ANALYSIS OF FRUIT AND VEGETABLE MARKET CHAINS IN ALAMATA, SOUTHERN ZONE OF TIGRAY: T HE CASE OF ONION, TOMATO AND PAPAYA.

M.Sc. Thesis

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Haramaya University

ANALYSIS OF FRUIT AND VEGETABLE MARKET CHAINS IN ALAMATA, SOUTHERN ZONE OF TIGRAY: THE CASE OFONION, TOMATO AND PAPAYA

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DEDICATION

I dedicate this piece of work to my mother Tadelech Adane and my father Gessess Teka and to all my brothers, for all their contributions.

STATEMENT OF THE AUTHOR

First, I declare that this thesis is my own work and that all sources of materials used for this thesis have been duly acknowledged. This thesis has been submitted in partial fulfillment of the requirements for an advanced M.Sc. degree at Haramaya University and is deposited at the University Library to be made available to borrowers under rules of the Library. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate.

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BIOGRAPHICAL SKETCH

The author was born on July 16, 1977 in southern zone of Tigray Samere Woreda in small village Adigerhi. He attended his elementary school at Atseyohans (Mekelle capital city of Tigray), Alamata complete elementary number one and Kidameye Gebeya (Dessie) Primary and Joiner School and Secondary school at Tadagiwa Ethiopia and Atseyohans Comprehensive High School at Alamata and Mekelle. Joined the then Mekelle University of Agriculture in 1997/98, he graduated with B.Sc. degree in Dry land Crop science on 14th July of 2001.

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ABBREVIATIONS

CSA	Central Statistical Authority
EARO	Ethiopian Agricultural Research Organization
FAO	Food and Agriculture Organization
ETB	Ethiopian birr
DA's	Development Agent
FTC	Farmers training center
Ha	Hectare
ILRI	International Livestock Research Institute
IPMS	Improving Productivity and Market Success Ethiopian Farmers'
kms	Kilometers
m.a.s.l	meters above sea level
PA	Peasant Association
Qt	Quintal
SCP	Structure Conduct Performance
SPSS	Statistical Package for Social Sciences
TAMPA	Tigray Agricultural marketing Promotion Agency
TGMM	Total Gross Marketing Margin
TARI	Tigray Agricultural research Institution
VIF	Variance Inflation Factor
WoRDA	Woreda office of agriculture and rural development

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ANALYSIS OF FRUIT AND VEGETABLE MARKET CHAINS IN ALAMATA SOUTHHERN ZONE OF TIGRA: THE CASE OF ONION, TOMATO AND PAPAYA

ABSTRACT

The study was initiated with the objectives of analyzing fruit and vegetable marketing chains in Alamata District, southern zone of Tigray. Specifically the study attempts to assess structure-conduct-performance of fruit and vegetable marketing, analyze market supply determinants, and analyze the institutional support services of extension, input supply and credit. The study also analyzes profitability of fruit and vegetable production and marketing and identifies problems and opportunities in fruit and vegetable production and marketing. Data came from 140 horticulture producing households, 9 horticulture wholesale and 30 retailers. Cobb Douglas (logarithmic function) econometric estimation procedure was employed to identify factors that determine onion, tomato and papaya market supply of the farm households in the area. The net profit obtained by the different market chain actors is indicated as follows. From simple calculation, on the average, a producer profited 11,293.09ETB from onion, 8,823.02ETB from tomato, and 11,432.93ETB from papaya per hectare production (assuming an average price of 1.79 ETB, 0.99 ETB and 2.19ETB per kg prices, respectively). On top of these assemblers, wholesalers and retailers profitability from the aforementioned crops were 35.49 ETB from onion, 24.24 ETB from tomato and 16.80 ETB from papaya for assembles per quintal. Wholesalers and retailers also obtain a profit of 47.80 ETB from onion, 34.30 ETB from tomato and 41.60 ETB from papaya and 30.04 ETB from onion, 24.33 ETB from tomato and 16.50 ETB from papaya, respectively per quintal (assuming an average price of 3.71 ETB for onion, 2.89 ETB for tomato and 3.56 ETB for papaya per kg at retile level). However, this potential benefit is under challenges of imperfect marketing. The market conduct is characterized by unethical practices of cheating and information collusion that led to uncompetitive market behavior even though the calculated concentration ratio did not indicate oligoposony market behavior (24.56%). Therefore some corrective measures are required by the government as well as institutions like cooperatives. Among the different variables that were hypothesized as determining factors for volume of marketable supply the econometric result showed that, number of oxen owned and age of household head for onion while only number of oxen owned for tomato and quantity produced for papaya were significant. All had the expected sign as prior

expected. According to the survey result an estimated volume of annual production of 3,552.50 Qt of onion 1,377 Qt of tomato and 255.33 Qt of papaya have been produced. The estimated marketed proportion according to the respondents was 98.99 percent of onion, 99.16 percent of tomato and 84.87 percent of papaya. The Alamata office of Agriculture and Rural Development is the main extension support giving institution. Three development agents are deployed in each Tabaias with the help of whom 1.42 percent of respondents got weekly extension service, 0 .71 percent have got extension service in two weeks, 0 .71 percent have got extension service any time required, 8.57 percent have got extension service with no regular program and the remaining 88.57 percent of respondents reported no extension contact at all. This weak extension support and limited seed supply system largely hinders production and productivity of the crops under study. On top of this, limited accessibility of chemicals, fertilizer and credit within the district are anther key constraints of production and marketing of the stud crops. Therefore it is essential to take some improvement measures by the government as well as private sectors.

1. INTRODUCTION

1.1. Background

Although horticultural crops are important for health and economy the amount and mode of production is still weak in Ethiopia. Horticultural crops can be differentiated as fruit (permanent crops) and vegetables (short season crops). Accordingly permanent crops are long term crops that occupy the filed planted for a long period of time and largely harvested every year and do not have to be replanted for several years after each harvest. These include tree crops such as coffee, Enset, Chat, oranges, Mangoes, Bananas, papaya, Avocados…etc. The trees that yield fruits like orange, Mangoes, Papayas, and others are known as fruit trees (CSA, 2001/02).

Diversification into horticultural crops is becoming attractive for many poor farmers around the world. Worldwide production of fruit and vegetable crops has grown faster than that of cereal crops, albeit from a much lower base. Between 1960 and 2000, the area under horticultural crops worldwide has more than doubled. There are several reasons for the global increase in production and trade of fruit and vegetable crops. Horticultural production is profitable. Farmers involved in horticultural production usually earn much higher farm incomes as compared to cereal producers and per capita farm income has been reported up to five times higher (Lumpkin *et al.*, 2005).

More than 47 thousand hectares of land is under fruit crops in Ethiopia. Bananas contributed about 60.56% of the fruit crop area followed by Mangoes that contributed 12.61% of the area. Nearly 3.5 million quintals of fruits was produced in the country. Bananas, papaya, mangoes and orange took up 55.32%, 12.53%, 12.78% and 8.35% of the fruit production, respectively (CSA, 2008).

Ethiopia has a variety of vegetable crops grown in different agro ecological zones produced through commercial as well as small farmers both as a source of income as well as food. However, the type is limited to few crops and production is concentrated to some pocket areas. In spite of this, the production of vegetables varies from cultivating a few plants in the backyards for home consumption up to a large-scale production for domestic and export markets (Dawit *et al*., 2004).

According to the CSA (2008) 501,599.14 ha was under fruit (47,990.34 ha) and vegetable (453,608.8 ha crops). Papaya, onion and tomato covered 3,254.3 ha, 15,628.44 ha and 5,341.58 ha, respectively. An annual production of 21,637,206.7 quintal was estimated from fruit (3,512,593.2Qt) and vegetable (18,124,613.5Qt) by the same year. Of which papaya, onion and tomato constituted 440,034.99Qt, 1,488,548.9Qt and 418,149.53Qt, respectively.

In a country like Ethiopia where the amount, timing and distribution of rain fail is irregular, use of irrigation would significantly improved and raise the level of production. However, irrigation is not extensive in Tigray region. In the Tigray region, where this study was conducted, crop lands that are actually irrigated was only 19.1thousand hectare and this accounted for 3.4% of the total crop land areas. Out of the total irrigated cropland areas in the region 72.2% were under cereals, 10.3% under pulses, 4.3% under vegetables, 9.3% under fruits and 3.6% under stimulant crops (CSA, 2003). On the same year the census data indicate that irrigated crop land area was relatively highest in south Tigray zone (74.4%) followed by central Tigray zone (16.6%). Even though, Tigray National Regional State has an abundance production potential and market access even within the region it had never reaped the opportunity, as it would suppose to be.

Alamata where this study focused is one of the naturally endowed *Woreda* in terms of capacity to grow different horticultural and other crops. The expansion of modern irrigation from deep walls enhances production of horticultural crops particularly vegetables. On top of this, the existence of spate irrigation supplements the erratic nature of rain.

Major types of horticultural crops currently growing in the district are onion, tomato, green pepper from vegetables and papaya, banana, avocado and guava from fruits. The production of horticultural crops in the *Woreda* is mainly for market. The production of horticultural crops are very random and fragmented resulting in over supply particularly onion.

1.2. Statement of the Problem

Fruit and vegetable production in Alamata District is mainly with irrigation, ponds, shallow wall and some times flood diversion especially to vegetables where oversupply of harvested products is the main characteristics. The nature of the product on the one hand and the lack of organized market system on the other have resulted in low producers' price. There are production and marketing problems challenging fruit and vegetable development in the District. These are input supply, pest and disease, low productivity, production seasonality from the production side and lack of transport, storage, post handling facilities, organized market system from the marketing side (WoARD, 2007). This therefore demands a holistic study of the system in the form of market chain analysis.

A number of factors related to technological, institutional, organizational and political situations influence competitiveness of market chain. So information on factors that affect competitiveness of fruit and vegetable market is essential for the design of any strategy or policy that has an objective of intervention. Identification, characterization and evaluation of market chain help's to remove barriers affecting performance and to strengthen strong sides.

Although fruits and vegetables are economically important commodities there was no study made on fruits and vegetables marketing to identify the key constraints and potentials on the system in the *District*. There was no adequate information on the supply of fruits and vegetables. It is essential that the marketing system of a commodity like fruits and vegetables operates efficiently.

Market chain analysis is believed in studies of production and marketing problems. Investigation of the system in terms of fruit and vegetable market structure, conduct and performance and institutional support services taking in to consideration the product and location specificity will, therefore, be used to identify the restricting factors and come up with specific possible solutions of the District. It is for these specific reasons that the study was designed to be under taken in the District.

1.3. Objectives of the Study

The overall objective of the study was to analyze the fruit and vegetables marketing chain in Alamata District. The specific objectives of the study include –

1. to analyze the production and marketing support services of extension, input supply, credit and marketing
2. to analyze the structure of production costs and determine profitability of production
3. to analyze the determinants of marketable supply
4. to analyze the market structure, conduct and performance
5. to identify major constraints, opportunities of production and supply

1.4. Scope of the Study

The area coverage of this study was Alamata District in Tigray national regional state, with specific focus on Papaya, onion and tomato. These crops account for the major proportion of fruit and vegetable production in the District and pass through a number of marketing stages especially that of onion and tomato. The commodity approach to market study was used to analyze marketing chains of fruit and vegetable, the study emphasized different market levels, roles of market players in the marketing channel, market direction, price formulation and bargaining power of producers, traders buying and selling strategies, storage, transport, information, involved in fruit and vegetable marketing and factors determining supply of fruit and vegetable in the District was the center of the study.

1.5. Significance of the Study

This study might generate important information useful to formulate fruit and vegetable marketing development programs and guidelines for interventions that would improve efficiency of the fruit and vegetable marketing system. The potential users of the results of this study would be farmers, traders, policy makers, governmental and non-governmental organization, who want to introduce interventions in fruit and vegetable marketing system. Further more, this study could be used as source material for further study.

1.6. Limitations of the Study

Being the first study in the district it may lack details of investigations which could have reinforced in understanding of the whole system particularly in relation to production studies. The time limit and budget constraint exclude consideration of other neighboring districts and regions as well could give more weight to the limitation.

1.7. Organization of the Study

The thesis is organized as follows. The next section reviews literature on production and marketing, of fruit and vegetables. Section three deals with the research methodology. Section four presents results and discussions. The final section summarizes the findings of the study and provides some policy suggestions.

2. LITERATURE REVIEW

2.1. Market and Growth

It is generally believed that small farm agriculture plays a central role in economic development, both in supplying a significant portion of the domestic food crop supplies and in generating income for low-income families. But on the other hand there are constraints related to access to production resources and markets (Minot, 1986).

Markets may provide the incentives to profit maximizing participants to develop new technologies, products, resources of supply, new markets and methods of exploiting them. The role of marketing in development process could be summarized as follows: the marketing system channels the net capital surplus out of agricultural sector which could be used to accentuate the development of industry, infrastructure and social service; it integrates the farming community in to the market economy through communication and exchange; the provision of secured market outlets which encourage producers to increase marketable surplus and diversify production; and marketing becomes and remains as one of the most important economic sub-sector during the whole process of development.
Markets also have an influence on income distribution, food security, and other important development objectives. Despite its importance, as indicated above, marketing is given little attention or credence in the developing countries.

CIAT (2004) states that the traditional form of agriculture started to change as communities and nations started to be modernized. Urbanization was fostered by industrialization and this led to increased demand for food for urban dwellers. More sophisticated arrangement of actors' evolved with the arrangement of farm produce transport, storage, processing, retailing and wholesaling. As cities expand, food supply system developed in the increasingly longer market chains with clear division according to product type and market segmentation.

