesses as women ventures, because of its relations with cooking, which is also mainly done by women. All respondents interviewed in the consumer category were female. This is because 80% of household chores are performed by females (GSS, 2012).

4.1.3 Educational level of respondents

Out of the 150 farmers interviewed, only (1%) had tertiary education with a quarter (25%) of them without formal education. However, a greater proportion 43% of the farmers had primary education with about a third (31%) having up to a secondary education. Out of the 30 wholesalers in the markets, only 5 (14.28%) had primary education with the remaining (85.71%) being illiterate.

In the Tamale markets the results indicated that, of the seventy (70) retailers interviewed, 72.85% of them were illiterates whilst about 23% had primary education. The 2010 Population and Housing Census (PHC), revealed that, of the population age eleven and above, 57.3% are illiterates (GSS 2012). This explains why majority of the population in the tomato retail business are illiterates. Only 4.2% of these retailers had up to a secondary level education.

4.1.4 Marital status of respondents

Majority of these farmers (61%) are married, while 18% are not married due to divorce. The remaining (21%) are still single. Among the Wholesalers, less than 7% are single with majority (63.3%) being married. About 13.3% had lost their spouses



with the remaining 6.6% divorced. The high incidence of marriage among women is due to the cultural issues associated with being single at a marriageable age in the northern part of Ghana. There is a strong stigma against women who are not married and this could be the reason behind majority of women being married.

Again, majority (66%) of the retailers are married whilst 12.85% are divorced, about 3% are still single with the remaining being widows. A large proportion (66%) of the consumers are married. Out of the 29% of consumers who were once married, 15% are now divorced with the rest (14%) being widows. 5% have never married.

4.1.5 Age of respondents

None of the farmers were below the age of 20. About 70% were however between the ages of 20 and 40. Out of the remaining 30%, 20% were between the ages of 41 and 50, with the rest above age 51. The youthful age of the farmers is attributable to the fact that tomatoes is more of a cash crop, which is normally patronized by the relatively young farmers.

Generally, the highest percentage of consumers (39%) in the Tamale metropolis were between the ages of 31 and 40. Out of the 29% of the respondents who are 30 years and below, only 2% are 20 years and below. A large number (26%) of the consumers are 50 years and above. The rest (6%) are between the ages of 41 and 50.

An estimated 64% of wholesalers are between the ages of 20 and 40. None of the wholesaler are less than 20 years. However twenty eight percent (28%) of them were between the ages of 41 and 50 .Only 8% are 51 years and above. This is in line with the work of Robinson and Kolavalli (2010) who discovered that an estimated 85% of wholesalers in the Accra Markets (Makola) were between the ages of 21 and 65.



About 2.2% of retailers are below the age 20. Majority (73.9%) of these retailers are between the ages of 20 and 40. An estimated 28% of them are between the ages of 41 and 50. With the remaining 8% above 50 years. Table 4.5 gives a summary of the demographic characteristics of all the actors along the chain.

Table 4.1 Summary of the demographic characteristics of respondents

ACTORS		Farmers	Wholesalers	Retailers	Consumers
Sex (%)	Male	90	0	0	0
	Female	10	100	100	100
Educational					
Level (%)	Primary	43	14.2	22.8	23
	Secondary	31	0	4.2	16
	Tertiary	1	0	0	32
	Illiterate	25	85.8	72.9	29
Age (%)	<20	0	0	2.2	2
	20-30	35	28	33.8	27
	31-40	35	36	40.1	39
	41-50	20	28	20.9	6
	51<	10	8	4	26
Marital					
Status (%)	married	61	63.3	75.7	66
	divorced	14	16.6	12.8	15
	single	21	6.6	2.8	5
	widow	4	13.3	8.6	14

Source: Authors' Estimate from Field Survey, January 2016.



4.2 Factors Affecting the Adoption of Dry Season Tomato Farming

There are several factors that influence a farmer's decision to adopt dry season farming. The study looks at the relationship between the farmers who adopted and those who did not and what really informed their decision.

The first objective of the study was to investigate the factors that influence the adoption of dry season tomato farming. The results of the maximum likelihood estimation results of the probit model are shown in Table 4.2 below. The output are the marginal effects after the estimation of the probit model.

The results indicated that age negatively and significantly affect the adoption of dry season farming. With a marginal effect of -0.023, an increase in age by a year will result in a decrease in the probability of a person adopting dry season by 0.023. This implies that younger people adopt dry season farming more than the aged. This could be attributed to the fact that dry season farming requires more work and energy than the wet season, a demand which only the younger persons can provide. Again, marriage increases the probability of adopting dry season farming. Married people have a higher probability of adopting dry season farming. This could be explained by the fact that, married people need more income to support their family, thus the probability of a single person adopting dry season farming is smaller than a married a person. Increasing household size is however a disincentive to the adoption of dry season farming. The results indicate that as a household increase by a person, the probability of the person adopting dry season faming reduces. This however, contradicts the researchers *a priori* expectation, which suggest that larger household would adopt dry season farming.



Access to irrigation is also important in determining the factors affecting adoption of dry season farming. The results indicate that access to irrigation increases the probability of adopting dry season farming by 0.91. In other words, wherever there is an irrigation facility, the probability of farmers adopting dry season farm is almost certain.

Distance between farm and water sources is a disincentive for the adoption of dry season farming. As the distance between the farm and water source increases by a kilometer, the probability of such a farmer adopting dry season farming reduces by 0.35. This is significant and meets *a priori* expectation. Distance between farm and water source increase cost and time spent in farming, thus negatively affects adoption of dry season farming. Again the farther a farmer's home is from the irrigated farm, the lower the probability of the farmer adopting dry season farming. This confirms the earlier negative effect of age on the adoption of dry season tomato farming. In effect older people find it difficult to adopt dry season farming when their homes are far from their farm. This is because distance naturally increases the cost involved in transporting the farmer to and fro his farm. Farmer's years of farming experience also had an insignificant influence on their decision to adopt dry season farming. As a farmer's experience in farming increases by a year the probability of him/her adopting the dry season farming also increase by 0.022. This is insignificant but meets our *a priori* expectation. Experienced farmers know the importance and benefits associated with dry season farming and thus their decision to go into dry season farming.

Access to credit is another influential factor that affects the adoption of dry season farming. Farmers who have access to credit, have a 0.81 probability of going into



dry season farming higher than those who do not have access to credit. Note that the binary dependent variable is stated as; 1= adoption of dry season farming and 0= non-adoption of dry season farming.

Table 4.2 Marginal effects After Probit Estimation of the factors influencing a farmer's decision to adopt dry season farming

Variable	Marginal effects	Parameters	P> z
Age	-0.023	β_1	0.020**
Marriage	0.61	β_2	0.030**
Household size	-0.022	β_3	0.041**
Access to irrigation facility	0.91	β_4	0.000***
Distance b/n farm and water source	-0.35	β_5	0.015**
Years of Experience	0.022	β_6	0.031**
Farm size	0.036	β_7	0.197
Distance between farm and home	0.042	β_8	0.259
Years in education	-0.051	β_9	0.123
Access to credit	-0.819	β_{10}	0.082*
No observations = 150		LR χ^2 (12) = 86.89	
Prob > χ^2 = 0.0000		Pseudo R² = 0.6469	

*, **, *** significant at 10%, 5% and 1% respectively

Source: Authors' Estimate from Field Survey, January 2016.

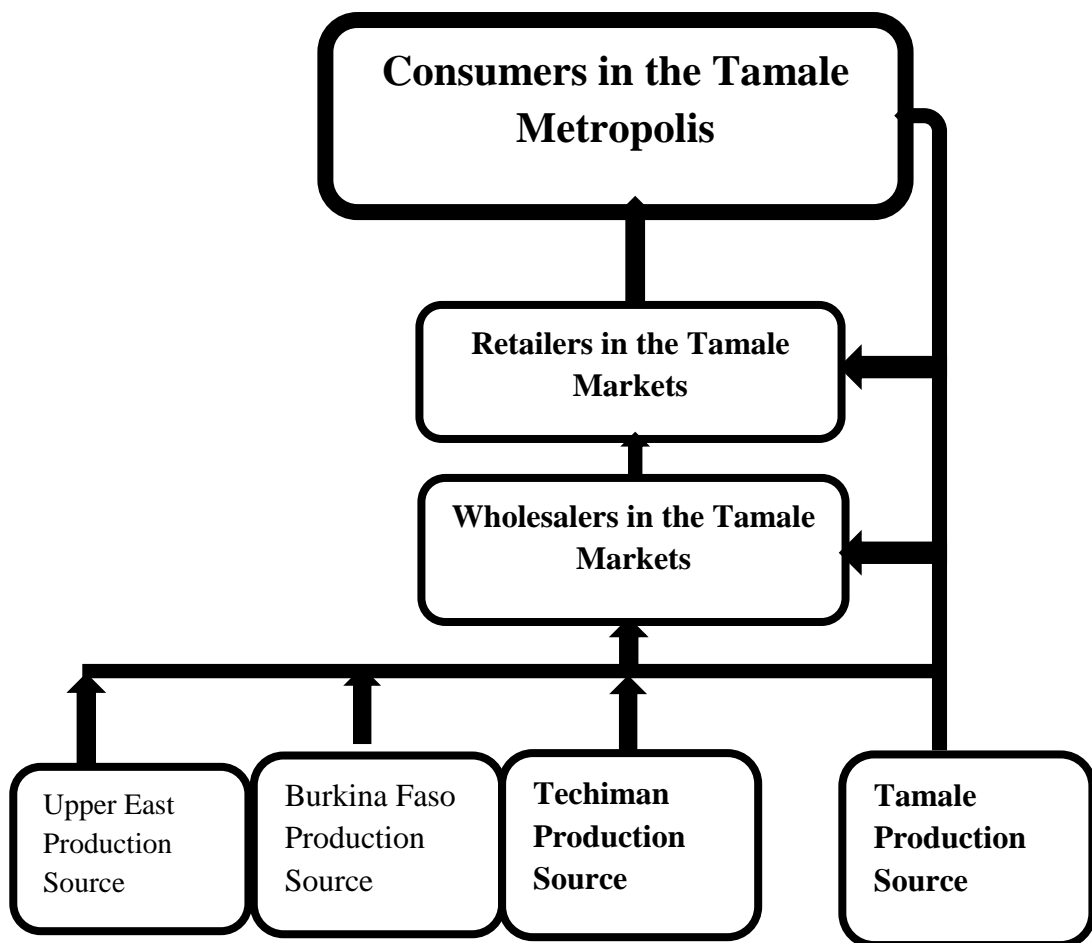
4.3 Sources of Tomato Supply into the Tamale markets

There are four main sources of tomatoes into the Tamale Markets. These are the Techiman and its surrounding source, the Upper East source, the Burkina Faso and the domestic source as shown in figure 4.1. The tomatoes each region supplies the Tamale markets differ in quantity and variety. Depending on the source of tomatoes,



the product usually passes through a number of actors before it gets to the final consumer. The study revealed that apart from the domestic/Tamale supply source all other supply sources rely on the wholesalers to buy their produce. The wholesalers in tend rely on the retailers to get their products to the consumer. Figure 4.1 gives a graphical view of how the product gets to the final consumer in the Tamale Metropolis from the diverse supply sources.

Figure 4.1 Supply Chain of Tomatoes into the Tamale Market



Source: Authors construct from field survey, 2016

4.3.1 The Upper East and Burkina Faso Supply Source

The study revealed that the irrigation schemes in the Upper East Region supply the Tamale markets for only a while (a month or less). In line with the findings of Ihle and Amikuzuno (2009), the study revealed that supply from the Upper East Region



is usually in January. The Burkina Faso irrigation schemes then supply the market from February onwards to May.

During this season, the product is supplied into the market once every two days. A fully loaded truck containing an estimated 160/180 standard crates are supplied into the markets. A standard crate which is mostly used by the traders is equivalent to 54 kg. The field survey indicated that, during this period an estimated 12,750 crates equivalent to 688,500 kg of tomatoes are supplied into the Tamale markets. There are also a number of road side traders who stop vehicles carrying tomatoes down south to buy. The field survey further discovered that these retailers buy the product in small quantities in an unregulated manner making it difficult to estimate.

4.3.2 The Techiman and its Surroundings Season

Techiman and its surroundings (i.e. Tanoso, Akumadan, Toubodom among others) fall within the southern ecological zone and thus has a dual raining season. Techiman's first wet season falls between March and June, by the time the product supply begins to shrink in Burkina Faso, i.e. by late May /June, production from the Techiman first wet season would have been ready to supply the Tamale markets. Hence between the periods of July – August, the first Techiman wet seasons take over the markets. The field survey showed that between this period (i.e. July – August) an estimated eighty (80) crates of tomatoes are supplied to the markets each day. It is thus estimated that a total of 4,800 crates equivalent to 259,200 kg enter the Tamale markets during this period.

Later the second wet season of the Region (Techiman) combined with the dry season farms take over the tomato supply needs of the markets, from October to



December. From the survey, the second season also supplies an estimated 80 crates a day, and hence 7,200 crates equivalent to 388,800 kg during that supply period.

4.3.4 Tamale and its adjoining communities'/ Domestic Supply source

During this supply period, the adjoining communities flood the Tamale markets with the product from their farms and backyard gardens. At this season, the product become so abundant that its prices could reduce to as low as GHC60 per 54kg crate compared to the GHC560 per 54kg crate during May (i.e. the Burkina Faso peak supply season).

In an effort to discount the effects of distance on the price differentials between two markets in Ghana, [i.e. Navorongo and Accra (Makola) markets], Ngeleza and Robinson (2010), concluded that access to the Navorongo markets by the farmers greatly influences the low prices. Their analyses and selection of these two markets spanned from the fact that Navorongo market did not have any restriction to access, and hence the free interplay of the demand and supply factors. They attributed this to the fact that the adjoining producing communities could just bring in the product at any time to sell to the buyers in the market. In a sharp contrast to this observation at the Navorongo markets, the market in Accra and other urban centres were highly controlled and nobody could smuggle in a truck of tomatoes into the market without the information getting to the queens. This restriction paved way for the queen to dictate the price of the product.

Whilst the case of a restricted market holds for the queens in the Tamale market during the off season trade (dry season), the situation is different during wet season. During the wet season, so many adjoining communities cultivate the product, at their farms and at their backyard gardens and thus supply the markets. The farmers



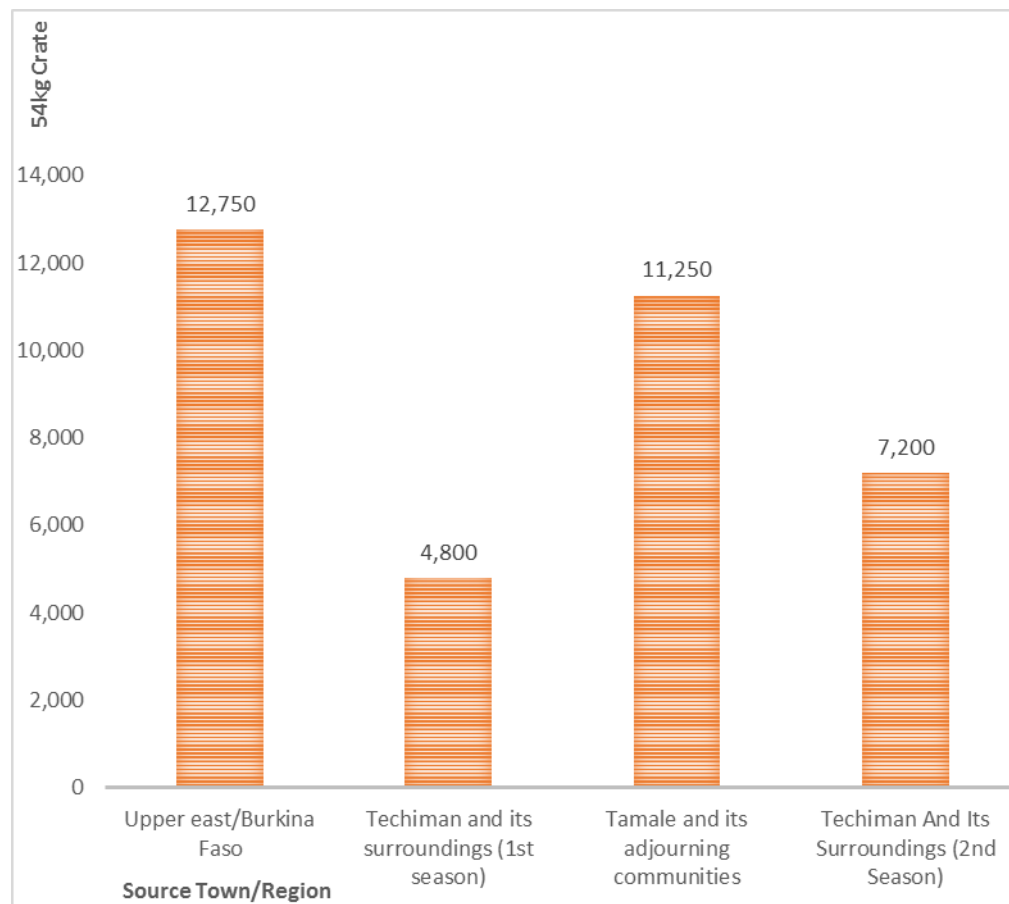
carry the product to the market hence minimizing the regulatory power of the wholesalers. During this period, the wholesalers are unable to control the supply/restrict it, because the sources of supply then become numerous.

The survey revealed that, during this season, tomatoes are sold virtually for free at all vantage points in and around the Metropolis. The research discovered that due to the unregulated supply nature of this season, it is very difficult to estimate the quantity of tomatoes supplied to the metropolis. However, the survey team together with queens estimated that, supply of the product could be at 250 crates a day (more than twice the usual supply) throughout the one and half months season. Thus, by computations, the quantity supplied during this season could be estimated as 11,250 crates equivalent to 607,500 kg. By this, it implies that consumer get to consume more of the product during this season.

As discussed earlier the quantity of tomatoes in the Tamale Metropolis vary with time and season. Figure 4.2 below gives a summary of the quantity of tomatoes each supply source feeds the Tamale markets.



Figure 4.2 Sources of tomato supply into the Tamale markets all year



Source: Authors' Estimation from field survey, 2016

4.3.5 Tomato Marketing in the Tamale Metropolis

Marketing of the product in the Tamale Metropolis is done by two distinct groups of traders, namely, wholesalers and retailers. The wholesalers (also known as the market queens) are responsible for the bulk purchase of the product from the farm gate to the urban markets whilst the retailers are in charge of direct sales to consumers.

4.3.5.1 Marketing characteristics of wholesalers in the Tamale Markets

As discussed earlier, the supply of tomatoes into the Tamale market comes from four different supply sources. The Tomato queens have an organized routine. Every day about six traders leave the Tamale market to the farming zones to bring the

product into the market. The field survey indicated that each trader is allowed to bring between 8 and 12 crates a week. This is in line with the findings of Robinson and Kolavalli (2010), who estimated that each trader on trade route is expected to bring to the Accra market about 10 -20 crates every week.

The study discovered that the wholesalers are pivotal in the value chain of tomatoes. All wholesalers in the markets were introduced into the business by a relative. The queens do not only control and dominate the market; they also serve as the life line of the entire trade. They do not just control a chunk of the resources in the trade, but they also help regulate the system. The queens are by far, the most organized group along the chain with a very respected and time tight schedule of their trips and supply of the product into the market.

The works of Robinson and Kolavalli (2010), Adimabuno (2010), Ngeleza and Robinsons (2011), Ihle and Amikuzuno (2009), Donkoh and Amikuzuno (2012), all assert that, the queens use their dominance and power in the markets to enjoy higher profits, However, contrary to this widely accepted view, the study revealed that the queens in the Tamale market do not make high profits as such but have justified reasons for their dominance and control. The queens do not only invest all their resources and lives in the trade, they also invest in all other actors (farmers and retailers) along the chain.

4.3.5.2 Marketing characteristics of Retailers in the Tamale Markets

Once a retailer buys the commodity from the wholesaler, the retailer then sort, package and display them for re-sale. Wholesalers buy and sell in standardized 54kg boxes, while the retailers sells after sorting and packaging in small containers, such as the ‘alonka’ (15kg) container etc. This confirms the findings of Robinson and



Kolavalli (2010, p.7). Who discovered that, “Retailers sell tomatoes by container (volume) and quality rather than weight”

The survey revealed that 92.85% of retailers determine what price the consumer pays considering the availability and the state of the product at any given period in the market. About 7.14% of respondents believe prices at which they sell to the consumers come about as a result of bargaining.

As soon as the commodity arrives at the urban destination, the wholesalers after factoring in the other costs involved in buying and carrying the commodity to the market centre, fix the price for a crate. Hence 88.57% of the retailers believe that the prices are fixed by the wholesalers whilst the remaining 11.42% believe the prices are arrived at after bargaining.

The Tamale market is still under construction; for the convenience of buyers, majority (51.42%) of the retailers are found hawking on the principal streets of Tamale. Some of these retailers selling on the streets were displaced by the ongoing construction work at the market center, whilst others just prefer to sell around the street, for they believe they make more money on the road side than in the markets. Some of the retailers insist that consumers prefer to buy on the street to walking all the way into the market which could be tedious at times.

Not all retailers engage in the business all-year- round. An estimated 61.42% of retailers do business throughout the year. The remaining 38.57% are seasonal/temporal retailers. A number of retailers only engage in the tomato business when the product is in good supply, they stop as soon as the supply begins to dwindle. The Tamale markets records the highest number of retailers during the July-September



period, during which all adjoining communities would have been supplying the product to the market.

In all, about 71.42% of persons who buy from retailers are domestic users. The remaining 28.57% are buyers who use it for other purposes such as retailing or selling to commercial users. About 81.42% of the respondents have a market store where they keep their products after the daily sales whilst the remaining do not have, and are either perching or carry the product home every day after sales. An estimated 41.42% of respondents engage in other economic activities (i.e. selling other related vegetable such as pepper, okra among others). The remaining percentage had tomatoes business as the only economic activity they engage in. The engagement of the retailers in other economic activities, such as the sale of other vegetable, is attributable to the fact that the use of tomatoes in cooking largely goes with these other food stuff.

4.4 Gross Margins of Actors along the Tomato Value Chain

In the calculations of Gross Margins (GM) of the actors along the tomato value chain, each actor's activities that accrued to the Total Variable Cost (TVC) is deducted from the Total Revenue (TR) i.e. $TR - TVC = GM$. In the case of the farmer for instance, farm inputs constitute the variable cost. In the case of the traders, their variable cost mainly borders on marketing cost. The discussion under this section considers the margins of each actor along the chain in a season. Note that, the research used different computational methods to arrive at the Gross margins of each actor in a season. Apart from the producers' gross margins which were directly calculated in a season, in the calculation of the gross margins of retailers, monthly



gross margins were used to arrive at the seasonal gross margins. In the case of the wholesalers gross margins per crate was used to arrive at the seasonal gross margin.

4.4.1 Producer Gross Margins

From the results fertilizer usage constituted 55.1% of the entire variable cost, hired labour constituted 11.87%, with pesticides following closely with about 8.9% of the entire variable cost component. Organic manure usage recorded the least (0.034%) of the variable cost component. As indicated in Table 4.3, producers, supplying the Tamale market with tomatoes make different gross margins per season.

In the Upper East Region, tomato farmers make a margin of GHC 1,246.08, compared to GHC 3,195.42 and GHC 1,500 among farmers in Techiman and Tamale respectively. Tractor plough recorded a zero usage in the Techiman and its surrounding areas, whilst constituting as much as 6.77% and 16.5% of the total variable cost components for farmers in Tamale and Upper East Region respectively. This is because the general topography of northern Ghana makes the use of tractor for ploughing easier. This variation resulted in an increased cost compared with the Techiman farmers. Total revenue of a farmer per season in Techiman stood at GHC 4,513.1 compared with as low as GHC 3,557 and GHC 2,976 in the Upper East Regions and Tamale respectively. The number of crates harvested and sold in the Upper East stood at 36 and 34 respectively, 31 and 27 respectively in Techiman and 33 and 31 respectively in Tamale and its surroundings. The Upper East Region therefore harvested and sold more tomatoes per farm than their Techiman counterparts. The question is what then accounts for the huge variation in the revenue? Again, farmers in Tamale and its surroundings recorded a lower total variable cost compared to Upper East Region Farmers, and yet recorded



low sales revenue. Table 4.3 is summary of all the cost, revenue and margins a producer from the three main sources make in a season.

Table 4.3 Producer variable cost, revenue and Gross Margins by Region per hectare

Item/Activity	Techiman and Its Surroundings	Upper East Region	Tamale and its Surroundings
	Cost Of Input Per Hectare (Gh¢)	Cost Of Input Per Hectare (Gh¢)	Cost Of Input Per Hectare (Gh¢)
Hired labour	128.5	284.82	145
Family labour	18.76	24.62	20
Fertilizer	570.3	1360.78	950
Weedicides	40.1	17.54	35
Organic manure	1.2	0	3
Pesticides	68.84	239.56	105
Stakes	132	0	96
Irrigation cost	115.20	4.5	15
Tractor plough	0	379	100
Transportation	109	2.9	10
TVC	1,183.9	2,313.72	1,476
TR	4,379.32	3,559.8	2,976
GM per season	3,195.42	1,246.08	1,500

Source: Authors' Estimation from field survey, 2016.