Markets aggregate demand and supply across actors at different spatial and temporal scales. Well-functioning markets ensure that macro and sectoral policies change the incentives and constraints faced by micro-level decision makers. Macro policy commonly becomes ineffective without market transmission of the signals sent by central governments. Similarly, well-functioning markets underpin important opportunities at the micro level for welfare

improvements that aggregate into sustainable macro-level growth. For example, without good access to distant markets that can absorb excess local supply, the adoption of more productive agricultural technologies typically leads to a drop in farm-gate product prices, erasing all or many of the gains to producers from technological change and thereby dampening incentives for farmers to adopt new technologies that can stimulate economic growth.

Markets also play a fundamental role in managing risk associated with demand and supply shocks by facilitating adjustment in net export flows across space and in storage over time, thereby reducing the price variability faced by consumers and producers. Markets thus perform multiple valuable functions: distribution of inputs (such as fertilizer, seed) and outputs (such as crops, animal products) across space and time, transformation of raw commodities into value-added products, and transmission of information and risk (Barrett and Mutambatsere, 2005).

According to Clemence and Maria (1994), three types of vertical marketing systems are distinguished: the administrative (informal collaboration programs developed by one or limited number of firms), contractual system (formalized agreements as a means for achieving control) and the corporate system (channel members at different levels of distribution are owned and operated by one organization). Despite increased attention to market institutions, relatively little institutional research has addressed the role of market intermediaries such as brokers or commission agents, in facilitating exchanges between anonymous trading partners. That is, little institutional analysis has been undertaken on the process by which economic traders find each other in the market (Eleni, 2001)

The micro-level realities of agricultural markets in much of the developing world, however, include poor communications and transport infrastructure, limited rule of law, and restricted access to commercial finance, all of which make markets function much less effectively than textbook models typically assume. A long-standing empirical literature documents considerable commodity price variability across space and seasons in developing countries, with various empirical tests of market integration suggesting significant and puzzling forgone arbitrage opportunities, significant entry and mobility barriers, and highly personalized exchange (Barrett and Mutambatsere, 2005). Barrett and Mutambatsere (2005) added also the causes for widespread inefficiencies as incomplete or unclear property rights, imperfect contract monitoring and enforcement, high transactions costs, and binding liquidity

constraints. Such failures often motivate government intervention in markets, although interventions have often done more harm than good, either by distorting incentives or by creating public sector market power.

The history of agricultural markets in developing countries reflects evolving thinking on the appropriate role for government in trying to address the inefficiencies created by incomplete institutional and physical infrastructure and imperfect competition.

Many scholars reason out the lack of shift from subsistence to commercial farming for different reasons like high risks, high transaction costs, limited food markets, limited insurance options and limited access to credit. Neway (2006) noted that integration of a household into a market economy involves forging new links deepening existing relationships between the household, on one side, and traders, micro finance institutions, and other farmers willing to supply labor and rent land, on the other.

According to Moti (2007) Although markets are essential in the process of agricultural commercialization, as many people argued, transaction costs and other causes of market imperfections could limit the participation of farm households in different markets. This implies that markets may be physically available but not accessible to some of the farm households. Under such circumstances, farm households may tend to choose crops that can easily be sold at the accessible markets. Such tendency is much stronger for households producing perishable crops like horticulture.

2.2. Marketing Functions

Marketing function studies marketing in terms of the various activities that are performed in getting farm product from the producer to the consumer. These activities are called functions (Cramers and Jensen, 1982).

According to Saccomandi (1998), functions can be classified based on objectives: logistical, marketing and economic objectives. Logistical functions are related to the concentration, transport and preservation of products. Marketing functions are dedicated to classification, packaging, development of demand and market information. Economic functions include financing, risk bearing and facilitation of exchange.

Marketing of agricultural products consists primarily of moving products from production sites to points of final consumption. In this regard, the market performs exchange functions as well as physical and facilitating functions. The exchange function involves buying, selling and pricing. Transportation, product transformation and storage are physical functions, while financing, risk bearing and marketing information facilitating marketing (Branson and Norvell, 1983).

Goetz and Weber (1986) stated dimensions before a commodity be available to the urban consumer to include: the temporal, spatial and form dimensions. The temporal dimension is regarding the storage and providing reliable supply, the spatial dimension regards the transport of the produce from point of production to urban centers, and the form dimension discloses the processing, labeling, packaging, sorting and cleaning activities before the product arrive at the final consumer.

A clear understanding of marketing function with an investigation of strengths and weakness help where to improve the marketing system. The level of functions could differ from product to product and hence in the horticulture marketing study this part always draws attention.

2.3. Market Supply

Agricultural products differ from manufactured goods in terms of supply and demand. Agricultural products supply is different because of the very seasonal biological nature while their demand is comparatively constant through out the year.
In economic theory, it is stated that human being is always under course of action of choice from a number of options. The basis for the decisions could be issues ranging from household characteristic to the exogenous unmanageable factors. A case in point here is market supply where researchers put each owns point of determining variables.

The analysis can identify factors that determine market supply. A clear understanding of the determinants helps to know where to focus to enhance production and marketable supply. The study of market supply helps fill the gap for success of commercialization. There are different factors that can affect market supply.

According to Wolday (1994) Market supply refers to the amount actually taken to the markets irrespective of the need for home consumption and other requirements where as the market surplus is the residual with the producer after meeting the requirement of seed, payment in kind and consumption by peasant at source.

Marketable surplus is the quantity of produce left out after meeting the farmer's consumption and utilization requirements for kind payments and other obligations such as gifts, donation, charity, etc. This marketable surplus shows the quantity available for sale in the market. The marketed surplus shows the quantity actually sold after accounting for losses and retention by the farmers, if any and adding the previous stock left out for sale (Thakur *et al.,* 1997).

Neway (2006) indicated two options for commercialization. The most common form in which commercialization could occur in peasant agriculture is through production of marketable surplus of staple food over what is needed for own consumption. Another form of commercialization involves production of cash crops in addition to staples or even exclusively. At the farm household level, commercialization is measured simply by the value of sales as proportion of the total value of agricultural out put. At the lower end, there would always be some amount of output that even a subsistence farmer would sale in the market to buy basic essential goods and services. For this reason, the ratio of marketed out put up to a certain minimum level cannot be taken as a measure of commercialization. Neway (2006) proposed the proportion to be 20 percent of marketable surplus in the Ethiopia as a cut of rate for commercialization.

Marketed surplus is defined as the proportion of output that is marketed (Harris, 1982). Marketed surplus may be equal to marketable surplus, but may be less if the entire marketable surplus is not sold out and the farmers retain some stock and if losses are incurred at the farm or during the transit (Thakur *et al.,* 1997). In the case of crops that are wholly or almost wholly marketed, the output and marketed surplus will be the same (Reddy *et al.,* 1995).

Empirical studies of supply relationships for farm products indicate that changes in product prices typically (but not always) explain a relatively small proportion of the total variation in output that has occurred over a period of years. The weather and pest influence short run

changes in output, while the long run changes in supply are attributable to factors like improvement in technology, which results in higher yields.

The principal causes of shifts in the supply are changes in input prices, and changes in returns from commodities that compete for the same resources. Changes in technology that influence both yields and costs of production /efficiency/, changes in the prices of joint products, changes in the level of price/yield risk faced by producer, and institutional constraints such as acreage control programs also shift supply (Tomek and Robinson, 1990).

A study made by Moraket (2001) indicated households participating in the market for horticultural commodities are considered to be more commercially inclined due to the nature of the product. Horticulture crops are generally perishable and require immediate disposal. As such, farmers producing horticulture crops do so with intent to sell. In his study it was found that 19% of the sample households are selling all or a proportion of their fruits and vegetable harvest to a range of market outlets varying from informal markets to the large urban based fresh produce markets. Typically, many of the households producing fruits and vegetables also have access to a dry land plot where they commonly produce maize and/or other filed crops.

Bellemare and Barret (2006) estimated factors affecting sell of animal in Kenya and Ethiopia. They observed that the net purchase and net sales volume choices depend on expected market participation. The household head sex (female headed), age, family size, herd size, female TLUs, encumbered males, and small stock (sheep and goat) had significant and negative influence on number of animals sold. Unlikely, assets, land holding, other income, encumbered females, and average price of large stock (camels and cattle) had correlated positively with number of animals sold.

Harris (1982) also verified empirically the relationship between marketed surplus and output and income. She obtained negative relationship between marketed surplus and variables like family size, and distance to market. Farm size was not found as a direct causal variable, but production was as Harris (1982) put it.

A similar study was conducted by Holloway *et al* (1999). Their study wanted to identify alternative techniques for effecting participation among per-urban milk producers in the Ethiopian highlands. They found that cross breed cow type, local breed cows, education level of household head, extension contact, and farming experience of household head positively

affected quantity of milk sold while distance to the market affected the volume of sale negatively.

The behavior of marketed surplus to changes in prices and non price factors like irrigation, acreage and productivity is of critical importance. The most important factor, which increases marketed surplus significantly, is the increased production or output followed by consumption and payments in kind which should be reduced to keep up the quantity of marketed surplus of food grains (Thakur *et al.,* 1997).

Wolday (1994) used about four variables to determine grain market surplus at his study in Alaba Siraro. The variables included were size of output, access to market center, household size, and cash income from other crops. In his analysis, factors that were affecting market supply of food grains (teff, maize and wheat) for that specific location include volume produced, accessibility (with negative and positive coefficients), were found significant for the three crops while household size in the case of teff and maize still with negative and positive coefficients. Cash income from other crops was insignificant.

A Similar study on cotton at Metama by Bossena (2008) also indicates that four variables affect cotton marketable supply. Owen oxen number, access to credit, land allocated to cotton, productivity of cotton in 2005/06 were the variables affecting positively cotton supply. Similar study on sesame at Metema by Kindei (2007) also pointed out six variables that affect sesame marketable supply. Yield, oxen number, foreign language spoken, modern input use, area, time of selling were the variables affecting positively sesame supply and unit cost of production was found to negatively influence the supply. Similarly, Abay (2007) in his study of vegetable market chain analysis identified variables that affect marketable supply. According to him, quantity production and total area owned were significant for onion supply but the sign for the coefficient for total area of land was negative. For tomato supply, quantity of production, distance from Woreta and labor were significant. Similarly, Rehima (2007) in her study of pepper marketing chain analysis identified variables that affect marketable supply. According to her, access to market, production level, extension contact, and access to market information were among the variables that influence surplus. Another study by Gizachew (2006) on dairy marketing also captured some variables that influence dairy supply. The variables were household demographic characteristics like sex and household size, transaction cost, physical and financial wealth, education level, and extension

visits. Household size, spouse education, extension contact, and transaction cost affects positively while household education affects negatively.

According to Moti (2007) a farm gate transaction usually happens when crops are scarce in their supply and highly demanded by merchants or when the harvest is bulk in quantity and inconvenient for farmers to handle and transport to local markets without losing product quality. For crops like tomato, farm gate transactions are important as grading and packing are done on the farm under the supervision of the farmer. Therefore, households are expected to base their crop choice on their production capacity, their ability to transport the harvest themselves and their preferred market outlet.

From these little reviews, it is possible for households to decide where to focus to boost production and knowing the determinants for these decisions will help choose measures that can improve the marketing system in sustainable way.

2.4. Status of Horticulture Production in Ethiopia

Ethiopia has a variety of vegetable crops grown in different agro ecological zones by small farmers, mainly as a source of income as well as for food. The production of vegetables varies from cultivating a few plants in the backyards, for home consumption, to large-scale production for the domestic and home markets. According to CSA (2003) the area under these crops (vegetables and root crops) was estimated to be 356,338.82 hectares.

The productivity of crops is very low compared to the potential yield obtained in the research centers and on farmers' field technology verification studies. For instance, the productivity of onion and tomatoes was about 90 and 70 quintals per hectare compared to the potential yield of 400 and 350 quintal per hectare in research centers (EARO, 2002 as cited in *Dawit et al.*, 2004).

Tropical fruits growing in the region between the 'tropics' of cancer and Capricorn that is part of the earth which lies between 0 and 20 degree calluses latitudes and North and South of equator. These include Banana, Pineapple, Papaya, Mango and Guava.

Papaya (Carica papaya L) –Papaya is the most important species of others found in genus Carica. Papaya is grown in all tropical countries and in many frosts less sub-tropical regions

of the world. Early distribution over wide regions was enhanced by abundance of seeds in the fruit and their long viability (three years).

In Ethiopia papaya is produced in home gardens and semi-commercial level by farmers as well as commercial level by state farms for home consumption and local market (for fresh fruit and juice making). The commercial farms of upper Awash agro industry (Tibila and Awara, Melka farms), horticulture development enterprise (Ziwai farm) etc. Many growers prefer papaya to other fruit crops due to its early fruit bearing nature and ease of production practices (Jackson, et al, 1985; and IAR, 1991). Papaya trees come in to bearing 9-14 months after planting, then bear year round. The ripe fresh fruit of papaya are eaten fresh throughout the tropics and are used in preparation of jam, soft drinks, ice-cream flavoring, and crystallized fruits and in syrup. The seeds are also used for their medicinal value. Unripe fruits and young leaves can be cooked and taken as vegetables and spinach and the juice facilitate digestion and so that it is preferable for older people.