The study revealed that, the prices of this commodity largely affected the difference in margins. Farmers in Tamale and its surroundings recorded the lowest average selling price of GHC 90, the Upper East Region farmers recorded an amount of GHC 104 as the average selling price per crate whilst Techiman and its surroundings farmers recorded an average selling price of GHC 162 per crate. This resulted in the low sales revenue for farmers in the Upper East and Tamale, leading to low gross



margins. Apart from this, whilst farmers in the Upper East Regions and Tamale used more fertilizer, their counter parts from the Techiman used less fertilizer, therefore reducing their farming cost. These account for the huge differences in margins between the two distant suppliers. Generally speaking, farmers make the second highest margin along the chain as shown in the Figure 4.3 .In line with Emanu and Gebremedhin (2007) who found that, poor marketing institutions and the generally weak farmer organization are the main reasons for the low commodity prices.

4.4.2 Wholesalers Gross Margins

The wholesalers buy the product from the farm gate and transport them all the way to the urban markets. There are a number of cost components associated with the product from the purchasing point to the urban destinations. At the time of the research, the cost components were recorded and calculated as showed in Table 4.4. The average purchasing price of the commodity was GHC 373.30 per crate. Transportation cost stood at GHC 28.7, loading and offloading per crate stood at GHC 5.0 bringing total variable cost to GHC 407. The average selling prices per crate stood at GHC 421.7. This computation leads to a margin per crate as GHC 14.7 as shown in Table 4.4. It is important to note that, wholesalers buy an estimated 10 crates on each trip. Traders in the Tamale market go on a trip six (6) times a month. Therefore by mathematical calculation;

Margin per crate × number of crates per trip × number of trips per month = Margin per month

Thus,

$$\begin{aligned} & \text{GHC}15_{\text{margin per crate}} \times 10_{\text{Crates per trip}} \times 6_{\text{trips per month}} \\ & = \text{GHC}900_{\text{per month accrued to a whole saler}} \end{aligned}$$



By this calculation, a wholesaler makes gross margin of *GHC 900 every month*. If there are approximately four (4) months in a season then $GHC900_{\text{per month accrued to a wholesaler}} \times 4_{\text{months}} = GHC3,600$ per season.

The price of tomato in the Tamale market ranges from as low as GHC 65 per crate to as high as GHC 600. The study revealed that wholesalers make the highest margin during the Burkina Faso; they make as much as GHC 20 per crate and as low as GHC 10 per crate during the dry and wet seasons respectively.

Table 4.4 Cost and Gross margins of Wholesalers

Item /Activity /Price	Cost/Price (GhC)	Margins (GhC)
Average Wholesale Price per crate	421.667	
Average purchasing price	373.33	
Loading onto the truck cost	2.5	
Unloading of the truck cost	2.5	
Post-Harvest losses	0	
Transportation cost	28.66	
Total Variable Cost per Crate	407	
Gross margin Per Crate (Av. Wholesale price minus total variable cost per crate)		15
Gross Margins per season (15 x 10 x 6 x4)		3600

Source: Authors' Estimation from Field Survey, January 2016.

4.4.3 Retailer Gross Margins

From Table 4.5, it is clear that retailers make a gross margin per crate of GHC 37.48 and seasonal gross margin of GHC 1,260. This is the lowest among the actors of the tomato value chain. Although retailers make more margins per crate than wholesalers, the latter sells more crates in a season than the former and thus the huge difference in the margins.



Table 4.5 Cost, revenue and gross margins of retailers

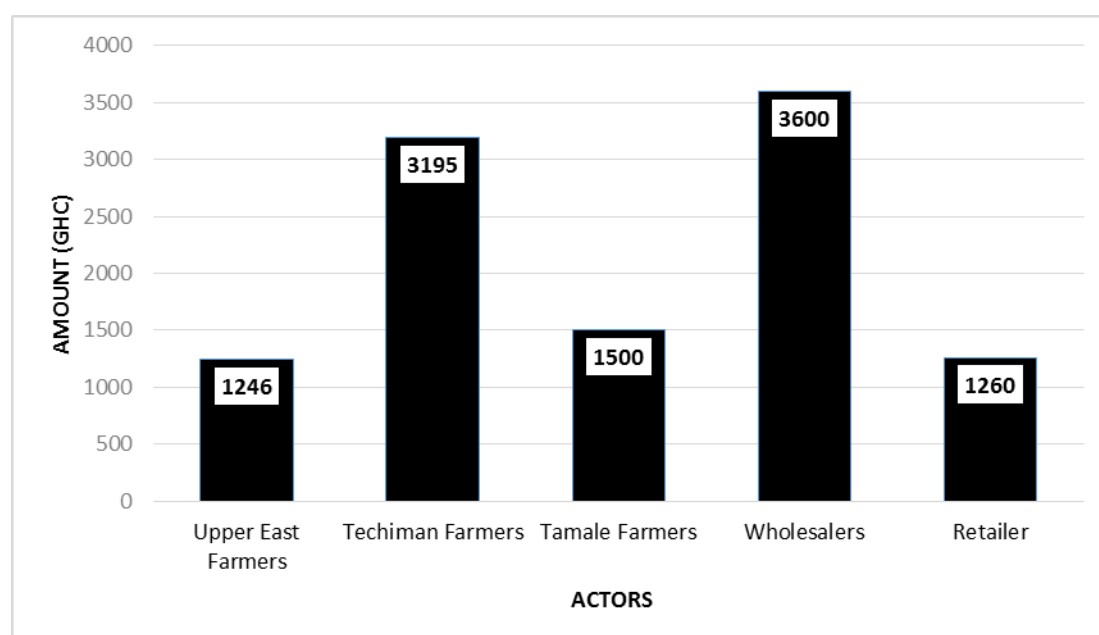
Item /Activity	Cost/Price (Gh¢)	Margins (Gh¢)
Average purchasing price	233.11	
Post-Harvest losses		
Partial losses	13.35	
Complete losses	5.4	
Head potter and other cost	4.28	
Total Variable Cost per Crate	256.21	
Average Retailer Price per crate	293.69	
Gross margin Per Crate		37.48
Gross Margins per season		1,260

Source: Authors' Estimation from Field Survey, January 2016.

4.4.4 Gross Margins of the Actors along the Chain

Figure 4.3 shows that among the suppliers of tomatoes into the Tamale markets, suppliers from Techiman make the highest margins, they still however come second to the wholesalers. The retailers however make the least margin.

Figure 4.3 Gross Margins Among Actors.



Source: Authors' Estimate from Field Survey, January 2016.

Table 4.6 is a summary of the cost, revenue and margins of all the actors discussed earlier. The results as shown below, indicate that the wholesalers control a substantial amount of the resources in the trade and hence have the highest gross margin.

Table 4.6 Total Variable Cost, Revenue and Gross Margins of all Actors per season

ACTOR		TVC (Gh)	TR (Gh¢)	GM (Gh¢)
Farmers	Upper East	2,313	3,559.8	1,246
	Techiman	1,183	4,379.3	3,195.4
	Tamale	1,476	2,976	1,500
Wholesalers		976,800	101,280	3,600
Retailers		8,740	9,964	1,260

Source: Authors' Estimation from Field Survey, January 2016.

4.5 Magnitude of Post-Harvest Losses among Actors

Objectives four of the study seeks to access the magnitude of post-harvest losses along the chain and among the major actors. Post-harvest losses come in two different dimensions. When a tomato is spoiling or rotting the value of the product reduces until it has no value. However, even after it is spoilt and has no value at all, the product still has some uses. For instance, when the product is completely rotten and cannot be used at all, the seeds are usually washed and dried for sowing in the next season. Hence the study categorized the losses into complete and partial losses.

4.5.1 Partial losses

Generally, after harvesting the tomato fruit averagely lasts 72 hours or less, depending on the variety and the mode of handling. After this period, the product begins to shows signs of spoilage. Certainly a product that has these signs of spoilage attracts lower prices than the product that does not show these signs. The



actor handling the product at any particular time is compelled to reduce the price. For instance, if a product is healthy and sells at GHC 40 per 'alonka' (15kg), as it begins to soften and shows signs of spoilage, the price might be reduced to GHC 30. This means there is a partial post-harvest loss of GHC 10.

4.5.2 Complete losses

Although, technically, there are no complete post-harvest losses since the seed could be used for other economic activities even after complete spoilage, the study categorized all post-harvest losses that had all its value left as seeds as a complete post-harvest losses. This categorization is due to the fact that when the product is spoilt completely, the product is not usually sold to the millers who wash and dry the product for its seeds. Pictures of how rotten tomatoes are processed into seeds are shown in the appendix II.

4.5.3 Post-Harvest Losses among Farmers

Post-harvest losses among farmers stood at 1.39 crates per hectare equivalent to GHC 161. Categorising these losses reveals that; partial losses stood at half a crate (0.52) per hectare, equivalent to GHC 61 and complete losses stood close to a full crate (0.87) crates per hectare, equivalent to GHC 100.53.

Since there are averagely 34.49 crates harvested per hectare, percentage of partial post-harvest losses can be calculated as:

$(0.52 \div 34.49) \times 100 = 1.5076\%$ this implies that, as much as 1.5% of revenue is lost due to partial post-harvest losses.

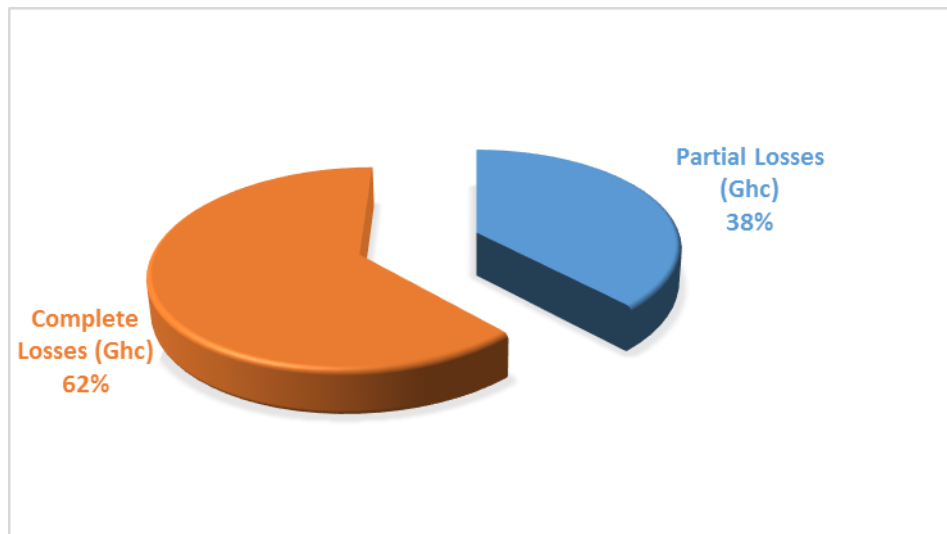
Similarly for complete losses;



$(0.87 \div 34.49) \times 100 = 2.52\%$ is lost due to complete post-harvest losses among farmers

In total, 4.03% of total revenue, representing GHC 161.53 is lost on every hectare, due to post harvest losses. Contrary to these findings, is the work of Robinson and Kolavali (2010) which revealed that, farmers in the Upper East Region recorded 50% post-harvest losses due to restricted access to the market. At the time of this research however, such restriction were no longer prevalent which could have accounted for the reduced level of post-harvest losses. This implies that by computation 38% of post-harvest losses recorded are partial whilst the remaining 62% are complete losses, as shown figure 4.4 below;

Figure 4.4 Categories of post-harvest losses among farmers



Source: Authors' Estimation from Field Survey, January 2016.

4.5.4 Post-Harvest Losses among Wholesalers

There are no direct post-harvest losses among the wholesalers. This is due to the fact that the wholesalers buy and sell in crates. They do not sort out the rotten ones before selling to retailers. It is usually the retailers who sort out along the chain.



What is common is that, wholesalers may not get good prices for their crates if they do not take their time to ensure that they buy very good tomatoes. However, wholesalers can also make losses if there is a breakdown of the vehicle carrying the product to the urban market or if there is an accident. As at the time of the research, no such incident was recorded. Usually, wholesalers supply on credit and get all the expected money back from the retailer only if the product is good and sells. Thus, post-harvest losses incurred by retailers negatively affect wholesalers indirectly as well. It is however very difficult to estimate the extent to which such indirect losses affect the wholesaler. The research findings show that wholesalers would most likely not get full payment for their products from retailers if the level of losses associated with the tomatoes traded is so high. Table 4.7 below is a summary of the post-harvest losses among the actors.

Table 4.7 Post-harvest losses incurred by each Actor along the chain

Actor	Partial Losses per season (GHC)	Complete Losses per season (GHC)	Total Post-Harvest Losses (GHC)	Percentage Of Total Revenue Lost
Farmers	61	100.53	161.53	0.0403
Wholesalers	-	-	-	-
Retailers	447	186	633	0.0644

Source: Authors' Estimation from Field Survey, January 2016.

4.5.6 Post-Harvest Losses among Retailers

The survey revealed that 61.42% of the retailers make no complete losses. All retailers however make at least some amount of partial losses. Because of the health implication of rotten tomatoes, many domestic buyers shun it. Quite a small number of domestic consumers (7.14%) purchase rotten tomatoes, 92.85% of the rotten tomatoes is purchased by the commercial users or the chop bar operators. Robinson

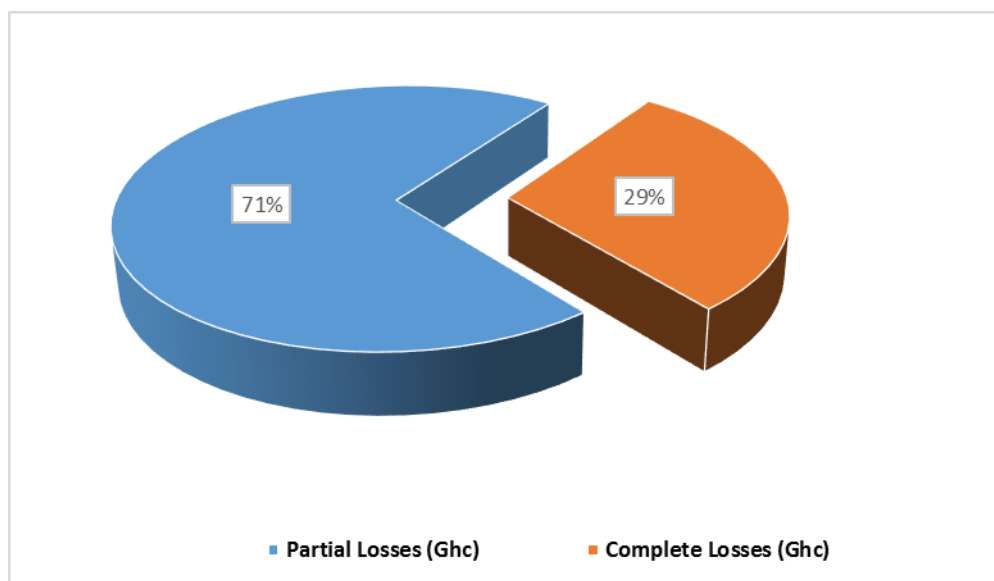


and Kolavalli (2010 p.61) assert that “lower quality tomatoes that are squashed, or slightly mouldy are cheaper and typically sold to chop bar operators who will cook them immediately”. They (Chop bars operators) treat the sourness with chemicals and then use it to prepare their products for sale. These people are profit oriented organizations and are not so bothered about the health implications of the product. They however believe it has no health implication and argue, they are only minimizing their operational cost by buying these rotten tomatoes at low prices.

Retailers in the Tamale market lose averagely **GHC 447** to partial post-harvest losses and **GHC 186** to complete post-harvest losses every season. These losses, made each season, represent 7.3% of the total amount that accrue to the variable cost of the retailers. The case of the retailer is special; their post-harvest losses add up to their variable cost and hence shoots the variable cost up by this figure (i.e. the amount lost due to post harvest losses). In all, 6.44% of total revenue is lost every month due to post harvest losses. The summation of both the partial and complete losses gives; **GHC 447 + GHC 186 = GHC 635 per season**. This implies that 29% of all losses incurred by retailers in the Tamale markets are complete losses with the remaining 71% being partial losses as shown in figure 4.5 below;



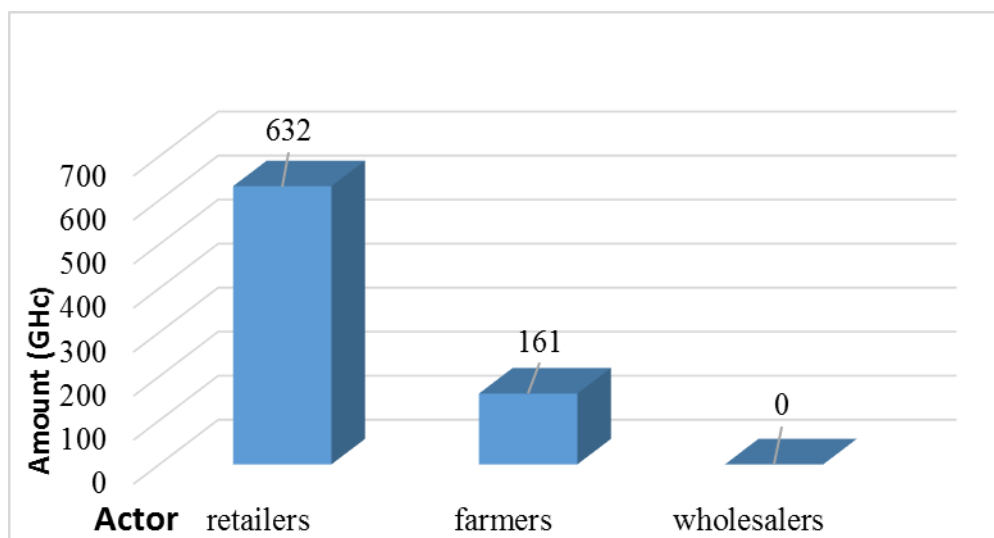
Figure 4.5 Categories of post-harvest losses Among Retailers



Source: Authors' Estimation from field survey, 2016

For easy comparison Figure 4.6 below presents a graphical view of the magnitude of post-harvest losses among all the actors in season.

Figure 4.6 Magnitude of post-harvest losses among actors along the chain.

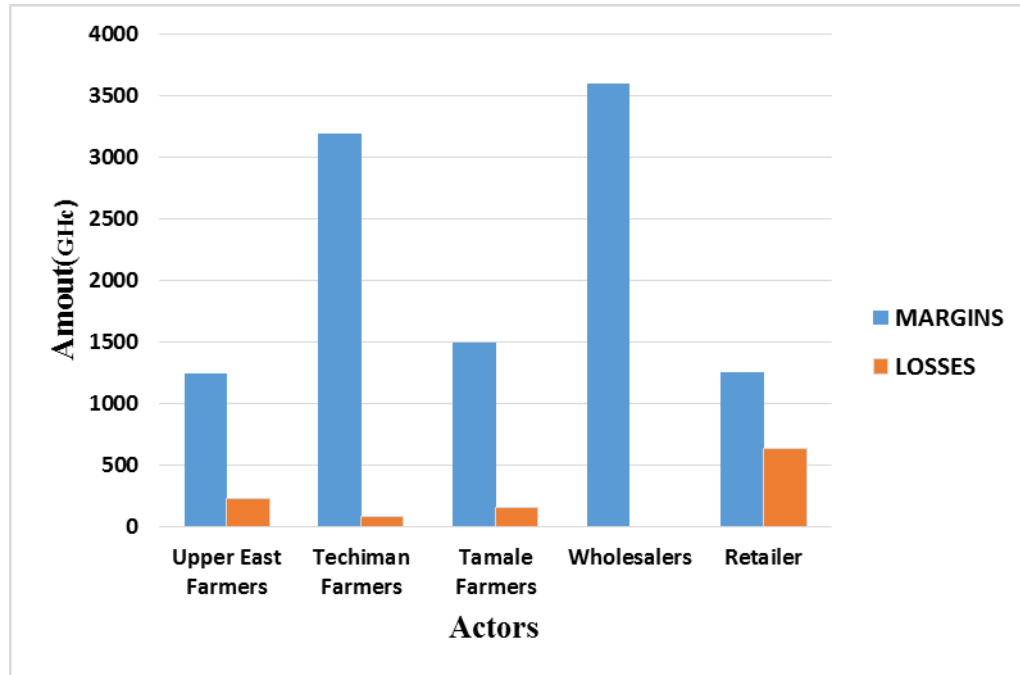


Source: Authors' Estimation from Field Survey, January 2016.

4.5.7 Effects of Post –Harvest Losses on Gross Margins

The study discovered that post-harvest losses greatly impacted on the margins of all the actors along the chain. Whilst the wholesalers recorded no post-harvest losses they made the maximum margins. This is because post-harvest losses reduce sales revenue which eventually leads to reduced margins. Clearly it is seen from Figure 4.7 that post-harvest losses significantly affect the margins accrued to each actor long the chain. Wholesalers with the highest gross margins suffer no post-harvest losses. Farmers from Techiman with the second highest gross margins has the second least post-harvest losses. The retailers and farmers from the Upper East suffer the most from post-harvest losses and are thus, at the bottom, in the ranking of gross margins.

Figure 4.7 Effects of Post-Harvest losses on Margins



Source: Authors' Estimation from Field Survey, January 2016.

4.6 The Rationale for a Regulated Tomato Market

4.6.1 The Queens Organized Routine trade trips

Although as at the time of the research, the market queens were yet to select and replace their deceased leader, the wholesalers were still organized and in control of the market, despite the power vacuum. However, there were instances of intruder traders described by Ngeleza and Robinson (2010) as the recalcitrant traders who would continue to defy the supply arrangement of the union. The wholesalers still had an organized time table of who goes where, when, and how much tomato is to be brought into the Tamale market each day.

The study discovered that every day a team, consisting of six members from the queens, leave to buy tomatoes to bring into the market. They bring in an estimated, 80 to 120 crates depending on the price, season and availability of the product at the purchasing destination. During the Burkina Faso season, traders bring in tomatoes after every two days.

4.6.2 Demand and Supply of Tomatoes

The study showed that, the queens constantly keep the supply of the product to meet the demand of the Tamale market. As observed by Amikuzuno et al. (2015), the commodity is relatively scarce during the dry season leading to increased price level. The increased price levels leads to a decrease in demand for the product. The risk in the industry is that because of the highly perishable nature of the product, everybody along the chain demands an immediate market. The farmer, like any other actor, after harvesting wants the product off his hands (immediate sales) to avoid spoilage.



4.6.3 The Risk associated with uncertain Demand

The queen, without knowing who wants to buy the product, when and what quantity needs to be bought, transports the product into the urban markets amidst all the uncertainty. The retailer, then tries her “luck” by displaying it at the road side or market center for the consumer. If the consumer’s demand delays or lags behind for just a day, the product gets rotten and the wholesaler loses indirectly (i.e. through the retailers). It is important to note here that majority of the retailers buy from the wholesalers on credit and pay if and only if they are able to sell. Hence the wholesalers indirectly bear the entire risk right from the farm gate to the dining table.

4.6.4 The Instrumental Role of the Queen in the Entire Chain

When the product is in abundance, the wholesalers are forced to reduce the price. Every investor requires some amount of certainty against the backdrop of risks. The queens cannot control the demand needs of the market, but they can control or limit supply to a justified minimum level to avoid gluts and propel a balance between demand and supply.

A wholesaler on a trip should be certain that, given a certain amount of demand, (i.e. 80 crates a day) her product can be guaranteed demand in a matter of 48 hours. Consumers do not adjust their demand for the product immediately; therefore, even when prices fluctuate so downwards at a time, quantity demanded would not respond so quickly, this to lead to losses.

This phenomena explains why wholesalers try to regulate the markets. Ngeleza and Robinson (2011) explained that in an effort to control this risk (associated with losses) the queens have manipulated access to the key urban markets which reduces



the risk associated with their trade, but increases the risk of tomato farming , since farmers cannot have free access to the Urban markets.

4.6.5 Does the Consumer Benefits during Gluts/excess supply?

The findings shown that, wholesalers embark on a journey to buy tomatoes, given a minimal assurance that their product would be demanded within a reasonable period. If the wholesaler returns with the product to the market anticipating that the immediate demand would equate the immediate supply; only to discover, that another person/trader, knowingly or unknowingly has brought in same quantity into the market, then, all other things being equal, the market would have twice what it needs immediately (i.e. Quantity supplied would be twice Quantity demanded). This would cause the price to fall. This decreased price is expected to benefit the consumer all other things being equal; however, the problem is that quantity demanded, in the case of the tomato products is not too swift to take advantage of the reduced prices, given, the short trading period of just a day or two. Sexton et al. (1991) and Ravallion (1986) argued, that the short run equilibrium among perishable commodities is an implausible equilibrium concept because trade does not adjust instantaneously to price differentials. Such a situation leads to reduced prices and losses for both traders; with a very small benefit to consumers who have room to purchase more.