Onion- (*Allium cepa*) is one of the most important commercial vegetables. Onion is a cool season crop. How ever it can be grown under a wide range of climatic conditions. It grows well under mild climatic with out extreme heat or cold or excessive rain fall (Kuldeep Sharma, 2006). The principal Alliums ranks second in value after tomatoes on list of cultivated vegetable crops worldwide (Robinwith and Currah, 2002). These people also reminded that all plant parts of alliums may be consumed by humans (except perhaps the seeds), and many wild species are exploited by local inhabitants. Careful handling and the choice of suitable storage method for the cultivar type in question are vital to ensure that the product retains its quality until it reaches the consumer. “Cosmetic quality’ is of increasing importance in competitive markets. The product is produced for both consumption and market. According to CSA (2003) out of a yearly production, 48.2 percent was utilized for sale, 39.9 per cent for household consumption in contrast to tomatoes where 66.7 per cent of the total production is send to market.

According to Lemma and Shimeles, 2003, in Ethiopia onion is produced in many parts of the country by small farmers, private growers, state enterprise mainly in Awash valley and Lake Region, where the bulk of dry bulbs and seed are produced. Recent statistical data (CSA, 2003) indicated the total hectare under onion was about 20,444 hectare with total production of 2,572,053 quintals dry bulbs per annum. Globally, onion is produced, at nearly 35 million

tones per annum (FAO, 2005). However, despite the enormous merits and potential, in Ethiopia the existing crop productivity has been low and variable under farmers' local condition. This is presumably due to lack of improved crop varieties, shortage of adapted varities to different agro ecologies, lack of inputs, lack of appropriate agronomic package, disease and poor extension activities (Shimeles, 1994).

Tomatoes- (*Lycopersicon esculuntum* Mill) is most important and remunerative vegetable crop in the world. Tomato is a rich source of minerals, vitamins and organic acids; tomato fruit provides 3-4% total sugar, 4-7% total solids, 15-30mg/100g ascorbic acid, 7.5-10 mg/100ml titratable acidity and 20-50mg/100g fruit weight of lycopene.

The importance of cultivated tomato to date is increasing in Ethiopia. It is widely accepted and commonly used in a variety of dishes as raw, cooked or processed products more than any other vegetables (Lemma, 2002, as cited on Abay, 2007).

The bulk of fresh market tomatoes are produced by small-scale farmers. Farmers are interested in tomato production more than any other vegetables for its multiple harvests, which result in high profit per unit area.

Tomatoes vary in visible fruit characteristics important for fresh market and processing values. These include shape, size, color, flesh thickness, number of locules, blossom end shape and fruit quality. The fruits may be globe shaped (Marglobe), oval or flattened (Marmande), and pear shaped (Roma VF), which differ in acceptability in the local market, quality, and storability.

2.5. Characteristics of Vegetables Marketing

Being produced both by commercial and smallholder farmers vegetable marketing is influenced by a number of factors that can be attributed to production, product, and market characteristics. Kohl and Uhl (1985) identified these attributes as-

Perishability-as vegetables are highly perishable, they start to loose their quality right after harvest and continued through out the process until it is consumed. For this purpose elaborated and extensive marketing channels, facilities and equipments are vital.

This behavior of vegetables exposed the commodity not to be held for long periods and fresh produce from one area is often sent to distant markets without a firm buyer or price. Prices may be negotiated while the commodities are en route, and they are frequently diverted from their original destination of a better price can be found. Sellers might have little market power in determining a price. As a result, a great deal of trust and informal agreements are involved in marketing fresh vegetables. There could not always be time to write every thing down and negotiate the fine details of a trade. The urgent, informal marketing processes often leads to disputes between buyers and sellers of fresh fruits and vegetables. Producers are normally price takers and are frequently exposed for cheating by any intermediary.

Price /Quantity Risks- Due to perishable nature and biological nature of production process there is a difficulty of scheduling the supply of vegetables to market demand. The crops are subjected to high price and quantity risks with changing consumer demands and production conditions. Unusual production or harvesting weather or a major crop disease can influence badly the marketing system. While food-marketing system demands stable price and supply, a number of marketing arrangements like contract farming provide stability.

Seasonality- Vegetables have seasonal production directly influencing their marketing. Normally they have limited period of harvest and more or less a year round demand. In fact, in some cases the cultural and religious set up of the society also renders demand to be seasonal. This seasonality also worsened by lack of facilities to store.

Product bulkiness- Since water is the major components of the product, it makes them bulky and low value per unit that is expensive to transport in fresh form every time. This, therefore, exposed farmers to loose large amount of product in the farm unsold.

These listed characteristics of the product require a special complex system of supportive inputs. It demands a regular marketing preparation process like washing, cooling, proper management from the time of harvest until the produce is put on display. It is frequently believed a vegetable not only remain attractive to the consumer it must also have a shelf life of few days after having purchased by the consumer (Nonnecke, 1989).

Improving vegetables marketing in developing countries is vital for a number of reasons: rapid increase in demand from growing domestic urban populations, opportunities to earn foreign exchange by exporting high value-off-season produce; the income raising opportunities it offer to small farmers and the contribution to employment made by its labor intensive production, handling and sales requirement are some to mention (FAO, 1986, cited on Abay, 2007).

Horticulture production is profitable. Farmers involved in horticulture production usually earn much higher farm income as compared to cereal producers. Cultivation of fruits and vegetables allows for productive employment where the labor/land ratio is high, since horticultural production is usually labor intensive. Increasing horticulture production contributes commercialization of the rural economy and creates many off-farm jobs. However, expanding the scale of horticulture production is often hindered by lack of market access, market information, and many biological factors (Weinberger and Lumpkin, 2005).

Ideally, measures commonly recommended for the improvement of vegetables marketing are better packaging, handling, and transport; sorting by quality; extending the market season and leveling out gluts and shortages by market delivery planning and storage; developing new markets; installation of refrigerated transport and processing equipment: and establishing marketing enterprises .

Bezabih and Hadera (2007) stated that production is seasonal and price is inversely related to supply. During the peak supply period, the prices decline. The situation is worsened by the perishability of the products and poor storage facilities. Along the market channel, 25 percent of the product is spoiled.

From these reviewed literatures severe production seasonality, seasonal price fluctuations, poor pre-and post harvest handling, prevalence of pest and diseases, lack of storage are some of the critical problems encountered vegetable production in Ethiopia.

2.6. Review of Empirical Evidences in Ethiopia

Jema (2008) indicated that limited access to capital markets, high consumer spending, and large family size attributable to lower economic efficiency for the marketed driven production like vegetables. On top of this, the marketing performance of vegetable shows that

poor performance and contract enforcement was mainly due to mutual trust and broker's mediation. Further more, information access, trader-specific investments, and farmer's age, whether the buyer is a trader, dependency on the trader, relationship duration, transaction frequency, and distance to the trader were found to be the significant factors affecting contract enforceability through brokers in eastern Ethiopia. Risk related to persishability and seasonality of supply, illiteracy, and client-buyer's type were found to be the significance factors causing contract breaches by the traders. On top of this Jema (2008), further identified that, existence of considerable economic inefficiency in production, poor contract enforcement, and imperfect completion in the marketing of vegetables are some of the main problems of vegetable production and marketing in eastern Ethiopia.

He also added that, volume handle, shipping cost, and time trend be significant factors in explaining variations in the price spreads. Moreover results of his study show that traders share of the marketing surplus increase with the degree of perishability of the produce. That is, the more perishable the produce is, the higher is the share that traders' capture from the marketing surplus.

Jema (2008) indicated further, marketing margins widen as supply increase, supporting the argument that large volume of shipment of perishable commodity reduces farm prices.

Bezabih and Hadera (2007) state low level of improved agricultural technologies, risks associated with weather conditions, diseases and pests, as the main reasons for low productivity. Moreover, due to the increasing population pressure the land holding per household is declining leading to low level of production to meet the consumption requirement of the household. As a result, intensive production is becoming a means of promoting agro-enterprise development in order to increase the land productivity. Horticultural production gives an opportunity for intensive production and increases small holders' farmers' participation in the market.

On top of this, Bezabih and Hadera (2007), further identified pest, drought, shortage of fertilizer, and price of fuel for pumping water as the major constraints of horticulture production in Eastern Ethiopia. Other problems they reported also include poor know how in product sorting, grading, packing, and traditional transporting affecting quality. Many of these findings also hold true for other parts of the country like Alamata.

They added absence of direct transaction or linkage between the producer and the large buyer as another property that characterized horticulture marketing. Buyers follow contact persons who identify vegetables to be purchased, negotiate the price, and purchase and deliver the products. Bezabih and Hadera (2007) categorized actors in the marketing channel as producers, intermediaries/ brokers, traders and consumers.

Brokers play a decisive role in the marketing system and determine the benefit reaching the producer. Onion and tomato are quite often purchased in the field with brokers. According to Bezabih and Hadera (2007), there are three types of brokers: the farm level broker, local broker and urban broker. Each has their one separate task where the farmer level broker identifies plots with good produces and links the producer with a local broker. The local broker in turn communicates with the farmer and conveys the decisions made to the urban broker or collector. In this process the producer have contact with local agents and do not have direct contact with the other intermediaries. The third broker, urban broker, gets the information from ultimate buyers and sets the price. Here neither the farmer nor the traders set actual prices for the products. If the farmer insists on negotiating the price, the brokers gang up and boycott purchasing of the product leaving the product to rot. The farm level and local brokers get 5ETB while the urban broker gets 10 ETB per quintal.

If there are several brokers in an area, they negotiate not to compete on the price offered by the broker. The changes in the value of products as they move away from production along the marketing channel to the consumer is the increased utility by making the goods available rather than adding value in terms of increased shelf life or increased safety.
Similarly, Dawit and Hailemariam (n.d) stated the importance of horticultural crops for both domestic and international markets as it was at an increasing rate from time to time associated with the expansion of small-and large-scale irrigation facilities supported by national and regional extension service on the production of horticultural crops.

In their paper, these researchers analyzed opportunities and constraints of vegetables marketing in the rift valley. They reported three options for selling horticultural crops similar to Alamata; right in the field (common for onion and tomato), sell at near by markets, and least proportion option to access distance markets. They added that in terms of volume about 93 percent of the total produce was sold to wholesalers.

Basing farmers report, these researchers also added the major production and marketing constraints to include shortage of chemicals, shortage of commercial fertilizer, shortage of irrigation water, shortage of quality seeds, low product prices, intensive influence of speculators and brokers in reducing the bargaining power of farmers, poor market access, poor access to transportation, and intensive competition among producers.

Million and Belay (2004) indicated that, lack of market outlets, storage and processing problems, lack of marketing information, capital constraints, high transportation cost and price variation are some of the important constraints in vegetable production

Moti (2007) In his research report, he documented findings of the role of horticulture for export earning stability, farm resource allocation between food crops and cash crops, household decision making in crop choice-land allocation and market out let choice, and the influence of asymmetric price information on bargaining power of horticulture farmers.

According to Moti (2007) horticulture could be way out for agricultural commercialization of small-scale farmers with relatively better agricultural resource potential. If small-scale farm household have to move towards the production of horticultural crops for agricultural commercialization, factors influencing household decisions behavior in resource use should be studied.

He reported that diversifying the export base towards non-traditional agricultural commodities, as horticulture is important. He added linking small-scale farm household horticultural production with export could help both in reducing export earning instability and enhancing farm household's income. In addition, he pointed out that the production of high value and labor-intensive horticulture products contributes to poverty reduction and rural development through generating higher income and better employment opportunities for landless households. He also added that lack of cooling and storage facilities for perishable crops hampers for well functioning markets. He suggested access and availability to market information and alternative market outlets can improve subsistence farming to commercialize.

3. METHODOLOGY

3.1. Background of the study area

Alamata is located in southern zone of Tigray 180km away from, Mekelle, capital of Tigray region on the main road to Addis Ababa. There are 10 peasant and two town dwellers association in the District. Agriculture is the main source of income of the population in the district. The total population living in the district is estimated to be 118,557 of which 58,591 were male (CSA 2007). The total cultivated land is estimated to be 34,503ha out of which 33,778.8ha is cultivated through rain-fed while 724.2ha is through irrigation. From the irrigated land, around 493.6ha are irrigated through surface irrigation system using perennial rivers and 175ha using privately owned ponds (shallow walls).

There are also two pilot sprinklers and/or drip irrigation system being implemented in the area with total of 55.6ha, With regard to sprinkler and/or drip irrigation system it is believed to have in the near future 99 deep wells with potential of irrigating 3997ha of land (REST, 1998). At the moment 30 deep wells dug out in the district with an estimated potential of irrigating 900ha of land. Altitude in the area ranges from 1178 to 3148m and 75% of the district is low land (1500masl or below and only 25% is found in intermediate high lands (1500 and 3148masl).The small undulating mountains surrounding the district are very steep and with low vegetation cover a large area and have a series of dissected gullies which serve as a source of run off water and alluvial soil to the Alamata valley.