The end result is that consumers benefit less, wholesalers suffer most. If this happens continuously any rational trader would channel the given resources to another sector. The study revealed that the queens are not just interested in ad hoc trading, but are interested in a systematic trade, with a fixed quantity at a time.



4.6.6 Queens and Farmers' Relationship

Many researchers (e.g. Yakubu, 2009), have argued that the queens determine the prices they want and the farmers are always obliged to give in or risk losing their produce. Contrary to this, the study discovered that in Tuobodom near Techiman farmers bring their produce to the road side to sell to a lot of wholesalers who come from cities like Kumasi, Accra, Bolgatanga, Tamale etc. The presence of so many buyers weakens the cartel system supposedly enjoyed by the queens, as they compete among themselves to buy from the farmers. They rush to any farmer bringing his produce to propose a price, the farmer then sells his/her product to the best bidder. It is important to note that farmers only suffer when their supplies outweigh the demand of the queens. At this instance, the queens buy from farmers with whom they have long standing relationships. The study discovered that even in times like that, farmers then rely on the queens to assist them get the product to the urban market on credit to avoid a complete loss. The queens therefore are instrumental in avoiding post-harvest losses and protect farmers even when that means fallen margins due to the increased supply in the market. The study revealed that the farmers even make more margins on each crate far more than the wholesalers, although the latter deals with more crates than the former.

4.7 The Perceptions and Factors Influencing Consumers' Choice and preference.

4.7.1 Consumer Perception

The consumers are the final actors in the chain; they act as the seal to the entire process. A consumer's choice is based on several factors, including his/her perception about the product. Consumers usually respond to the fluctuating prices prevailing in the fresh tomato market. Although majority of consumers in the



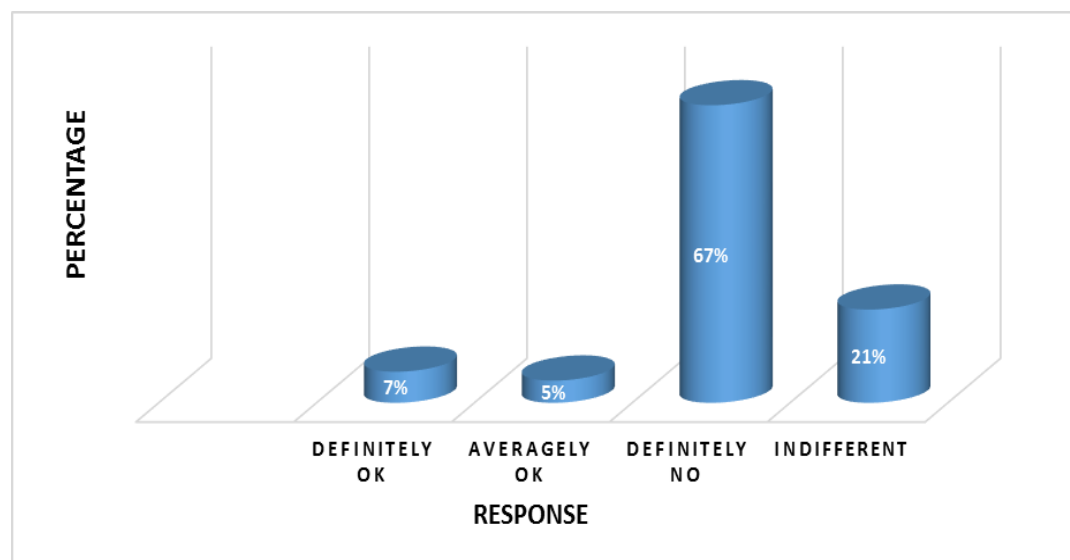
metropolis combine both products (fresh tomatoes and tomato paste) for cooking, they occasionally vary the proportion. For instance, during the wet season when the product is in abundant supply, consumers use more of fresh tomato than the tomato paste. However during the lean season when the price of tomato becomes relatively high, consumers divert their demand towards the tin tomatoes. It is important to note that, although the fresh tomato is a substitute to the tomato paste, the two are to some extent complements. The discussion under this section therefore looks at the varieties and types that are mostly preferred in the different seasons.

4.7.2 Consumer Perception Based On Quality

From figure 4.8 below, it is clear that 67% of consumers in the Tamale metropolis believe the quality of local variety of tomato compared with the Burkinabe variety is low. Whilst 21% suggested they were indifferent as to which one had the better quality, 7% believed the local variety was very much okay compared with the imported and 5% believe it was averagely okay. This explains why consumers prefer the imported variety to the local variety.. This justifies the earlier work of Ihle and Amikuzuno (2009) which discovered that wholesalers abandon the domestic fresh tomatoes from Upper East Region, for the Burkina Faso variety, arguing consumers prefer that to the local ones. Again the findings indicate that, an estimated 77.14% of retailers believe that the Upper East and Burkina Faso varieties are more valuable than the other varieties. About 82.85% of the retailers believe the Techiman variety is valuable whilst 97.14% of them believe the local variety (Dagbamba) is the least valuable. These responses were based on the varieties that yielded the most profit. They cited consumer choice and preference for these varieties as the main reason for their values.



Figure 4.8 Perception of Consumers Based on Quality



Source: Authors' Estimation from Field Survey, January 2016.

4.7.3 Perception of consumers based on price

Majority of consumers (55%) believe the price of the local tomato is reasonable compared with the imported fresh tomatoes, while 22%) think it is high. Also, 13% believe is the same, and the remaining 10% agree that, the local variety is lower in price than the imported Burkinabe variety as shown in table 4.8 below.

Table 4.8 Perception of price of local tomatoes compared with the imported

PERCEPTION OF PRICE	FREQUENCY	PERCENT (%)
Higher	22	22
Reasonable	55	55
The Same	13	13
Lower	10	10

Source: Authors' Estimation from Field Survey, January 2016.

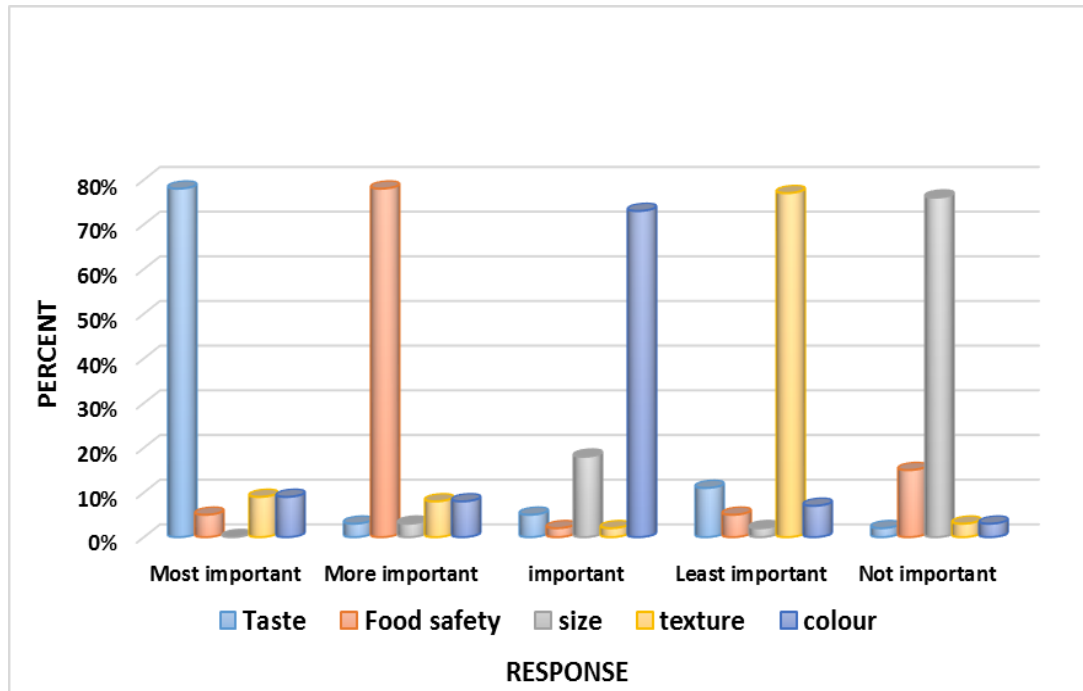
4.7.4 Factors Influencing Consumer Choice

The study also looked at some of the characteristics that consumers consider when buying fresh tomatoes from the markets. These were ranked according to the level of importance and are presented in figure 4.8 below. .

The most important characteristic that consumers in the Tamale metropolis consider when buying fresh tomatoes is taste. This is so because every consumer wants to have a tasty meal and since tomatoes form the core of the taste in every meal, consumers are more interested in that characteristic than any other. The second most ranked is food safety. This explains why rotten tomatoes which are hygienically not good for consumption has low patronage and retailers would have to sell it to commercial consumers. Colour of the tomatoes is another important characteristic that consumers look out for when purchasing. The colour of tomato is a characteristic that easily attracts buyers. It also helps make meals attractive, hence consumers' preference for such a characteristic. Texture/smoothness and size of the commodity were deemed to be the least characteristics consumers look out for before purchasing the product. This is depicted by figure 4.9 below;



Figure 4.9 Characteristics consumers consider when buying fresh tomatoes



Source: Authors' Estimation from Field Survey, January 2016.

4.7.5 Frequency of Tomato consumption

The research revealed that, about 3% of the respondents consume tomatoes once every week, 47% of the respondents consume the product 2 to 4 times a week, 34% of them consume it every day. An estimated 13% consume the product once in a month. The remaining 3% of consumers rarely consume the product. This finding is in line with that of Agyekum (2015), who estimated that the product forms about 38% of every Ghanaian vegetable expenditure.

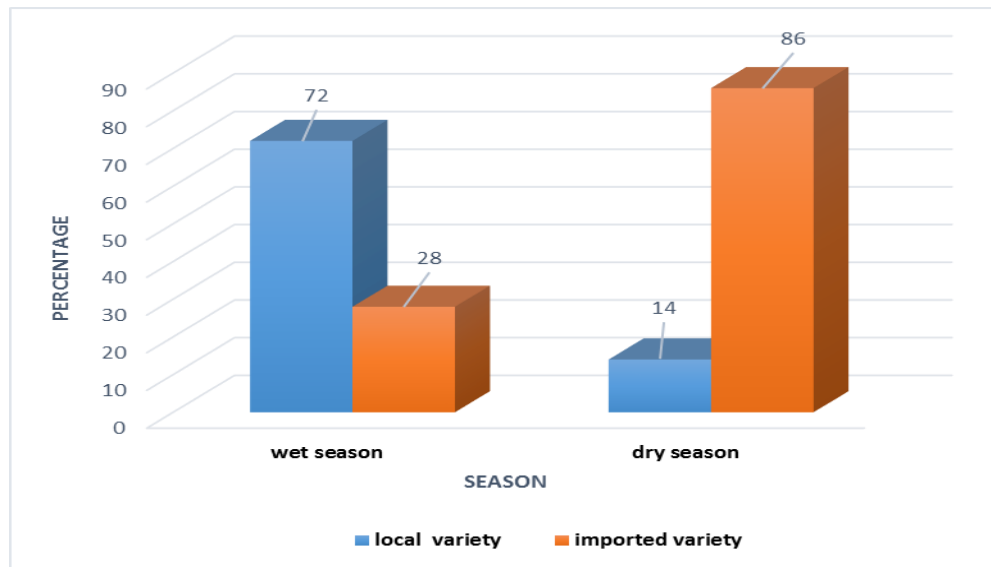
4.7.5.1 Frequency of Consumption across Seasons

As shown in the figure 4.10 below, seventy-two percent (72%) of the locally produced tomato is consumed during the wet season whilst 86% of the consumption of the imported variety takes place during the dry season. This is due to the fact that during the wet season supplies from the adjoining communities come at a cheap



cost. The commodity is cheap during the wet because it is in abundant supply. The situation however changes when it gets to the dry season and only irrigated schemes in the country and Burkina Faso supply the product. This is presented below in figure 4.10.

Figure 4.10 Frequency of consumption of tomatoes per season



Source: Authors' Estimation from Field Survey, January 2016.