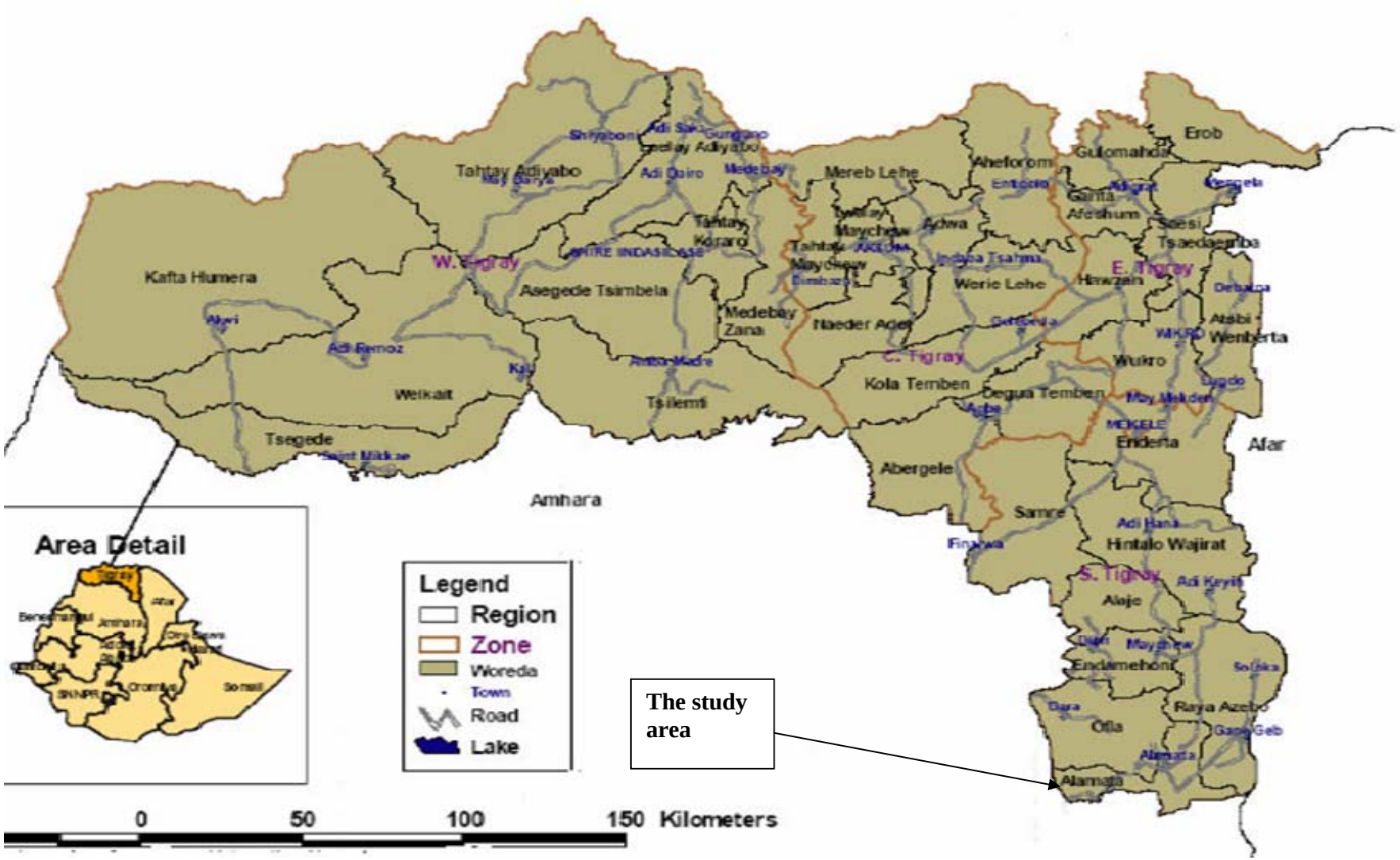

Figure 1 Map of the study area

The district is characterized by bimodal rainfall with average annual rain fall of 663 mm. Flood diversion is the most commonly used traditional system of supplementing the erratic rain fall pattern of the area .In eight of the seasonal rivers that pass through the district, it is estimated that around 6621hectares of land can be irrigated using flood coming from high land areas of the district during summer season (REST, 1998). Rain fed/spate irrigated onion production increased from 78 hectare in 2005 to 512 hectares in2006 and 724.2 hectare in 2007.

This can in part be explained by the various interventions (study tours, filed visits and market linkages) (Alamata IPMS, 2007).The average annual temperature is $29.7^{o}c$ with the maximum and $14.6^{o}c$ the minimum averaging $22.2^{o}c$.

The dominant crops produced in the district are mostly cereals, pulses and oil seeds, of the cereals sorghum, teff, and maize takes the largest portion of production. Currently the production of vegetables increases over time to cite an example in the 2005/2006 production year cover about 512 ha, while in the 2007/08 production year it reached about 724.2 hectares. In the 2006/2007 production year about 66582 quintal have been harvested which have been sold over 11.6 million birr from onion only (WoARD, 2007).Livestock are used as source of drought power, food, and income source in addition to crop production. It is estimated the district has a total livestock population of 106,461 of which cattle population 74,853 comprises the major share followed by small ruminants with a population of 24,971. Having this potential the district is suffering from lack of well organized systematized market oriented production system which discourages production and productivity of fruit and vegetables as required.

Generally, all these facts can tell us there is massive potential for improving the life of the population in the area if market oriented agricultural production system is efficiently and effectively undertaken.

3.2. Methods of Data Collection

Data were collected from primary and secondary sources. Primary data sources incorporated the entire situations of the marketing system from the producing farmer up to the retailers through structured questionnaire. The most important data types collected consist of

production, buying and selling, pricing, input delivery, determinants of market supply, production and marketing problem and, characteristics. Besides, secondary data on total land size, trend of vegetable production and population types and other data relevant to the study were collected and rapid market appraisal was under taken.

3.3. Sampling procedure

A multi-stage random sampling technique was employed. The sampling covered farmers and retailers to probability proportional to sample size.

3.3.1. Farmers' sampling

The farmers sampled for the survey were those that produce and are experienced in papaya, onion and tomato production and marketing. A total of 140 farmers were interviewed .Taking into consideration the time and budget constraint on the one hand and the sufficiency of representation from total 10 rural and 1 urban *Tabias* five *Tabias* were selected. Selection of *Tabias* was through a first listing of papaya, onion and tomato growing *Tabias* followed by a random selection of five for the study purposively. From each sampled *Tabia*, farmers growing papaya, onion and tomato in 1999 E.C were listed out with the help of development agents and other key informant farmers. From the list a random selection of farmers were taken proportionately to size summing to 140 in the whole of the study area (Annex table-1).

3.3.2. Traders sampling

Here sampling was the very difficult task due to the opportunistic behavior of the traders. But to have the possible level of representative prior to formal traders' survey, a rapid market appraisal (RMA) was conducted in order to get the overall picture of fruit and vegetable marketing chain in the District. It was estimated that about 29 wholesalers can visit Alamata at peak production period out of which nine wholesalers were randomly selected for detail analysis of wholesalers' market participation.

3.3.3. Retailers' sampling

The estimated number of retailers' horticulture in Alamata was 200 on the market day, Saturday, out of which 30 retailers were randomly selected.

3.4. Methods of Data Analysis

In this study both descriptive and econometric analyses were used to conduct market chain analysis. An econometric model was used to identify factors affecting marketable supply of fruit and vegetable for data's collected from a cross-section of samples. To describe the characteristics of market players' descriptive statistics like mean, standard deviation and percentage were employed.

3.4.1. Analysis of descriptive statistics

To describe the characteristics of market players and to identify key constraints in papaya, onion and tomato production and marketing descriptive statistics was used.

3.4. 2. Papaya, onion and tomato marketable supply analysis

In this study, Cobb Douglas (CD) production function (logarithmic function) model was used to analyze factors affecting farm level papaya, onion and tomato supply in Alamata District.

The Cobb Douglas production function is one of the most widely used functions in the economic analysis of problems related to empirical estimation in agriculture and industry (Sankhayan, 1988). The CD production function is also most suitable for analytical purposes. Since not any technique is superior in every aspect, the CD production has its own advantages and disadvantages (Dhawan and Bansal, 1977; Singh, 1977; Saito, 1994; Gujarati, 1995 as cited in Gebrehiwot H, 2005). Some of the advantages of the CD production function are: its simplicity and power to provide extra information related to elasticity, return to scale and other implications to be drawn from its estimates; it enables researchers to consider many variables at a time; it can show three type of relationships-increasing, decreasing and constant return to scale; and estimates from this function are free from units of measurement and factor ratios, on top of this when the CD production function changed to logarithmic function it can indicate the interaction among independent explanatory variables which is not possible to see it in its exponential form. The major disadvantages of the CD production function, on the other hand are; it can not be applied on individual farms, unlike budgeting and programming. If historical data are not available; it assumes that all farms in a group face identical production function, which is unlikely; zero input level in the CD production

function implies zero output which is unacceptable in some instances; it can not show both increasing and diminishing marginal returns in a single response curve.

To make commercialization effective, producers need to produce and supply substantial volume to market. Market supply could be increased through provision and use of superior production technologies and through improving other relevant factors too. It would be, therefore, essential to recognize and realize patterns of these influencing factors.

The most important variables that could determine market supply based on the reviewed literature include educational level, sex of household head, extension service, the relative importance of the crop in question, cash income from other crops, oxen number, livestock ownership and family size. Among production and market related variables distance to market, product prices, productivity, production level, total size of land holding and market information were found to be important determinants of marketable supply

However, special attention must be taken in considering the most important explanatory variables in explaining market supply level which could be different for different area of production, crop type, and level of commercialization. Therefore, considering specific situation at Alamata it was decided determinants of marketable supply to include quantity of production, distance to main road, total land owned, number of oxen, age, sex, family size, family labor, education level of household head, access to market information and extension contact.

Model Specification

The econometric model specification of the variables is as follows.

$$Y_i = F(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11})$$

where: Y_i = quantity of papaya, onion and tomato supplied to market

X_1 = number owned oxen by household

X_2 = Total land holding of the household head

X_3 = Quantity of produced each crop in 2007/ 08

X_4 = Distance from production area to main road

X_5 = Age of household head

X_6 = Family size

X_7 = Family labor

X_8 = Sex of household head

X_9 = Educational level of household head

X_{10} = Access to market information

X_{11} = Extension contact

Econometric model specification of supply function in matrix notation is the following.

$$Y = \beta' X + U$$

Where: Y = quantity of papaya, onion and tomato supplied to market

X = a vector of explanatory variables

β' =a vector of estimated coefficient of the explanatory variables

u_i = disturbance term

When some of the assumptions of the Classical Linear Regression (CLR) model are violated, the parameter estimates of the above model may not be Best Linear Unbiased Estimator (BLUE). Moreover, high multicollinearity may render important variables insignificant. Thus, it is important to check the presence of multicollinearity among the variables that affect supply of papaya, onion and tomato in the area.

Test for multicollinearity: to detect multicollinearity problem for continuous variables, Variance inflation factor $(VIF) = \frac{1}{1 - R_j^2}$, for each coefficient in a regression as a diagnostic statistic is used. Here, R_j^2 represents a coefficient of determination the subsidiary or auxiliary regression of each independent continuous variable X. As a rule of thumb, Gujarati (2003) stated that if the VIF value of a variable exceeds 10, which will happen if R_j^2 exceeds 0.90, then, that variable is said to be highly collinear. Therefore, for this study, Variance inflation factor (VIF) was used to detect multicollinearity problem for continuous variables. On the other hand, for dummy variables contingency coefficient was used.

According to Branson and Norvell (1983), the supply offered by farmers is a function of:

- price of the commodity to be supplied
- cost of all the inputs necessary to produce the commodity;
- net income or profit that could be obtained from alternative crops
- state of technology that affects potential yields;
- total acreage available, expectations about future price change and
- risk of production (weather, insects).

Definition of variables

Dependant Variable:

Quantity Supplied to Market: It is a continuous variable representing dependant variable. It was the amount of papaya, onion and tomato supplied by households to market and measured in quintal.

The Independent variables are:

1. Age of the household head (Aghh) - It is a continuous variable and measured in years. Age is a proxy measure of farming experience of household. Aged households are believed to be wise in resource use, and it is expected to have a positive effect on market participation and marketable surplus. On the other hand, older households may also be tradition bound and reluctant to take up new technologies, hence negatively affecting horticultural production.

2. Number of oxen owned (Noxown) - being a power for plowing, papaya, onion and tomato supply would increase as farmers increased their number of oxen ownership. The expected influence is positive on supply. It is a continuous variable and is expected to affect the

marketable supply of papaya, onion and tomato positively. This is because those farmers who have their own oxen can reduce their cost of production (oxen rent) and can plough their land on time and as a result, be able to produce more papaya, onion and tomato and supply for the market. Kindie (2007) found that the number of oxen owned by the households affected positively the marketable supply of sesame in Metema District.

3. Total land owned (Tlanown) - this is a continuous variable in hectare indicating the total land owned by a farmer. It is expected to take positive sign implying that the larger land size a farmer owns the more land size would be allocated for the crop at interest. Increase in size of land assumes direct influence on marketable surplus. Branson and Norvell (1983) and DNIVA (2005) found expanding the area under crop increased the marketable supply of the crop.

4. Quantity of produced (Qtypro) - This variable has important influence on market supply. It is expected to influence it positively. It is a continuous variable measured in quintals. The higher the produce, the more likely the household would supply to market.

5. Distance from production area to main road (Dfptmr) –This is a continuous variable included in the model to indicate the distance of household from the main road. As the crops are bulky the proximity to the road will matter the farmers need to produce and participate in the farming of marketable commodities. There is no doubt that transport is of great importance for marketing agricultural produce. In particular, rural communities in remote areas suffer from lack of transportation facilities. This happens due mainly to absence of adequate means of transformation and due to poor infrastructural conditions like roads (Robbins *et al.,* 1990). It is measured in kilometers of single trip and is expected to take a negative signs.

6. **Extension contact (Exct) –**this is a dummy variable with a value of one if a household has access to extension contact and zero otherwise. The aim of the extension service is introducing farmers with new and improved agricultural inputs for better methods of increasing production and productivity in turn increase marketable supply.

7. Access to market information (Actminform): access to market information is assumed to have positive impact on marketable supply of papaya, onion and tomato at the farm level. It is

a dummy variable with a value of one if a household head has access to market information and zero otherwise. The general idea is that maintaining a competitive advantage requires a sound business plan. Again, business decisions are based on dynamic information such as consumer needs and market trends. This requires that an enterprise is managed with due attention to new market opportunities, changing needs of the consumer and how market trends influence buying (CIAT, 2004).

8. Education of household head (Edlhh): this is a dummy variable with a value of one if a household head is literate and zero otherwise. Education increases farmers' ability to get and use information. Since households who have better knowledge are assumed to adopt better production practices, this variable is assumed to have positive relation with farm level marketable supply of onion, tomato and papaya.

9. Active family labor (Alforce) – this is a continuous variable representing the availability of economically active labor force in the household (male and female). It is expected to take positive coefficients explaining an increase in economically active labor force to increase the farmer's participation in the crop farming.

10. Family size (Fshh) – this is the total number of family members that can be taken as a proxy for level of consumption. This continuous variable is expected to influence participation decision and supply negatively

11. Sex of the household head (Sexhh) - This is a dummy variable. No sign could be expected a priori for this variable. It could take positive or negative signs of coefficients.

3.4.3. Structure _Conduct _Performance

Structure _ conduct _ performance (S-C-P): the structure conduct performance (S-C-P) approach was developed in the United States as a tool to analyze the market organization of the industrial sector and then it was applied to assess the agricultural marketing system (Pomeroy and Trinidad, 1995). Hence, this approach is applicable to analyze performance of papaya, onion and tomato market chain.

The study of competition in an industry usually rests upon an analysis of market structure, conduct, and performance. How a firm's policies, especially price policies, are determined is the measure of market conduct, and market performance describes the end results of market processes (Ford Foundation, 2007). As hypothesized in industrial organization theory, a causal flow exists between market structure, conduct and performance. This theory can be tested using indicators that determine the existence of and extent of deviations from the perfectly competitive model (Pomeroy and Trinidad, 1995).

Factors accounting for efficiency can be evaluated by examining enterprises for structure-conduct - performance. These elements measure the extent of deviation from the perfectly competitive norm. The larger the deviation, the more imperfectly competitive is the market, that is on extreme case would be monopoly (Abbot and Makeham, 1981). Due to its applicability, in this study the structure- conduct- performance approach is used as a framework to analyze and evaluate how efficiently papaya, onion and tomato market chains are operating in Alamata District.

3.4.3.1. Analysis of market structure

Market structure is the environment in which the firm operates. It includes the following elements: buyers/ sellers concentration, product/service differentiation, and entry barriers (Pomeroy and Trinidad, 1995). It is defined as the characteristics of the organization of a market, which seem to influence, strategically, the nature of competition and pricing behavior within the market. Structural characteristics can be used as a basis for classifying markets.

In this regard, one can categorize markets as perfectly competitive, monopolistic, or oligopolistic (Bain, 1968; cited in Pomeroy and Trinidad, 1995). Among the major structural characteristics of a market is the degree of concentration, that is, the number of market participants and their size distribution and the relative ease or difficulty for market participants to secure an entry into the market (Gebremeskel *et al.*, 1998).

In food marketing, very large number of producers and consumers at each end of the marketing chain is suggestive of competitive conditions and, therefore, the focus in analyzing market structure is on the numbers and sizes of enterprises within the system, and the potential access of additional participants to it. A high number of buyers and sellers along

the marketing chain, ease of entry into all functions, and widely available market information, together carry a strong presumption of competitive conditions (Timmer *et al.*, 1983).

Estimating the numbers, size and spatial distributions of each category of intermediary provides an indication of both the local structure of the market, and the range of alternatives faced by participants in the marketing chain in their buying, selling and hiring functions (Scarborough and Kydd, 1992).

Concentration ratio- Market concentration is defined as the number and size distribution of sellers and buyers in the market. In this study concentration ratio manipulation was done only for onion wholesalers not for tomato and papaya wholesalers due to limited sample size. It is felt to play a large part in the determination of market behavior within an industry because it affects the interdependence of action among firms. The greater the degree of concentration is the greater the possibility of non-competitive behavior, such as collusion (Pomeroy and Trinidad, 1995).

The commonly used measure of market power, or seller concentration, is given by the proportion of total industry sales accounted for by the four large enterprises in the industry. Kohls and Uhl (1985) suggest that, as a rule of thumb, a four enterprise concentration ratios of 50 percent or more is indicative of strongly oligopolistic industry, of 33-50 percent a weak oligopoly, and less than that, an un-concentrated industry. This is the number and size distribution of sellers and buyers in the market. The usual measures of market concentration are:

$$S_i = \frac{V_i}{\sum V_i}$$ ----------Equation (1)

Where Si –market share of buyer i

Vi- amount of product handled by buyer i

ΣVi=Total amount of product handle

$$C = \sum_{i=1}^{r} S_i \quad \text{i= 1, 2, 3, 4.}$$ ----------Equation (2)

Where C- concentration ratio

Si- percentage share of the i^{th} firm

r-is the number of relatively larger firms for which the ratio is going to be calculated

The basic limitations here are the lack of reliable data on firm basis for its application, the incapability of a single measure to reveal distribution of sales between the numbers of largest enterprises, and failure to take account of product differentiation or other possible monopoly elements. Besides, the index falls prey to inferential problems of forming hypotheses about conduct from structural characterization. For example, a large number of similar-sized enterprises may result in a low concentration index, but the possibility that these enterprises to collude, to form effective oligopolistic conditions is a chance (Scarborough and Kydd, 1992).

Barriers to entry and exit - The ease with which potential participants can enter various functions is commonly used as a means of assessing the degree of competition in an industry (Scarborough and Kydd, 1992). Stigler (2005) suggests about four points that can create barriers to entry: legal barriers (franchise and patents), economies of scale, superior resources, and pace of entry.

The modes of entry into trade, means of building capital, means of acquiring marketing skills and contacts, periods of apprenticeship, trader's perceptions of barriers, the origins and levels of initial capital required for traders of different sizes (functions, or commodities), and the degree of mobility between functions and commodities can be used as centre of data to see the barriers to entry (Timmer *et al.,* 1983).

Interviewing traders about barriers to entry might be difficult since all have entered the market and more or less they are undertaking trading activities. Rather, observation of the age, gender, and ethnic distributions of owners, an employees of different sizes of enterprises and the extent to which fluctuations in the number of active traders follow rises and falls in profitability can be considered. Market structure is most commonly evaluated by examining trends in the numbers and sizes of firms relative to each other, and to number of consumers and producer, in particular times and places (Scarborough and Kydd, 1992).

3.4.3.2. Analysis of market conduct

Market conduct refers to the behavior of firms or the strategies used by the firms, for example, in their pricing, buying, selling, etc., these activities may require the firms to engage into informal cooperation or collusion (Gebremeskel *et al.*, 1998). Definition of market conduct implies analysis of human behavioral patterns that are not readily identifiable, obtainable, or quantifiable. Thus, in the absence of a theoretical framework for market analysis, there is a tendency to treat conduct variables in a descriptive manner (Pomeroy and Trinidad, 1995).

In this study, conditions that are believed to express the exploitative relationship between producers and buyers were analyzed. Since there are no agreed upon procedures for analyzing the elements of market conduct, the following few questions were taken into consideration to systematically detect indicators of unfair price setting practices and conditions in places or areas where such market injustices are likely to prevail. The points include checking the availability of price information and its impact on prevailing prices; and the feasibility of utilizing alternative market outlets (Scarborough and Kydd, 1992).

3.4.3.3. Analysis of market performance

Market performance refers to the impact of structure and conduct on prices, costs, and volume of output (Pomeroy and Trinidad, 1995).

Marketing efficiency is essentially the degree of market performance. It is defined as having the following two major components: (i) the effectiveness with which a marketing service would be performed and (ii) the effect on the costs and the method of performing the service on production and consumption. These are the most important because the satisfaction of the consumer at the lowest possible cost must go hand in hand with maintenance of a high volume of farm output (Ramakumar, 2001).

The two approaches to measure marketing performance are: marketing margin and the analysis of market channel efficiency. A large number of studies have analyzed the marketing margins for different types of commodities to examine the performance of agricultural products marketing (e.g, Wohlengenant and Mullen, 1987; Schroeter and Azlam,, 1995; Holt, 1993) and (Sexton, Zharg and Chalfant, 2005 as cited on Jema, 2008) argued that even

though variations in the margin over time might be attributable to marginal marketing costs under perfect computation, additional factors such as seasonality, technological changes, and sales volume may also explain the variations in the margin.

Marketing Margin- In a commodity subsystem approach, the institutional analysis is based on the identification of the marketing channels. When there are several participants in the marketing chain, the margin is calculated by finding the price variations at different segments and by comparing them with the final price to the consumer. The consumer price is then the base or the common denominator for all marketing margins. Comparing the total gross marketing margin is always related to the final price or the price paid by the end consumer and then expressed as a percentage (Mendoza, 1995).

Marketing margin is most commonly used to refer to the difference between producer and consumer prices of an equivalent quantity and quality of a commodity. However, it may also describe price differences between other points in the marketing chain, for example between producer and wholesale, wholesale and retail prices (Scarborough and kydd, 1992).

The size of marketing margins is largely dependent upon a combination of the quality and quantity of marketing services, and the efficiency with which they are undertaken and priced. The quality and quantity of marketing services depends on supply and demand of marketing services and/or the degree of competition in the market place. The costs of service provision depend on both exogenous and endogenous factors and the efficiency is determined by the extent of competition between marketing enterprises at each stage.

Large gross margins may not express high profit; this is because size of marketing margins largely depends upon a combination of the quality and quantity of marketing services, and the efficiency with which they are undertaken and priced. The quality and quantity of marketing services depends on supply and demand of marketing services and/or the degree of competition in the market place. Therefore, in using market margin analyses to assess the economic performance of markets, it is always preferable to deconstruct them in to their cost and return elements (Scarborough and Kydd, 1992). However, the challenges of data availability on costs usually create a problem.

Mendoza (1995) warns that precise marketing costs are frequently difficult to determine in many agricultural marketing chains. The reasons are that these costs are often both cash costs and imputed costs, the gross and not the net marketing margin is advised to be calculated. According to Mendoza (1995), "marketing margins" should be understood as the gross marketing margins. He advises marketing researchers to emphasize on gross marketing margins in reporting their findings. In similar manner, in this study, gross marketing margin was considered instead of net marketing margin, as it was difficult to estimate the implicit costs incurred during transaction of onion, tomato and papaya.

The total marketing margin is given by the following formula

$$TGMM = \frac{Consumerprice - Farmer'sprice}{Consumerprice} \times 100$$ ----------Equation (3)

Where TGMM-Total gross marketing margin

Producers' participation or producers' gross margin is the proportion of the price paid by the end consumer that belongs to the farmer as a producer.

$$GMM_p = \frac{Consumer\,Price - MarketingGrossMargin}{Consumer\,Price} \times 100$$ ----------Equation (4)

Or GMMp = 1- TGMM

Where

GMMp- Producers' participation (farmers' portion)

$$PS = \frac{P_x}{P_r} = 1 - \frac{MM}{P_r}$$ ----------Equation (5)

Where

PS- Producer's share

Px- Producer's price of fruit and vegetables

Pr-Retail price of vegetables, and MM – Marketing margin

Studies have found out that estimating marketing margin quite accurately through price surveys at all levels in the distribution channel during one week under normal conditions is normally recommended. In the case of perishable products, estimating the margin depends largely on primary data collection in the form of surveys carried out over time intervals

relevant market cycle occurs. Recording prices at different levels of the marketing chain during a two-to-three-week period is sufficient to calculate quite accurately the relevant marketing margin (Mendoza, 1995).

4. RESULT AND DISCUSSION

This chapter presents the results and discussion of descriptive and econometric analysis of the study. Descriptive analysis employed to describe the socio-demographic characteristics of sampled farm households, Structure Conduct and performance, extension support service and profitability of onion, tomato and papaya producers and traders are discussed. Econometric analysis was employed to identify determinants of papaya, onion and tomato supply.

4.1. Household and farm characteristics

4.1.1. Household characteristics

Table 1.Respondents' socio- demographic characteristics

List	Number of respondents	Percent
Sex		
Male	135	96.40
Female	5	3.60
Education level		
Illiterate	54	38.60
Able to red and write	43	30.70
Grade 1-4	16	11.40
Grade 5-8	23	16.40
Grade 9-12	4	2.90
Marital status		
Single	7	5
Married	127	90.70
Divorced	4	2.90
Widowed	2	1.40

Table 1. Respondents' socio- demographic characteristics (continued)

Religion		
Orthodox-christen	112	80
Muslim	28	20
Family size		
mean	6.02	
	(2.30)	
Active labor force		
Average labor	3.33	
	(1.64)	

Source, Survey result, 2008

*numbers in the parenthesis are standard deviations

The age of respondents ranged from 20 to 78 years with a mean of 42.7. The family size range from a minimum of 1 to a maximum 14, average family size and average active labor force was 6.02 and 3.33, respectively. Table one depicts that about 39% of the sample respondent were illiterate, 31% able to read and write, 11% grad 1-4, 16% 5-8, and the remaining 3% attended 9-12 grade. Eighty percent of the sample respondent was Orthodox-christen; the remaining 20% were Muslim. About 91 % of the sample respondents were married and the remaining, 5%, 2.9% and 1.4% were single, divorced and widowed, respectively (Table 1).