4.7.6 Fresh and Tin Tomatoes as substitutes and complements

It is common knowledge that the fresh tomato and the tin tomatoes are very close substitutes as well as complementary. However whilst the price of fresh tomatoes remains highly unstable, that of the tin/tomato paste remains very consistent and stable. The expectation by economic theory is that when the price of a particular product shoots up, the quantity demand for its substitute also increases, all other things being equal.

The findings indicate that the price of fresh tomatoes is a major influencing factor as far as the consumer purchasing decision is concerned. The study revealed that in line with economic theory, consumers of fresh tomatoes consider price of fresh tomato to



be highly influential on their demand for the product. During the wet season when fresh tomatoes are very cheap consumers use more of it, however in the dry season when the prices of the commodity begins to rise, consumers conveniently reduce the quantity of fresh tomatoes they use and replace it with tomato paste which then becomes relatively cheap. As shown in the figure 4.11 below, 65% of the respondents believed that the price of fresh tomatoes mostly influence their demand whilst the remaining thirty-five percent (35%) believe the price of tin tomatoes influence the quantity of fresh tomatoes they buy. Since the price of tomato paste remains stable, consumers usually shift their demand towards the alternative, i.e. tomato paste any time the prices of the fresh tomato goes up.

As discussed earlier the price of fresh tomatoes is directly related to availability of the product, for this reason in the dry season the high prices of the product is as a result of the decreased supply of the products which leads to an increase in the demand for tin tomatoes.

4.8 Consumer Choice or Preference between Fresh and Tin Tomatoes

Besides the choices consumers make among the varieties of tomatoes, they also make choices among the types of tomatoes. This is to say consumer have the option of choosing between fresh tomato (both the local and imported) and tomato paste. Although the use of fresh and tin tomatoes are complementary, the study explored some of the factors that inform a household preference for either the fresh or tin tomatoes in both wet and dry seasons, as indicated in Table 4.9 below. Marital status, income and household size were the most significant variables.

The result indicates that the probabilities of a married person choosing fresh tomatoes are 0.244 and 0.23 higher than that of unmarried persons in the wet season



and dry season respectively. This is again attributed to the price system. Generally speaking, the price of fresh tomatoes is usually very high in the dry season compared to the relatively stable prices of tomato paste. Again couples may pull their resources together and therefore are financially well positioned to buy fresh tomatoes at all-times despite the fluctuating price systems with season. The difference is not much. As a household size increases, in the dry season such a household would prefer less of the fresh tomato which at that time is relatively expensive. The probability of such a household choosing fresh tomatoes in the dry season decrease by 0.031. This is significant and meets *a priori* expectation as shown in Table 4.9.

Table 4.9 Marginal effects after probit estimations (consumers choice of the types of tomatoes i.e. the tomato paste and fresh tomatoes)

Variable	Wet season		Dry season	
	marginals (dy/dx)	P> z	marginals (dy/dx)	P> z
Sex	0.165	0.211	0.0004	0.998
Household Size	0.023	0.219	-0.031	0.095*
Marital Status	0.244	0.041**	0.23	0.064*
Expenditure On Tomatoes	0.0005	0.924	-0.0007	0.896
Expenditure On Vegetable	0.002	0.408	-0.0002	0.940
Income	0.0005	0.069*	0.0005	0.090*
Employments	-0.032	0.834	-0.106	0.455
Age	-0.003	0.554	0.0002	0.961
Educational Level	-0.041	0.731	-0.053	0.647
	Number of obs =	100	Number of obs =	100
	Prob > chi ² =	0.0111	Prob > chi ² =	0.02222
	Pseudo R ² =	0.286	Pseudo R ² =	0.288

Note: *= significant at 10% , **= significant at 5%

Source: Authors' Estimation from Field Survey, January 2016.

Irrespective of the season, an increase in the income of a consumer would lead to an increased probability of choosing fresh tomatoes over the tomato paste. This implies



that rich people prefer the product (fresh) irrespective of season. This could be attributed to the tasty nature of meals prepared with fresh tomatoes.

It can thus be concluded that, consumer's preference for the two types of tomatoes largely vary with season. The results from the estimation confirm that prices of fresh tomatoes plays a crucial role in determining consumers' choice at any season in the year. For instance, during the dry season, consumers use more of tomato paste than in the wet season as discussed earlier. Again, consumers prefer to use fresh tomatoes during the wet season than in the dry season. Prices of tomatoes paste are known to be relatively stable and thus, are certainly not the reason for the shift in the demand.



CHAPTER FIVE

SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS

5.0 Introduction

The chapter summarizes the research, highlighting the key findings. Conclusions are then drawn on the key findings. Finally, policy recommendations on the way forward of the tomato industry.

5.1 Summary of Findings

The Northern Region of Ghana is an important region in the production, marketing and consumption of tomatoes. Like many Agricultural products, tomatoes get into the Tamale markets from different sources/production zones. There are a number of actors responsible for the transition of the commodity from the farm gate to the urban consumer. The study therefore set out to carry out socio economic analyses of tomato production, marketing and consumption in the Tamale Metropolis. Specifically, the study examined the Gross margins and post-harvest losses among actors, the sources of tomato supply into the Tamale Markets and factors that influence farmers' decision to adopt dry season farming as well as the perceptions and choices of consumers of tomatoes in the Metropolis.

The study adopted a multistage sampling procedure to select a total of 350 actors in the tomato value chain. This is made of farmers (150), wholesalers (30), retailers (70) and consumers (100).

In analyzing, the factors that affect farmers' decision to adopt dry season farming; the results indicate that availability of irrigation schemes was a very influential factor that affected dry season. Credit and the distance between a farm and the water source also greatly influenced farmers' decision to adopt dry season farming.



The study also revealed that annual supply of fresh tomatoes into the Tamale Metropolis is estimated at 1,944 tonnes. Out of this, the Burkina Faso source supplied 34.5%, closely followed by 33.33%, supplied by Techiman and its surrounding source, Tamale and its surrounding supplied the least (31.25%).

Furthermore, farmers from Techiman were producing at a lower cost than the farmers from the Upper East Region. The use of tractors was prevalent among farmers in the Upper East Region but absent among farmers in Techiman. Fertilizer usage again increased the margins gap between farmers of Upper East Region and Techiman. This was because more fertilizer was used at the Upper East Region than Techiman.

Similarly, wholesalers made the most profit, along the chain, making GHC 3,600 per season, the highest gross margins with no post-harvest losses. Closely followed are farmers from Techiman and its surroundings with an estimated GHC 3,195.42 gross margin per farm, with the second lowest rate of post-harvest losses. The retailers and farmers from Upper East made the lowest gross margin; that is, GhC 1,260 and GhC 1,246.08 respectively and yet recorded the highest post-harvest losses along the chain.

However, Post-harvest losses greatly affected retailers, with wholesalers being the least affected because of their bulk purchases and sale. Averagely, retailers lost as much as 7.3% of their revenue to post harvest losses. The study discovered that post-harvest losses decreased the margins of farmers in the Upper East Region than farmers from the Techiman zone.

Lastly, consumers generally preferred the Burkinabe variety to the local variety, attributing their choices to the quality of the Burkinabe variety. Consumer choice of



the type of tomatoes however, varied with season, for instance the study discovered that consumers preferred and consumed more of the tomato paste than the fresh tomatoes during the dry season. They however shift their demand to purchasing more fresh tomatoes during the wet season when the product is relatively cheap and is abundant in supply. Income, household size and marital status were factors that significantly affected consumer's choice of fresh tomatoes over tin tomatoes with season.

5.2 Conclusions

The following conclusions may be drawn from the findings: First, the presence of the irrigation schemes, access to credit and the distance between the farms and the water sources greatly affect adoption of dry season farming. With regards to the Second, the margins enjoyed by the wholesalers are fair; the low margins of the retailers are as a result of post-harvest losses which cause each retailer as much as GH¢635 per season.

In line with previous works, the study concludes that consumer choice and preference are a true reflection (reason for) of the diversion of trade from the Upper East Region to Burkina Faso, because consumers perceived tomatoes from Burkina Faso to be of a superior quality than the Upper East variety. The fluctuating nature of the prices of fresh tomatoes results in the substitution of the product for the tomato paste during the lean season when prices are high.

Finally, the researcher is of the belief that the role of the queens in the marketing system underscores the failure of marketing institutions to adequately manage the marketing chain effectively and efficiently without gluts and shortages. The



regulated tomato market system pursued by the wholesalers in the Tamale market remains the only reason why the tomato trade is still in existence.

5.3 Policy Recommendations

Based on the findings of the study the following recommendations are made: First, Policy makers should make more efforts in building more irrigation facilities, since that encourages dry season farming, which is necessary for the country to meet its tomato needs during the dry season. Again given the fresh tomato deficit that hits the country during the dry season, investors should take advantage of this and invest in irrigation farming which has the tendency of yielding higher profits.

Also famers in Ghana, especially those in the Upper East Region, must adopt the varieties produced in Burkina Faso. Ghanaian farmers must again make conscious efforts to improve the soil fertility of their farm lands using manure without solely depending on fertilizer, which increases their cost of production. Price fluctuation for fresh tomatoes greatly affected consumer's choice in a season. Increased production levels and a consistent supply chain mechanism could greatly reduce the price fluctuation and hence ensure a stable consumption pattern for consumers.

Access to credit also greatly affected farmers' adoption of dry season farming; hence policy should be geared towards making credit available to farmer. In order to minimize post-harvest losses, Government should revamp the collapse tomato factories to enable farmers get ready markets for their tomatoes to avoid gluts and spoilage.



REFERENCES

- Adama, C. A. (2009). *Consumer perception of groundnut quality, aflatoxin awareness and Willingness to pay for safe groundnuts in the northern Region*. Ghana.
- Adimabuno, A. M. (2010). *Marketing and market queens: a case of tomato farmers in the Upper East Region of Ghana*. Gedruckt mit Genehmigung der Philosophischen Fakultät der Rheinischen Friedrich-Wilhelms-Universität Bonn.
- Agriculture, F. a. (2012). *A Profile Of The South African Tomato Market Value Chain*.
- Agyekum, A. (2015). *Overview of Tomato Value Chain in Ghana; A Presentation at the WACCI Tomato Value Chain Meeting*,. Legon, Accra.
- Ahenkora, S., Akpalu, E., Kerr, J., Marfo, K., & Ulzen-Appiah, F. (1995). *Gender and the implementation of structural adjustment in Africa: examining the micro-meso-macro linkages: the Ghana study*. Accra: SAGA initiative.
- Al-Hassan, R., & Diao, X. (2007). Reducing Regional Disparities in Growth and Poverty Reduction in Ghana: Policy Options and Public Investment Implications, (in) *Poverty Reduction Strategy in the New Millennium: Emerging Issues, Experiences, and Lessons*. China Financial Economic Press., L. Zhang and S. Fan (eds.) 221–249,.
- Ameyaw, S. (1990). *The dynamics of female entrepreneurship and indigenous food markets: a case of Techiman market women, Ghana*, 'Office of Women in Development. Michigan State University: Working Paper, No. 205, April.
- Amikuzuno, J., Setsoafia, E. D., & Seini, A. Y. (2015). *Regional Integration In Africa: Why Cross-Border Price Transmission And Integration Of Agricultural Markets Matter*,. Selected Paper prepared for poster presentation at 2nd Globalfood Symposium, University Of Goettingen Germany. 24th-25th April 2014.
- Amikuzuno,, J., & Donkoh, S. A. (2012). *Border effects on spatial price transmission between fresh tomato markets in Ghana and Burkina Faso: any case for promoting trans-border trade in West Africa?* At the International Association of Agricultural Economists (IAAE) Triennial Conference, Foz do Iguaçu, Brazil, 18-24 August, 2012.
- Asuming-Brempong, S. & Bruce, S. D., (2004). Responding to Economic Shocks in Ghana: the Agricultural Sector as a Social Safety Net,. *Journal of Agricultural and Development Economics*,, Vol.1 No 1, p 117-137.
- Awiti Kuffuor report to IFPRI (2009), in Robinson, J. Z., & Kolavalli, S. L. (2010). *The Case of Tomato in Ghana: Marketing, Ghana Strategy Support Programme (GSSP)*,. Working Paper No. 20, Development and Strategy Governance Division, IFPRI, Ghana.



- Baden, S. (1988). *Gender issues in agricultural market liberalisation*. BRIDGE Report No 41, BRIDGE, IDS, Brighton, January.
- Bello, A. L., & Bello, D. (2000). *The importance of intrinsic and extrinsic clues to consumer's choice*.
- Blench, R. M. (1999). *Agriculture and the environment in northeastern Ghana: a comparison of high and medium population density areas*. London. Research, 23(3),25.: In: R.M. Blench (ed.) Natural resource Management and Socio-economic Factors in Ghana, 21-43, Overseas Development Institute.
- Bonner, G. P., & Nelson, R. (1985). *Product attributes and perceived quality*. Foods. In J. Jacoby & J. Olson (Eds.), Perceived quality (pp. 64-79). Lexington, MA: Lexington Books.
- Briones, Roehlano M., 2013. " HYPERLINK "https://ideas.repec.org/p/phd/dpaper/dp_2013-16.html" Market Structure and Distribution of Benefits from Agricultural Exports: the Case of the Philippine Mango Industry ," HYPERLINK "<https://ideas.repec.org/s/phd/dpaper.html>" Discussion Papers DP 2013-16, Philippine Institute for Development Studies.
- Cause M, Chloe F, Clement C, Melanie L, Brigitte N,(2010). Consumer Preferences for Fresh Tomato at the European Scale: A Common Segmentation on Taste and Firmness. *Journal of Food Science*, Wiley, 2010, 75 (9), pp.S531-S541.
- Clotey, V. A., Karbo, N., & Gyasi, K. O. (2009). The Tomato Industry In Northern Ghana: Production Constraints And Strategies To Improve Competitiveness. *African Journal Of Food, Agriculture, Nutrition And Development*, Volume 9 No.6 2009 September.
- Creswel, J. W. (2001). *Educational Research: Planning, conducting and evaluating qualitative research*. New York Prentice Hall.
- Donkoh, S. A., Tachega, M., & Amowine, N. (2012). Estimating Technical Efficiency of Tomato Production in Northern Ghana. *American Journal of Experimental Agriculture*, 3(1): 56-75, 2012.
- Donkoh, S. A., S. Ayambila, S. Abdulai (2013). Technical Efficiency of Rice \production at the Tano irrigation Scheme in Northern Ghana. *American journal of Experimental Agriculture*. 3(1), 25-42,2013.
- Emana, B., & Gebremedhin, H. (2007). Constraints and Opportunities of Horticultural; An empirical application for beef. *Food Quality and Preference Journal*, 11, 238.
- FAOSTAT. (2015). *Global production and trade of tomatoes* FAO.
- Ghana statistical Service (2012),Ghana population and Housing census Report.

- Henson, S. (1996). Consumer willingness to pay for reductions in the risk of food poisoning in the UK. *Journal of Agricultural Economics*, 47(3): 403-420.
- Holm, L., & Kildevang, H. (1996). Consumers' views on food quality. A qualitative interview study. *Appetite Journal*, 27, 1-14.
- ICOUR. (2001). *Farmers Bulletin NO. 39*, Ghana.
- ICOUR (1995) *Farmers Bulletin NO. 17* Ghana
- Ihle, R., & Amikuzuno, J. (2009). *The integration of tomato markets in Ghana with and without direct trade flows*. August 16-22, 2009, Beijing, China.: Contributed paper prepared for presentation at the International Association of Agricultural Economists Conference.
- International labour Organisation (2014), *Market Study and Marketing Strategy of Tomato Sector in Mafraq*. Draft Report v2 (10 August 2014)
- Inusah Y., Julius Y. and Michael M. (2013), *The tomato industry in Ghana Fundamental challenges, surmounting Strategies and perspectives*. *International Journal of Current Research* Vol. 5, Issue, 12, December, 2013
- Konings, P. (1981). *Peasantry and the State in Ghana, the Example of the VEA Irrigation Project in the Upper Region of Ghana*. Leiden: African Studies Centre, Working Paper No. 5.
- Lars, P. (2009). *Consumer Behaviour: The Psychology of Marketing*. Los Angeles, CA 90089-0443, USA (213) 740-7127 (213) 740-7127 <http://twitter.com/larsperner>.: Department of Marketing. Marshall School of Business, University of Southern California.
- Laube, W. (2005). *Players, Structures and Institutional Change: External Interventions and the (De-) institutionalisation of Local Natural Resource Regimes in West Africa*.
- Levitt, T. (1981). *Marketing intangible products and products intangibles*. *Harvard Business Review*, 59(3), 99.
- Lumpkin, T., Weinberger, K., & Moore, S. (2005). *Increasing Income through fruit and Vegetable Production, Opportunities and Challenges*. Marrakech, Morocco: Consultative Group on International Agricultural Research Science Forum.
- Lyon's (2005), in Adimabuno, A. M. (2010). *Marketing and market queens: a case of tomato farmers in the Upper East Region of Ghana*. Gedruckt mit Genehmigung der Philosophischen Fakultät der Rheinischen Friedrich-Wilhelms-Universität Bonn.
- Malholtra, N. K. (2003). *Marketing Research :an applied orientation-customer version*. Australia: Pearson Education.



- Mathilde, A., Ottaviani, J., & Stefano, L. (2008). *The Dark Side of the Italian Tomato: A documentary by Aljazeera*. online <http://webapps.aljazeera.net/aje/custom/2014/italiantomato/index.html>.
- Ministry Of Food And Agriculture. (2013). *Facts And Figures*. Statistics, Research And Information Directorate (Srid) August, 2013.
- Monney et al.,(2009) in Agyekum, A. (2015). *Overview of Tomato Value Chain in Ghana; A Presentation at the WACCI Tomato Value Chain Meeting*., Legon, Accra.
- Nachmias, C. F. (1996). *Research methods in social sciences*., Paris: Holder Arnorld.
- nd., T. U. (2010). *Keep tomatoes moving: strengthening cooperation between traders and farmers in Ghana*. <http://www.agri-profocus.nl/docs/200809121401518839.pdf>.
- Neuman, W. J., & Kreunger, P. (2003). *Social Research methods qualitative and quantitatve Approach (4th ed.)*:. London Allyn and Bacon.
- Ngeleza, G., & Robinson, E. J. (2011). *Do Ghana's market queens help or hinder? A spatial arbitrage model incorporating uncertainty and market power*. International Food Policy Research Institute.
- Orchard, J. A., & Suglo, E. K. (1999). *Integrated food crops systems projects: Enhancing smallholder livelihood through reducing costs and adding value to agricultural production*. Final Technical Report, June. U.K.
- Ochieng and Sharma (2005 in Adimabuno, A. M. (2010). *Marketing and market queens: a case of tomato farmers in the Upper East Region of Ghana*. Gedruckt mit Genehmigung der Philosophischen Fakultät der Rheinischen Friedrich-Wilhelms-Universität Bonn.
- Parasuraman,, A., Zeithaml, V. A., & Berry,, L. L. (1988). Servqual: A multiple-item scale for measuring consumer perception of service quality. *Journal of Retailing, Production and Marketing in Eastern Ethiopia*., 64(1), 12.
- Ravallion, M. (1986). Testing market integration. *American Journal of Agricultural Economics* , 68 (1): 102–109.
- Reeves, C. A., & Bednar,, D. A. (1994). Defining quality: Alternatives and implications. *The Academy of Management Review*, vol. 19, no. 3, pp. 419-445.
- Robinson, J. Z., & Kolavalli, S. L. (2010). *The Case of Tomato in Ghana: Marketing, Ghana Strategy Support Programme (GSSP)*., Working Paper No. 20, Development and Strategy Governance Division, IFPRI, Ghana.
- Satish, Y. D. (2001). *food industry and focus on Quality Management*. IIM-A Working paper : In a freer WTO Trade regime.

- Sexton, R. J., Kling, C. L., & Carman., H. F. (1991). Market integration, efficiency of arbitrage, and imperfect competition: Methodology and application to U.S. celery. *American Journal of Agricultural Economics* , 73 (3): 568–580.
- Steenkamp,, J. B. (1989). *Product quality-an investigation into the concept and how it is perceived by consumers*. Assen/Maastricht: van Gorcum Publisher. Retrieved 22nd March, 2013 from [http://www. emeraldinsight.com/Insight/manulDocumentRequest.do](http://www.emeraldinsight.com/Insight/manulDocumentRequest.do).
- UNCTAD. (2015). *Commodity profile-Tomatoes*. [http: www.unctad.info/ en/ Infocomm/AACP-Products/COMMODITY-PROFILE---Tomato/](http://www.unctad.info/en/Infocomm/AACP-Products/COMMODITY-PROFILE---Tomato/), Accessed 19th July,2015.
- Yamane, Taro. (1967). *Statistics: An Introductory Analysis*, 2nd Edition, New York: Harper and Row.
- Yakubu M., (2009) *Power and influence of actors along the tomato trade chain . Ghana. A Project Report to IFPRI.*



SECTION B. IRRIGATIONAL FARM CHARACTERISTICS

15. Do you have access to irrigable lands? A. Yes [] B. No []

16. Do you farm in the dry season A. Yes [] B. No []

17. If no/yes why.....

If yes answer the following

18. Where do you get water from?

19. Do you have access to regular water supply A. Yes [] B. No []

20. How does this affect production?
.....

21. How many acres do you farm?

22. How far is the water from your farm?.....km

23. How much do you pay for the irrigational facility GH¢ in a year?

24. Do you receive any training before engaging in dry season farming? A. Yes []
B. No []

25. What is your major incentive for engaging in dry season farming?

Using ONE (1) as the most important reason and five (5) as the least reason rank the following

REASON	RANK
High prices during the dry season	
Nearness to the source of water	
For food security reasons	
Any other (specify)	

26. Which of the following farming season is your yield per acre greater? (a)Wet season (b) dry season

27. Which of the farming seasons is more profitable? (a)Wet season (b) dry season

28. Why

29. How many years have you been engaged in dry season farming?



SECTION C. TOMATO PRODUCTION (COST STRUCTURE)

Table 1: Please complete the table as per your usage and cost of the listed inputs in the last farming season

Input	Usage 1 = Yes 2 = No	Units per acre	Unit cost per acre (GHC)	Total cost
<i>Tractor/Labour Service</i>				
Tractor plough (per acre)				
Hired Labour (man days)				
Family/communal Labour (man days)				
<i>Agro-chemicals</i>				
Fertilizer (kg)				
Weedicide (kg)				
Organic manure				
Pesticide (kg)				
<i>Tomato direct/Indirect inputs</i>				
Stakes (per acre)				
storage				
Transportation				
Others (specify)				
TOTAL VARIABLE COST				

30. Where do you buy your inputs/agro chemicals from?

- a. community based agro-chemical retailers []
- b. Agro-chemical retailers from District capital []
- c. Retailers from other Districts in the Region []
- d. Retailers from other Regions []



31. Have you adopted any new tomato variety? a. Yes [] b. No []

Please complete the table indicating the usage of the harvested tomato for last season

<i>Post production activity</i>		<i>Quantity (crates)</i>
Crates of tomato harvested		
Crates stored		
Tomato losses	Partial loss	
	Complete loss	
<i>Output usage</i>		
Number of crates sold		
Number of crates eaten/consumed		
Others, e.g. gifts		

32. What is the main reason why you produce tomato? a. For sale [] b. Consumption [] c. Both []

33. How do you store tomatoes (please state).....

SECTION E. INSTITUTIONAL ISSUES

34. Do you belong to any farmer-based organization? a. Yes [] b. No []

35. What benefits do you gain from being a member of this group?

.....

36. Do you have access to any form of credit/subsidies/aids for your production process? a. Yes [] No []

37. How do you locate buyers for your produce? A. lead boys [] b. phone calls [] c. random search for buyers d. markets d. anywhere possible [] e. others specify []

38. Do you in any way engage in contract farming with the Traders a. Yes [] b. No []

39. IF yes what is the mode of payment?

.....

40. Do you have access to extension services? a. Yes [] b. No []

41. If yes how often does the extension officer visit? a. Weekly [] b. Monthly [] c. Quarterly [] d. Annually []

42. Do you have access to any form of credit/support/aids for your tomato business? Yes [] No []

If you have access to any form of credit please indicate the amount GH¢ and your source



- a. Banks [] B. Cooperatives [] C. Relatives and friends []
 D. Personal savings [] E. Other (specify)

43. Is your farm covered by any insurance policy? a. Yes [] b. No []

SECTION F. MARKETING CHANNELS

44. Whom do you mainly sell your tomato to? a. Consumers [] b. Retailers []
 c. Wholesalers [] d. Any available buyer []

45. Where do you mainly sell your tomato? a. at the farm gate [] b. at home []
 c. by the roadside [] d. market center [] e. other places (specify)

46. Do you sell your tomatoes to any available buyer? a. Yes [] b. No []

If No why

SECTION G. MARKETING COST AND PRICING/ REVENUE STRUCTURE

47. What time of the year do you normally harvest your tomato?

- a. July-Sept [] b. Oct-Dec [] c. Jan-March [] d. April-June [] e. All year round []

Please indicate the price of tomato per crates with respect to variety and size that you produce.