4.1.2. Farm characteristics

4.1.2.1. Production

Random selections of 140 farmers were taken out of which 135 are male and 5 are female. The numbers of papaya, onion and tomato growers were 32,114 and 47 respectively.

Table 2. Sample growers by crop type

Grower by type	Number of producers	
	N	Percentage
Onion only	72	51.42
Tomato only	13	9.30
Papaya only	11	7.90
Onion and tomato	23	16.42
Onion and papaya	10	7.14
Tomato and papaya	2	1.42
Onion, tomato and papaya	9	6.42
Total	140	100

Source, Survey result, 2008

4.1.2.2. Land holding and allocation pattern

The survey results indicate that amount of arable land holding ranged from 0.13 to 5.13 with a mean land size of 1.80 ha and a median of 1.62ha. In the 2007/08 production year the maximum size of land allocated for onion, tomato and papaya was 2.75ha, 0.50ha and 0.25ha with standard deviation of 0.37, 0.12, and 0.06, respectively.

Based on the survey result the mean cultivable land allocated was to teff 0.96ha, 0.80ha to sorghum, 0.38ha to onion, 0.49ha to maize, 0.19ha to tomato, 0.06ha to papaya, 0.13ha to green pepper placed in order (Table 3). Secondary data obtained from office of agriculture and rural development of Alamata revealed that allocation of land to vegetable increased from year to year (appendix table 2).

Table 3. Average land holding and allocation pattern for sample farmers in Alamata District in 2007/08 (in ha)

Description	Minimum	Maximum	Mean	Std.devation
Total cultivated land holding	0.13	5.13	1.80	1.06
Land allocated for onion	0.01	2.75	0.38	0.37
Land allocated for tomato	0.00	0.50	0.19	0.12
Land allocated for papaya	0.01	0.25	0.06	0.06
Green pepper	0.02	0.38	0.13	0.11
Teff	0.25	2.75	0.96	0.56
Sorghum	0.13	3.25	0.80	0.53
maize	0.13	1.00	0.49	0.31

Source, Survey result, 2008

Traction power-As draught power is important source of farm power 0.7percent of the respondents owned six, 2.1percent owned five, 7.1 percent owned four,15.7 percent owned three, 58.6 percent owned two, 12.1 percent owned one and 3.6 percent owned zero oxen.

4.1.2.3. Pattern of crop rotation

The survey results show that about 26 percent of the onion producers and 57 percent of tomato producers undertake crop rotation practice and none of the papaya producers undertakes rotation, this is due to the perennial nature of the crop, and early introduction of the fruit to the District. Depending on the crop type and nature of production, crop rotation could be important in increasing soil fertility, optimal use of nutrients, disease and pest protection, efficient utilization of water and ultimately boosts production and productivity. Above all the first crop rotation type is more or less important practice for the reason that some fix nitrogen like chickpea which is leguminous plant while, others use nitrogen like maize and most of them are from different family with different root system some shallow and some are relatively deep. This therefore, protects dieses and pest and optimal utilization of nutrients at different level of the soil.

Based on the points mentioned above the relative importance of these crop rotation practiced by the sample respondents listed below are; 1, 4, 2 and 3 in that order.

1. Maize---cotton----tomato----cabbage ----- pepper ---- sesame ---- onion ---- chickpea
2. Cotton ---- maize ----- sesame ------ tomato ----- pepper
3. Sesame ----- maize ------- onion ----- tomato ------- pepper
4. Onion ---tomato ------- cotton -------maize-----sesame------ pepper ----- teff ---chickpea

4.1.2.4. Inputs used for onion, tomato and papaya production

Agricultural inputs are important elements for production and productivity. As a result the typical inputs utilized for production of the three crops were seed, modern and traditional irrigation, labor, land, chemicals and fertilizer though the amount and type of chemical and fertilizer used was very limited.

Onion, tomato and papaya were planted with seedlings raised in small plots at homestead and irrigation area. Seed for onion and tomato were supplied from cooperative, office of agriculture and from open market through private dealers. Papaya seedlings were supplied from government nursery through office of Agriculture and Rural Development, and through farmer to farmer exchange.

The survey result shows that in the production year of 2007/08 93.85percent of the 114 household onion producers used improved onion seed and 13.2 percent used chemicals (insecticide and pesticide).

Of the 47 tomato producers 78.3 percent used improved tomato seeds and 19.6 percent used chemical fertilizer, insecticide and pesticides. None of the papaya producers used modern chemicals and 68.8 percent used improved papaya seedlings supplied from government nursery.

As pointed out by sample farmers, the average seed cost purchased per kg of onion and tomato in the production year of 2007/08 was 250.10ETB and 400.65ETB, respectively. While the average cost per single papaya seedling was 0.25 ETB. The common seed types were Adama Red and Bombay Red in the case of onion Bombay Red was more used (90%) than Adama Red. The most commonly used tomato seed type was Roma VF (70.3%).

Sample respondents pointed out that, irrigation of onion, tomato and papaya was with modern irrigation (drip and sprinkler), pond, shallow wall, spate irrigation and water technology (motor pump, pedal pump and family drip). Out of the 140 sample respondents 7 owned motor pump, 12 owned pedal pump and 2 owned family drip. Farmers applied urea fertilizer on their tomato and onion to a limited amount. The source of fertilizer was from office of agriculture and Rural Development. Of 114 onion and 47 tomato growers only 12 and 5 respondents applied fertilizer on their field, respectively. The application rate was below the recommendation that was about one quintal per hectare.

Table 4. Suppliers of onion, tomato and papaya seeds/seedling for the farmers and mode of purchase in (2007) Alamata

Type of seed	Source	% of sampled households	Mode of purchase on		
			cash	credit	others
Onion	Market	30.7	29.23	**	**
	Cooperatives (both union and primary)	48.2	45.89	3.8	**
	Woreda office of agriculture	7.9	7.52	**	**
	Others	13.2	12.56	**	1
	total	100	95.2	3.8	1
tomato	Market	57.1	55.44	**	**
	Cooperatives (both union and primary)	8.6	8.35	**	**
	Woreda office of agriculture	28.6	27.77	**	**
	others	5.8	5.63	**	2.9
	total	100	97.1	**	2.9
Papaya	Woreda office of agriculture	38.5	17.79	**	**
	Own	46.2	21.34	**	**
	others	15.4	7.11	**	58.80
	total	100	46.2		58.80

Source, Survey result, 2008

* Others; refer to on kind exchange and gift. ** indicated blank space

4.1.2.5. Agronomic practice

The area covered with fruit and vegetables was lower as compared to the potential of the District. The probable reason for this could be lack of knowledge of the producers about the importance of horticultural production and marketing and poor progress of the deep well expansion started by the Regional and Federal Government. Onion and tomato from vegetables and papaya from fruits were some of the popular crops grown in the study area.

Farmers were asked whether production of horticultural crops was increasing or decreasing, over the last five years development plan. Apparently, 88.6 percent, 71.7 percent and 62.5 percent of onion, tomato and papaya producers pointed out that production of these crops has increased. The survey shows that the average round of tillage was 4.5 times for onion and 3.6 times for tomato. Weeding for onion was on the average 3.2 times while for tomato 3. The average harvesting rounds of tomato after starts bearing was from 5-6 times and papaya could bear at intervals for more than a year under sound agronomic management practice.

Cropping calendar- The period for land preparation for horticultural production differs from farmer to farmer. Some start land preparation right after harvest while others start after few days. The model farmers' plant onion seedling side by side by considering maturity time of the already planted onion plot for immediate transplanting after few days of harvest. This reduces seedling growth time. There are some differences in the cropping periods of onion, tomato and papaya. Tomato can be planted from September to May while onion can be planted from June to mid may. Some of the *Tabias* farmed in January and February and used irrigation to supply up to May. In fact, there are Tabias that plant onion seedling on July get matured on October first which was exposed some times to unexpected rainfall that deteriorate/spoil onion. Papaya started planting from end June to late July and started production supply to market early May on wards.

4.1.2.6. Type of seed used

The most commonly used seed type were Red Bombay and Adam Red for onion and Roma VF for tomato. The varieties of papaya utilized in most cases not clear that is farmers were planting papaya seed from own and other farmers but these days dwarf varieties with better yield have been introduced and distributed by office of Agriculture and Rural Development. Most of the farmers are very much familiar with the best quality seed of onion and tomato.

Even 5 farmers travel to Addis Ababa by them selves to find the quality seed of onion when onion seed was not available in the district. The survey result indicates that 90%of the farmers grew Bombay Red for its short growth period and relatively high productivity. Likewise, 70.3% of the tomato growers sow Roma VF for its relative storability.

4.2. Access to services

4.2.1. Access to extension service

Extension service- the rural extension services are on the verge of a major shift in extension service delivery through the farmer training center system. As a result in the study area in 10 of the rural PA 10 FTC's were constructed to give training to farmers based on 70% practical and 30% theoretical training. Accordingly, extension service was mainly delivered by the *Woreda* office of Agriculture and Rural development.

Respondent farmers reported that the average distance they had to travel to development center was 2.60 km (of single trip travel).

Each sampled *Tabia* had three development agents assigned to work in crop production, animal science and natural resource. On top of this *Tabias* like *Tumuga* and *Limaot* had one additional irrigation DA's as the area have started deep wall modern irrigation both Drip and sprinkler irrigation (55.6ha) and traditional irrigation scheme(370ha). This is because the Regional Agricultural and Rural Development Bureau gives special attention to modern and traditional irrigation areas to technically support the farmers' right from land preparation, seed selection, disease and pest, water management up to post harvest handling. According to the region, one DA's is deployed for areas that have more than 50 ha of irrigation area that can be cultivated.

Respondents reported that the extension frequency of extension visit they had from development agents was put as follows. Accordingly, from all respondents two were visited once in a week, one once in two weeks, one any time required and twelve were visited with no regular program and hundred twenty four were not visited at all.

4.2.2. Access to and availability of credit

Credit is important to facilitate the introduction of innovative technologies and for input and out put marketing arrangements.

However, the lack of definite credit service delivery for vegetable and fruit producer and the nature of production system at the harvest period opened an opportunity for farmers not to request credit. Furthermore, producers develop cash on hand system. The existence of alluvial soil which is fertile soil coming from high land also relieved from use of fertilizer. Although credit was accessible and available for poor farmers whose daily income was below one dollar per person to build asset and food secured by purchasing the different packages designed by the regional government, however, there is lack of attention to access and avail credit for horticultural producers. As a result, no producer reported credit except 8 onion and 5 tomato growers.

4.2.3. Access to infrastructure

Except two *Tabaiy*s (25%) Alamata is comparatively with better facilities. It has about 24 km asphalt road, 27 Kms all weather roads, and about 73km dry weather road. In the harvest season, Truckee's can move in any direction they like to collect products. Four of the rural *Tabias* had telephone line, one bank service at Alamata. Mobile telephone works in all papaya, onion and tomato growing plains. Five rural *Tabiays* have 24hours electric power service. Dedebit micro finance institution was the only institution that can legally give credit service to poor farmers with group collateral; cooperatives give credit to a limited extent.

4.2.4. Access to markets

The survey results reveal that 50%, 78.9% and 65.2% of the papaya, onion and tomato producers respectively sold their product at PA market. The remaining respondents sold the product at *Woreda,* other PA markets and outside *Woreda* market. As the crops (onion, tomato and papaya) have short shelf life, it was anticipated to sell the products there in farm gate. Except one *Tabia* all other *Tabias are* found in the main road to Addis Ababa and have relatively easy access for product sale. Because of this natural gift and access to pieces of market information, on demand, supply and price producers have the chance to sell their produce on the main road which is very small distance from their farm land and seem to reduce transport cost and create easy market access. *Facha* (local administrative office compound), *Gerjelle* and *Limaot* primary cooperative office were the usual roadside where onion marketing took place. Retailing of horticultural products took place in Alamta town on daily basis but the amount handled by retailer and number of buyers was small relative to the

market day of the town on Saturday. *Timuga* and *Gerjelle* were the other common retail area though the sizes of the market were small (in terms of volume handle and number of marketing actors).

4.2.5. Access to market information

The sampled respondents revealed that the major source of market information were traders (assemblers, wholesalers), brokers, cooperatives, personal observation and others. About 84% of Papaya producers have got market information form personal observation. This could be probably because of papaya price information was not collected and distributed to farmers like the other commodities either through cooperatives and/or TAMPA (Table 5).

Table 5. Source of market information for onion, tomato and papaya marketing at Alamata (2007)

Percent response by crop type	Source of information for the commodities			
	Traders(assemblers, wholesalers), brokers	cooperatives	Personal observation	Others[1]
Onion				
N	46	21	36	11
Percent	40.40	18.40	31.60	9.60
Tomato				
N	14	15	15	3
Percent	29.78	31.91	31.91	6.38
Papaya				
N	2	1	27	2
percent	6.25	3.13	84.38	6.25

Source, Survey result, 2008

- Personal observation meant when a farmer finds price of a commodities by himself either from local market and/or *Woreda* market.

[1] Others source of information for the commodities includes news paper, telephone, radio and friends

4.3. Profitability analysis of onion, tomato and papaya.

4.3.1. Profitability analysis of onion, tomato and papaya producers

The survey result indicates the average productivity for onion; tomato and papaya were 97.22Qt, 145.87Qt and 123.98Qt per hectare, respectively. The cost of production per hectare on average was 5,445.76ETB for onion, 5,196.52ETB for tomato and cost of papaya after discounting was2,909.82ETB and the average return per hectare were 16,738.85ETB for onion, 14,019.54ETB for tomato and 23,075.62ETB for papaya(before discounted), respectively. On the survey all cost structure and return were collected at *Timad* level (which is one fourth of a hectare) for final analysis all costs and returns were converted to hectare basis to keep the standard and readable.