Table 6. Please indicate the price of tomato per crates with respect to variety and size.

<i>Variety</i>	<i>Average Price of a crates (Large size)</i>	<i>Quantity sold</i>	<i>Average Price of a crates (Small size)</i>	<i>Quantity sold</i>	<i>TOTAL REVENUE</i>
TOTAL					

48. Who determines the price of your tomato? a. Myself [] b. Wholesalers/Market queens []
 c. Tomato farmers association [] d. Bargain []

49. What months do you normally receive high prices for your tomato? a. July-Sept []
 b. Oct-Dec [] c. Jan-March [] d. April-June []
 e. All year round []

50. What months do you normally receive low prices for your tomato? a. July-Sept []

b. Oct-Dec [] c. Jan-March [] d. April-June [] e. All year round []

SECTION H. CONSTRAINT ANALYSIS

52. What are the constraints you face in the production and marketing of tomato?



(Rank according to the most disturbing constraint) 1=the most worrying to 4= least worrying

Constraints	RANK
<u>Abiotic constraints</u>	
Unreliable rainfall pattern	
Soil infertility	
<u>Biotic Constraints</u>	
Pest infestation	
Disease infestation	
<u>Input constraints</u>	
High cost of labour	
High cost of other inputs	
Inadequate access to farm inputs (agro-chemicals, stakes, etc.)	
<u>Institutional constraints</u>	
Poor access to extension services	
Inadequate storage facilities	
Insecure land tenure	
Inadequate access to capital	
Poor road network	
Others (specify.....)	

53. Mention the actors who assist you marketing you tomato produce (please list)

NAME OF ACTOR	ROLE	COST/per Crate	SIGNIFICANCE

THANK YOU FOR YOUR COOPERATION



-] c. market center [] e. other places (specify)
18. Whom do you sell your tomato to? a. Consumers [] b. Retailers [] c. Other wholesalers [] d. Tomato processing companies [] e. Any available buyer [] and why?
19. How much do **you sell a crates of tomato currently?**
20. Do you have preference for some tomato varieties in your tomato business?
a. Yes [] b. No []
21. If yes/No why.....
.....
If yes indicate the varieties you buy (rank according to importance and indicate reason)

<i>Variety</i>	<i>Rank</i>	<i>Reason</i>
Techiman		
Upper East		
Burikina Faso		
Local or Dagbamba		

SECTION C. INSTITUTIONAL ISSUES

22. Do you belong to any tomato trader organization? a. Yes [] b. No []
23. What benefits do you gain from being a member of this group?
.....
24. What is your major challenge in the business
25. Do you have access to any form of credit/support/aids for your tomato business?
Yes [] No []
If you have access to any form of credit please indicate the amount GH¢
..... and your source
b. Banks [] B. Cooperatives [] C. Relatives and friends []
D. Personal savings [] E. Other (specify)
26. Do you have any insurance policy for your business? a. Yes []
b. No []

SECTION D. POWER AND INFLUENCE

27. Do you in any way engage in contract farming with the farmers? a. Yes []
b. No []
28. Do you buy from several tomato farmers? a. Yes [] b. No []
29. How do you locate farms to buy from? a. Lead boys [] b. Through Farmers []
c. Random search for farms [] d. Any other specify
30. Who is responsible for organizing the transport? A. The traders union [] b. ourselves [] c. Any other specify.....



31. How many traders go with a transport vehicle at a time to bring tomato into the Tamale market?
32. Who is responsible for moderating the number of traders on trip at a time? a. The traders union [] b. ourselves [] c. Any other specify []
33. What is the criterion for selecting your leaders in the market? A. age [] b. years of experience c. wealth [] d. elections [] e. Any other specify.....
34. Is the tomato market regulated? a. Yes [] b. No []
If yes why
35. What is your source of power in regulating/controlling the market? a. Police [] b. purchasing power [] c. dominance/respect [] d. Any other specify [].....
36. Do you know all the whole sale traders in the market? a. Yes [] b. No []
37. Are there any other source of tomato supply into the Tamale market during the raining season? a. Yes [] b. No []
38. IF Yes which other sources LIST
.....
.....
.....
39. How long does this other source of supply last (Please indicate the month or period).....
40. Why can't you stop this other supply.....
41. When do you receive high prices for the tomato? a. July-Sept [] b. Oct-Dec [] c. Jan-March [] d. April-June []
42. When do you receive low prices for your tomato? a. July-Sept [] b. Oct-Dec [] c. Jan-March [] d. April-June []

SECTION E: COST AND REVENUE STRUCTURE ALONG THE MARKETING CHAIN

43. Indicate the cost incurred and the losses made in the tomato marketing process During your last trip

Activity	Cost per Crate (GH¢)	Number of Crate	Total cost (GH¢)
Purchasing prices/ farm gate prices			
Storage			
Transport			
Head potters			
Post-Harvest losses			
Partial complete			
Tax/duty			
Loading and unloading			
Others specify			
Total variable cost			



Indicate the Revenue generated

<i>Variety</i>	<i>Average Price of a crates (Large size)</i>	<i>Quantity sold(crates)</i>	<i>Average Price of a crates (Small size)</i>	<i>Quantity sold(crates)</i>	<i>TOTAL REVENUE</i>
Techiman variety					
Total Revenue					

SECTION F. COST AND REVENUE ANALYSES WITH SEASONS

Using the average price per crate estimates with respect to season, cost and revenue generated.

<i>Season</i>	<i>Total quantity bought</i>	<i>Crates lost</i>	<i>Cost per crate</i>	<i>Transports cost</i>	<i>Other cost e.g. loading duty, taxes, etc.</i>	<i>Total cost per crate</i>	<i>Average selling price per crate (revenue)</i>	<i>Expected margins</i>
<i>Techiman season</i>								
<i>Upper East season</i>								
<i>Burkina Faso season</i>								
<i>Domestic season</i>								
<i>Totally</i>								

Mention the actors who assist you in marketing you tomatoes (please list)

NAME OF ACTOR	ROLE	COST/per Crate	SIGNIFICANCE

THANK YOU FOR YOUR COOPERATION!

18. Who determines the price when you are buying the tomato? a. Myself []
b. Wholesaler [] c. Tomato Marketers Association [] d. Tomato Producers Association [] e. Bargaining []
19. Who determines the price when you are selling the tomato/tomato product?
a. Myself [] b. Wholesaler [] c. Tomato Marketers Association []
d. Tomato Producers Association [] e. Bargaining []
20. How much do you sell a unit (alonka) of your tomato GH¢..... during the wet season
21. Where do you mainly sell your tomato/tomato product? a. At home []
b. by the roadside [] c. market center [] e. other places (specify)
22. And why do you sell at this point?
23. Who are the main buyers of your tomato/product? a. Domestic Consumers []
b. others Retailers [] c. chop bars [] d. Other tomato processing companies [] e. No specific buyer []
24. Do you sell tomatoes all year round? A. Yes [] b. No []
25. Do you have preference for some tomato varieties in your tomato business?
a. Yes [] b. No []
26. If yes/No why.....

If yes indicate the varieties you buy (rank according to importance and indicate reason)

<i>Variety</i>	<i>Rank</i>	<i>Reason</i>
Techiman		
Burkina Faso /Upper East		
Dagbamba /local		

SECTION D. MARKETING COST AND PRICING

27. What time of the year do you normally buy the tomato a. July-Sept []
b. Oct-Dec [] c. Jan-March [] d. April-June [] e. All year round []
28. When do you receive high prices for your tomato? a. July-Sept [] b. Oct-Dec []
c. Jan-March [] d. April-June []
29. When do you receive low prices for your tomato/tomato product? a. July-Sept []
b. Oct-Dec [] c. Jan-March [] d. April-June []
30. Who are the main buyers of the soft/almost rotten tomatoes? a. Household consumers []
b. Commercial/Chop bar operators [] c. Tomatoes factories
d. Any other (specify)
31. Which variety of tomatoes do consumers prefer? A. Burkina Faso variety []
b. Upper East Variety [] c. Techiman Variety [] d. Any other specify
32. What reasons do consumer give for such preferences? a. It is tasty [] b. It is hard and last longer []
c. It is cheaper [] d. Any other reason specify
33. Which other source do you receive tomatoes from, apart from Burkina Faso/Upper East and Techiman? Please name the source.....



34. How many crates do you receive from those other sources?

SECTION E: COST AND REVENUE STRUCTURE ALONG THE MARKETING CHAIN

44. Indicate the cost incurred and the losses made in the last tomato marketing process.

Activity	Cost per Crate (GH¢)	Number of Crate	Total cost (GH¢)
Purchasing prices/ Wholesale price			
Transport			
Head potters			
Post-Harvest losses	Partial		
	complete		
Tax/duty			
Others specify			
Total variable cost			

Indicate The Revenue Generated

<i>Variety</i>	<i>Average Price of a crates (Large size)</i>	<i>Quantity sold(crates)</i>	<i>Average Price of a crates (Small size)</i>	<i>Quantity sold(crates)</i>	<i>TOTAL REVENUE</i>
Techiman variety					
Total Revenue					

SECTION F. INSTITUTIONAL ISSUES

35. Do you belong to any tomato trader organization? a. Yes [] b. No []
36. Do you have access to any form of credit/support/aids for your tomato business?
Yes [] No []
37. Do you have any insurance policy for your business? a. Yes [] b. No []



SECTION F. COST AND REVENUE ANALYSES WITH SEASONS

Using the average price per crate estimates with respect to season, cost and revenue generated.

<i>Season</i>	<i>Cost per crate</i>	<i>Crates losses</i>	<i>Other cost e.g. loading duty, taxes, etc.</i>	<i>Total cost per crate</i>	<i>Average selling price of a crate (revenue)</i>	<i>Total quantity bought</i>	<i>Expected margins</i>
<i>Techiman season</i>							
<i>Upper East season</i>							
<i>Burkina Faso season</i>							
<i>Domestic season</i>							
<i>In totality</i>							

38. Mention the actors who assist you marketing your tomato (please list)

NAME OF ACTOR	ROLE	COST/per Crate	SIGNIFICANCE

THANK YOU FOR YOUR COOPERATION!



12. Where you do usually purchase fresh tomato from? (Tick all that apply) a. Open Market [] b. Supermarket [] c. shop or store [] d. by the road side e. others (specify).....
13. What quantity of fresh tomato do you usually purchase per month? a. alonka [] b. big tomato tin [] c. paint container [] d. other (specify).....
14. Please can you rank, (in the order of importance) the characteristics you consider when buying fresh Tomato in general (please use the codes). Enter a ranking for each, with 1= most important, 2=second most important . . . and 5=least important

CHARACTERISTICS	RANK
Taste	
Food safety(food hygiene)	
Size	
Texture(hard or soft)	
Color tomato	

SECTION C: Consumers knowledge and choice

15. When purchasing tomato, do you normally care whether the produce is of foreign origin or local origin? A. Yes [] b. No []
16. Are you satisfied with the **quality** of local tomato at present as compared to the imported fresh tomato? a. Definitely yes [] b. Averagely ok [] c. Definitely no [] d. Indifferent []
17. What do you think about the current **price** level of local tomato compared to the imported tomato (Burkinabe variety)? a. Higher [] b. Reasonable [] c. The same [] d. Lower []
18. Which of the varieties do you prefer in the wet season? a. local variety [] b. imported variety [] c. indifferent []
19. What mostly influence you, in purchasing fresh tomatoes? Rank 1=most and 2=the least

ITEM	RANK
Prices of fresh tomatoes	
Prices of tin tomatoes	

20. Which of the varieties do you prefer in the dry season? a. local variety [] b. imported variety [] c. indifferent []

SECTION D: CONSUMER CHOICE OF TOMATO PASTE AND FRESH TOMATO

21. During the wet season which of the following do you often buy? a. Tomato paste[] b. fresh tomatoes [] c. both []
Why
22. During the dry season which of the following do you buy often? a. Tomato paste[] b. fresh tomatoes [] c. both []
Why
23. Among the many varieties of tomato paste, which one do you use the most
a. Pomo [] b. Gino [] c. Tasty Tom [] d. Others specify
.....
Why the choice above?
.....



24. Do you combine both the paste and the fresh one in preparing dishes?
a. yes always [] b. yes sometimes [] c. never []
25. If yes
WHY.....
...
26. Which of the following form of tomatoes do you prefer the most? A.
fresh to tin tomatoes [] b. tin to fresh tomatoes [] c. indifferent []

THANK YOU FOR YOUR COOPERATION



Appendix II Pictures from the field



Grinding of Rotten Tomatoes in the Tamale Market



Executives of the Tomato wholesalers in the Tamale Market