Table 6 indicates that on average a producer can get a net profit of 117.34ETB, 60.99ETB and 108.68 ETB(after discounting) per quintal from onion, tomato and papaya in that order. It seems that the production of horticultural products is profitable especially that of onion and papaya. The producers share from the wholesaler market calculated as 72.03% seems greater than the wholesalers (28.95%) (Table 6 and 8). Hired labor and family labor cost was the major cost of producers which constituted about 40% of the total production and marketing structure costs of onion.

In computing papaya profitability the following technique was considered as the crop is perennial. Papaya is assumed to give production at an average for five consecutive years after establishment. Seedlings and traction power costs are important costs at the first year of establishment. All the other costs indicated on table 6 are fixed costs that can run up to production termination of the crop but the value and amount of money can vary with time. To calculate the net profit obtained from papaya the following formula was used.

$$NPV=\frac{\sum_{t=1}^{n} B_t - \sum_{t=1}^{n} c_t}{(1+r)^n}$$

Where NPV=is net present value

B_t=benefit from one year

C_t= cost incurred in a year

r=interest rate per year, for simplicity r was considered 10%

n= number of years

Cost and benefits were calculated and discounted independently over fiver years by considering cost of first year (establishment cost) was 4888.25ETB and operational cost with out seedling and traction power cost was 3506.70 ETB from the second year onwards and the return from one hectare of papaya before discounting was 23,075.62ETB.

The calculation results in cost incurred and benefit obtained were 14,549.11 and 71,313.75, respectively. As indicated from the above calculation the net present value obtained per hectare of papaya discounted for five year was 57,164.64ETB. About 11,432.93 ETB net profits can be obtained from papaya production in one year per hectare (108.68ETB per Qt) (Table 6).

Table 6. Average cost and profitability of onion, tomato and papaya producers (Birr/ha) (Alamata, 2007)

List of cost type	Crop types		
	Onion	Tomato	papaya
Seed/seedlings	880.35	518.85	286.89
Fertilizer	83.11	49.32	**
Chemical	230.81	150	8.25
Family labor	890.94	1018.86	2412.05
Hired labor	1265.53	695.78	548.37
Traction power	672.48	664.74	1094.66
Irrigation fee	315.05	575.68	**
Interest rate	6.27	7.33	**
Cost of packaging material	481.20	600	117.79
Loading and unloading cost	240.60	361.6	107.79
Transport cost	144.36	289.28	233.50
Land rent	100.00	100.00	**
Other costs	54.73	84.75	78.95
Total cost per hectare	5,445.76	5,196.52	2,909.82*
Total cost per quintal	56.59	35.93	28.39*
Average selling price/Qt	179.05	98.99	219.35
Revenue/ha of production	16,738.85	14,019.54	23,075.62
Net profit(Loss)/ha	11,293.09	8,823.02	11,432.93*
Net profit(Loss)/Qt	117.34	60.99	108.68

Source, Survey result, 2008.

** indicates no cost

* indicates discounted values over five years for papaya

4.3.2. Profitability analysis of onion, tomato and papaya assemblers

The average marketing cost incurred for one quintal of onion from production area to the market place of the assembler was 36 ETB. Out of which transport cost covered about 39% of the total marketing cost. Similarly the marketing cost of tomato and papaya per quintal was 45.76ETB and 25.20ETB respectively. Of which 32.78% and 38.89% of tomato and papaya in that order was transportation cost (Table 7).

Table 7. Average cost and profitability of onion, tomato and papaya assembling (Birr/Qt) (Alamata, 2007)

List of expenses per Quintal	Crop type		
	Onion	Tomato	Papaya
Average purchase price	178.67	100.5	220.00
Packaging cost	2.50	15.00	9.80
Weighing cost	.50	0.5	0.30
Loading and unloading Cost	2.00	2.00	2.00
Transport cost	14.00	13.36	13.00
Store rent	1.00	1.00	00
Brokerage cost	6.83	5.80	0.10
Commission paid	8.67	7.60	00
Tax paid	.50	0.50	00
Average selling price	250.16	170.50	262.00
Net profit per quintal	35.49	24.24	16.8

Source, Survey result, 2008

4.3.3. Profitability analysis of onion, tomato and papaya wholesalers

The amount of marketing cost spent on one quintal of onion, tomato and papaya to reach the consumer of the aforementioned commodity was 40.1ETB, 46ETB and 33.7ETB in that order. As the survey result indicates tomato marketing cost was higher by 14.71% and 36.49% than that of onion and papaya marketing costs, respectively (Table 8). This could be due to probably the packaging cost of tomato.

Table 8. Average cost and profitability of onion, tomato and papaya wholesaling (Birr/Qt) (2007).

List of expenses per Quintal	Crop type		
	Onion	Tomato	Papaya
Average purchase price	249.00	169.25	262.2
Packaging cost	2.70	15.00	10.6
Weighing cost	0.50	0.5	0.50
Loading and un loading Cost	2.00	2.00	2.00
Transport cost	15.40	13.60	15.40
Store rent	1.00	1.00	00
Brokerage cost	7.40	5.80	5.20
Commission paid	10.60	7.60	00
Tax paid	0.50	0.50	00
Average selling price	337.40	249.55	337.50
Net profit per quintal	47.80	34.30	41.60

Source, Survey result, 2008

The study obviously showed that the net profits of wholesalers for the three crops were greater than the profits of assemblers and retailers. The net profit calculated for wholesalers, assemblers and retailers were 47.8ETB, 35.49 ETB and 30.04 ETB from onion, per quintal respectively and 34.3ETB, 24.24 ETB and 24.33ETB net profit obtained from tomato, respectively. Of the marketing cost of wholesalers and assemblers for onion, transport cost was the major component which accounts for about 38.04 % and 38.89% respectively, (Table 7 and 8)

4.3.4. Profitability analysis of onion, tomato and papaya retailers

The survey result indicates that the net profit obtained from onion, tomato and papaya at retail level was 30.04ETB, 24.33 ETB and 16.50 ETB, per quintal respectively. As pointed out on (Table 9) profit of onion is higher by 55.25% and 64.55% than that of tomato and papaya, respectively. According to the survey result taxi paid by retailers seems large as compare to wholesalers and assemblers this might be retailers have constant buying and selling stales and could be taxed easily by the municipality regularly where as wholesalers and assemblers were relatively have no fixed place and are difficult to taxi them regularly.

Table 9.Average cost and Profitability of onion, tomato and papaya retailing in (Birr/Qt) (Alamata, 2007).

List of expenses	Crop type		
	Onion	Tomato	Papaya
Average purchase price	336.97	248.55	336.75
Packaging cost	0.48	15	0.00
Cost of labor	0.49	.60	0.50
Tax paid	2.87	1.03	2.00
Average selling price	370.85	289.51	355.75
Net profit per quintal	30.04	24.33	16.50

Source, Survey result, 2008

4.4. Analysis of Econometric Results

The econometric analysis was planned to investigate factors affecting, volume of supply to market. The analysis was undertaken for onion, tomato and papaya independently.

4.4.1. Determinants of market supply volume

Sampled respondents indicated that 98.99 % of onion, 99.16 % of tomato and 84.87% of papaya produced were marketed. Respondents also pointed out that the remaining percentage of total production was accounted for by spoilage and home consumption.

The probable variables expected to influence volume of marketed supply and which were included in the estimate of the market supply equation were age of the respondent, sex of the respondent, active labor force male and female, distance from production to main road, extension contact, total land holding, quantity of produced of each crop, access to market information, number of oxen owned, family size and education level. Cobb Douglass (logarithmic function) model was employed to estimate marketable supply factors. For the parameter estimates to be efficient, assumptions of Classical Linear Regression (CLR) model should hold true. Hence, multicolliniarity detection test was performed using appropriate test statistics for each as follows.

Test for Multicollinearity: the variance inflation factor (VIF) was employed to test the existence of multicollinearity problem among explanatory variables. VIF shows how the variance of an estimator is inflated by the presence of multi-collinarity (Gujarati, 2003). All values are less than 10. This indicates absence of serious multicollinearity problem among independent continuous variables (Appendix Table 5). Contingency coefficient results indicated absence of multicolliniarity problem among the independent dummy variables (Appendix Table 6).

As can be observed from the econometric result in Table 10, out of 10 hypothesized explanatory variables for onion, only two variables were found to determine marketable supply of onion at farm level. These are age of household head (lnagehh) and number of oxen owned (lnNoxen). Although aged household heads are believed to be wise in resource use, and expected to have a positive effect on market participation and marketable supply, on the other hand, older households may also be tradition bound and reluctant to take up new

technologies, as a result the negative and significance at 10% probability level indicated on Table 10 is that as age of the household head increased by one percent elasticity of marketable supply of onion decreased by 0.42 percent. On the other hand number of oxen owned as it was expected, has positive relationship with household marketable supply of onion and was statistically significant at 1% probability level. The positive and significant relation between the variables indicates that a one percent increase in number of ox increases the elasticity of marketable supply by 0.987 percent (Table 10). Kindie (2007) also found that number of oxen owned by household significantly and positively affected farm level marketable supply of sesame in Metema District. A similar study made by Bosena (2008) in Metema also found that number of oxen owned by household significantly and positively affected marketable supply of cotton. Quaintly produce was dropped from the analysis for the reason that it takes the power of all the explanatory variables. On top of this, vegetable crops like onion is produced in the district mainly for market, about 99% sold from the produced. This could be the probable reason for taking the power of the other explanatory variables during inclusion in the econometric model. Furthermore, the less number of significance in the econometric model may be due to lack of disparity among independent explanatory variables of the sampled households and marketable supply of vegetables particularly onion may not be a problem. On top of this lagged price was dropped from the model for the reason that it had no significant impact on the econometric model result this might be probably there might not exist price difference among sampled households. The R^2 value of the model is 0.51 and adjusted R^2 value is 0.46 (Table 10). It was observed that the adjusted coefficient of determination was more than 45 percent in the marketable supply function, implying that more than 45 percent of the variations in marketable supply were explained by the explanatory variables.

Table 10. Logarithmic estimation of factors affecting farm level marketable supply of onion

logonion sold	Coef.	Std. Err.	t	p>/t/
logAghh	-.42008	.2372038	-1.77*	0.080
logFshh	.0641425	.170274	0.38	0.707
Sexhh	-.0540619	.3482013	-0.16	0.877
logAlforce	.0478615	.1728364	0.28	0.782
Edlhh	.0070445	.1139999	0.06	0.951
Exct	-.2582765	.1700856	-1.52	0.132
Actminform	.1796118	.121531	1.48	0.143
logDfptmr	-.0700667	.0838966	-0.84	0.406
logNoxown	.9872845	.1203112	8.21***	0.000
logTlanown	-.1395385	.0893702	-1.56	0.122
Constant	4.213054	.8919356	4.72***	0.000
R^2				0.5078
$\overline{R}^2$				0.4581
N				110

Source, Survey result, 2008

***, * Significant at 1% and 10% probability level, respectively

Similar to onion 9 explanatory variables were hypothesized that were expected to affect marketable supply of tomato. However, only one variable was significant that is number of oxen owned. As it was explained above and expected, number of oxen has significant and positive influence on marketable supply of tomato and it was statistically significant at 5%probabelty level. The positive and significant relation between the variables indicates that an increase in one percent of ox increases the elasticity of marketable supply of tomato by 0.478 percent (Table 11) or as number of ox increases by one unit elasticity of marketable supply of tomato changes by 0.478 factors. Although Sex of household head was an important variable for the study crop, it was dropped from the analysis for the reason that all tomato sampled respondent were male.

Table 11. Logarithmic estimation of factors affecting farm level marketable supply of tomato

logtomato sold	Coef.	Std. Err.	t	p>/t/
logAghh	.3340151	.413654	0.81	0.425
logFshh	-.1889235	.3385683	-0.56	0.580
logAlforce	-.2215437	.2765666	-0.80	0.429
Edlhh	.0785927	.1931508	0.41	0.687
Exct	-.2764517	.3183008	-0.87	0.391
Actminform	.0598461	.2005771	0.30	0.767
logDfptmr	-.0837571	.1207195	-0.69	0.492
logNoxown	.4787495	.2358549	2.03**	0.050
logTlanown	.2085068	.1553981	1.34	0.188
Constant	2.295358	1.672197	1.37	0.179
R^2				0.227
$\overline{R}^2$				0.029
n				45

Source, Survey result, 2008

** Significant at 5% probability level

As can be observed from the econometric result, table-12, among the eleven hypothesized determinants of market supply of papaya, one variable (logQtypro) was found significant for papaya. The sign was positive confirming the justification put at the hypothesized and significant at 1% probability level. The positive and significant relationship indicates that as papaya production increased by one percent the elasticity of marketable supply of papaya increased by 1.0479 percent (Table 12). R^2 Value of the model is 0.95 and adjusted R^2 value is 0.92 (Table 12). This result indicates that about 92 percent of the variation in farm level marketable supply of papaya was attributed to the hypothesized variables.

Table 12 Logarithmic estimation of factors affecting farm level marketable supply of papaya

logpapaya sold	Coef.	Std. Err.	t	p>/t/
logAghh	-.137916	.2837674	-0.49	0.633
logFshh	.21497	.2583958	0.83	0.417
Sexhh	-.0238357	.3432504	-0.07	0.945
logAlforce	-.0233572	.2827753	-0.08	0.935
Edlhh	.0027825	.0202336	0.14	0.892
Exct	.0275298	.2081267	0.13	0.896
Actminform	-.0456125	.1258396	-0.36	0.721
logDfptmr	-.0693344	.0846103	-0.82	0.424
logNoxown	-.0352564	.1267165	-0.28	0.784
LogQtypro	1.047989	.0792657	13.22***	0.000
logTlanown	-.1997609	.1320207	-1.51	0.149
Constant	.1391705	1.150618	0.12	0.905
R^2				0.9511
$\overline{R}^2$				0.9194
n				29

Source, Survey result, 2008

*** Significant at 1 % probability level

4.5. Analysis of structure-conduct and performance

The study employed structure-conduct and performance to evaluate degree of competition, behavior of the marketing actors and their achievement in onion, tomato and papaya marketing in Alamata Woreda.

4.5.1. Analysis of market structure of onion, tomato and papaya

4.5.1.1. Measure of market concentration ratio

District level analysis was undertaken to calculate concentration ratio as the number of traders was few at the local market level as indicated in Table-13, Calculation of the concentration ratio by considering an average load a wholesaler took per day in peak production season basing the four firm criteria indicated no oligopsony. Kohls and Uhl (1985) suggested, as a rule of thumb, a four largest enterprises concentration ratio of 50 percent or more as an indication of a strongly oligopolistic industry. The result of the District level concentration ratio for onion was found to be 24.56 percent Table-13. This indicates that the top four traders handled less than 50 percent of the onion market. According to Kohls and Uhl (1985) the onion market at the district level has no oligopsonistic market structure. The survey result indicated that seventy percent of the onion product were supplied and sold to Shere and Adigrat due to the existence of military crew and the remaining supplied to Mekelle, Adiwa, Axum, Humera and to different government and non-government institutions within the region. Concentration ratio was not calculated for papaya and tomato due to low number of the sampled wholesalers.

Table 13. Onion wholesale Traders' Concentration ratio

list of wholesalers (W_i)	Average quantity load in Isuzu per week	Average quantity load in Isuzu per day	% share of purchase	% cumulative purchase $C = \sum_{i=1}^{r} Si$)	Main destination
W_1	9.00	1.29	4.02	4.02	Mekelle
W_2	6.00	.86	2.68	6.70	Mekelle
W_3	15.00	2.14	6.70 *	13.40	Mekelle
W_4	7.00	1.00	3.13	16.53	Mekelle
W_5	7.00	1.00	3.13	19.66	Mekelle
W_6	14.00	2.00	6.25 *	25.91	Mekelle
W_7	4.00	.57	1.79	27.70	Mekelle
W_8	4.00	.57	1.79	29.49	Mekelle
W_9	12.00	1.71	5.36	34.85	Mekelle
W_{10}	4.00	.57	1.79	36.64	Mekelle
W_{11}	14.00	2.00	6.25 *	42.89	Mekelle
W_{12}	6.00	.86	2.68	45.57	Mekelle
W_{13}	9.00	1.29	4.02	49.59	Mekelle
W_{14}	5.00	.71	2.23	51.82	Mekelle
W_{15}	10.00	1.43	4.46	56.28	Mekelle
W_{16}	6.00	.86	2.68	58.96	Mekelle
W_{17}	6.00	.86	2.68	61.64	Mekelle
W_{18}	7.00	1.00	3.13	64.77	Mekelle
W_{19}	5.00	.71	2.23	67.00	Mekelle
W_{20}	5.00	.71	2.23	69.23	Mekelle
W_{21}	7.00	1.00	3.13	72.36	Mekelle
W_{22}	11.00	1.57	4.91	77.27	Mekelle
W_{23}	9.00	1.29	4.02	81.29	Mekelle
W_{24}	6.00	.86	2.68	83.97	Mekelle
W_{25}	12.00	1.71	5.36 *	89.33	Mekelle
W_{26}	5.00	.71	2.23	91.56	Mekelle
W_{27}	4.00	.57	1.79	93.35	Mekelle
W_{28}	8.00	1.14	3.57	96.92	Mekelle
W_{29}	7.00	1.00	3.13	100.00	Mekelle
$(\sum V_i)$	224	31.99	$\sum_{i=1}^{4} S_i$ =24.56		

Source; Owen survey, 2008

- W_i = indicates number of wholesalers coming to Alamata at peak production period

4.5.1.2. Marketing actors

The major market players include producers, rural assemblers, wholesalers, retailers, transporters, brokers and consumers. 50%, 78.9% and 65.2% of onion, tomato and papaya producing farmers, respectively sold their produce at the farm level. Based on the informal group discussion with some of wholesaler, rural assembler and *Woreda* cooperative promotion employee, the number of wholesale buyers who come to Alamata during peak production period were estimated to be twenty nine, almost all of them handled equivalent amount of the product Table -13 . On top of this, the numbers of rural assemblers working on onion and to a very rare case on tomato and papaya were estimated to be fifteen. Each of them had equivalent capacity in product volume handling. The number of retailers in the study area estimated up to 200 on the market day of the district.

The large number of retailers was found during the market day of the Woreda, Saturday (200 in number). Almost all the retailers had equivalent amount of volume of product handling.

Producers-These are the primary or first link actors of the market channel who cultivate and supply surplus onion, tomato and/or papaya to the market. The land for the aforementioned commodities was either its own plot, share crop and/or rented to produce the already mentioned crops. Since the products are very perishable in nature right after harvest they are sold either at PA and/or *Woreda* market. The study revealed that, 78.9 percent, 61.7 percent and 50 percent of onion, tomato and papaya producers sold at PA market (farm field) in that order. The remaining, 21.1 percent of onion, 34 percent of tomato and 40.6 percent of papaya producer sold at *Woreda* market. The process of onion, tomato and papaya selling had its own selling procedures. Onion is sold through cooperatives, local assemblers, farmer brokers, direct to wholesalers and friends and by farmers themselves at PA level. Local assembler as well as wholesalers makes an agreement on the type, amount, quality and selling price with the farmers or brokers. After they agree wholesalers and/or locale assemblers select best quality onion only and weigh traditionally by measurement called *Keshkesh* (sisal sack type) for weight advantage to the buyers, the estimated weight of one *Keshkesh* would be 60 to 65 kilo grams but farmers received the price of 50 kilogram and hence respondents reported that apart from low price farmers are cheated 20 to 30 kilo grams per quintal, according to the respondent, this was the usual phenomena producers encountered. Although the District cooperative office and union have tried many times to convince the farmers not to sale

through traditional measurement like the above mentioned, they still persist to use it. Sometimes farmers' water onion field prior to uprooting for weight advantage.

On the other hand, collection and selling process of papaya and tomato went as follows. Papaya producers collect the matured pieces once every two weeks or more interval for almost more than a year. Right after collection, the products are taken either to road side, Alamata or Mekelle and handed over to the local processor, retailer and a limited amount sold directly to consumer at retail price. Similarly tomato farmers used to collect in small amount within two to three days interval almost for a month and took to road side and/or Alamata. The most common roadsides where farmers used to sell are *Timuga-Waja, Limaot* (multi-purpose cooperative), *Kulu-Gezelemlem* (local administrative compound) and *Gerjelle*. The perishable nature of tomato obliged producers to sell the product right after collection at the prevailing prices.

During the survey period respondents were asked when they sell and decision taken at time of low market price of tomato. The survey revealed that 26.6 percent sell immediately after harvest and 55.5 percent sell at low price as tomato cannot be stored for long time due to its perishable nature. For collection and product delivery of tomato farmers used wooden box and *Kirchat* (basket) delivered by buyers and/or own. The estimated average weight of wooden box was 50 Kg. According to the survey result, 71.9 percent of the respondents sell to any buyer and 28.1 percent sell to regular customers.

Survey data indicated that the average number of days a farmer can store after harvest for onion and tomato when price was low, 7 days for onion and 3 days for tomato. But under modern storage facilities and best pre-harvest and post harvest practices onion can stay for more than five months without spoilage. Due to this fact and lack of adequate, reliable and timely market information, farmers are forced to dispose their produce within very limited period at low selling price. On the other hand due to the limited production and supply of papaya at the moment storage was not a problem, precisely because what is produced is marketed immediately right after harvest. But it would be a critical problem in the near future when production and productivity of papaya is intensified and supplied to market within the District.

Rural assemblers (local collectors)-These are one of the actors in the market link. Though rural assembler found in Alamata were limited in number, they played a very crucial role in the market chain since they had close link with wholesalers who come from large market size centers, product owners and brokers.

They live either in rural *Tabiyas* or Alamata town. Most of them reside on farming in the rest months of the year and a few of them might engage on other none-farm activities. Majority of them collect and sell onion than tomato and papaya. On the average they handled 155quintal of onion per week when product of the afro mentioned crops appear to market and they send these collected products to Mekelle wholesaler, retailer or Alamata *Woreda* market actors. There is no need for the assembler to go to Mekelle in person for product delivery. Product delivery and money exchange were through contract vehicle owners and Commercial Bank in that order due to long term created clientele relationship among them.

Brokers –These agents work for a commission on behalf of other participants. They operate at all level of the marketing chain. They enhance the selling and buying process between producer and wholesalers with out handling any product for sale. The market challenges due to high perishable nature of the product, seasonal fluctuations of supply and distant trade with unknown partners in a market with limited information make it difficult for the parties to transact independently of other market intermediary. The estimated number of brokers reported working in Alamata was not more than 20. Brokers found in the *Woreda* were both urban and rural brokers. The urban ones brokered mainly on vehicle on top of that, some times brokered on onion to get 300 to 350ETB per ISUZ load. Most of the urban brokers live with their family. Their age ranges from 18 to 32 years. All were male and except two, all were literate, their education level ranges from 5 to 10 grades. On the other hand the rural brokers except two who were fully engaged brokering as their main stay all the others had practiced farming, during the farming season. Among these, one had mobile telephone and he was the one among the model farmers in producing vegetables especially that of onion and he influenced much to the farmers in the selling and buying process.

The brokering process was as follow. At the first place, sample of the product in question is taken by farmer broker for display to buyers. After display, the farmer broker lobbies buyers on behalf of the producer. Right after they had agreed on quality and first price, wholesalers return to the farm to check the quality and start purchasing. Wholesalers had better

communication network with traders of the potential horticultural producer of the nation, as compared to the producer and hence did not get difficulty in setting prevailing prices. On top of that, wholesalers knew how to take price and weight advantage over the producer.

The brokerage cost ranges from 300 to 350 ETB per an Isuzu load. Brokering in the case of tomato and papaya were very rare due to the limited volume produced within the *Woreda* especially papaya has better chance to sell by producers direct to processors.

Wholesalers- These are known for purchase of bulky products with better financial and information capacity. They buy onion; tomato and/or papaya at the farm gate, from assemblers and/or road side with a larger volume than any other marketing actors does. They relatively spend their full time in wholesale buying throughout the year in and out of the district. The informal group discussion made revealed that about 29 wholesalers visited Alamata during peak production period of onion. Almost all come from Mekelle (Table -13). Each wholesaler used to load onion, tomato and/or papaya with an Isuzu and bus for papaya as the amount of papaya supplied to market is small. On the basis of amount handled by wholesalers of onion, tomato and papaya respectively are indicated on (table13, appendix 3 and 4).They came in October, December for onion produced on spate irrigation and April mid May every year for regular irrigation. In these months, they buy and send to receiving partner at (Mekelle, Shire, Adigrat, Adwa, Axum and Humera). Some wholesalers supply constantly to institutions (Mekelle University and Military Crew in Adigrat and Shere) through a bid. The working capital of wholesalers ranged from 35,000 up to 400,000 ETB.

Retailers- These are known for their limited capacity of purchasing and handling products and low financial and information capacity. Beside this, these are the ultimate actors in the market chain that purchase and delivered onion, tomato and/or papaya to consumers.

A total of 30 retailers were interviewed out of which 6 were males and 24 were females. The majority (74.1 percent) were able to read and write. The survey result revealed that the average years of experience was about 5.63 with minimum and maximum of 2 and 10 years working experience, respectively. All the respondents in the study area were not licensed to sell/handle onion, tomato and/or papaya.

Table 14. Onion, tomato and papaya retailers demographic characteristic at Alamata (2007)

Character	Number of respondent	Percentage (%)
Sex		
Male	6	20
Female	24	80
Religion		
Orthodox	23	76.7
Muslim	7	23.3
Languages spoken		
Tigrigna and Amharic	30	100
Education level		
Illiterate	5	16.7
Able to red and write	22	73.3
Formal education	3	10
Marital status		
Single	8	26.7
married	15	50
Divorced	6	20
widowed	1	3.7

Source, Survey result, 2008

Out of the 30 local retailers only 4 were papaya retailers and the remaining 26 respondents were either onion (16) and/or tomato (23) retailers. Table 14 shows that all retailers were able to speak both Tigrigna and Amharic.

Respondents were asked to tell about their family background. Accordingly, only five percent reported that their parents are/were engaged in trading business that might have an impact on the respondents' intention to engage in. The rest twenty four (83.3 percent) parents were farmers. The particular season where Alamata tomato appear to market was between April and mid May and that of onion was between March and early of May for all the five *Tabias* that have regular irrigation scheme and between September and end of December for those *Tabias* that have spate irrigation like *Kulu-Gezeleml*, *Gerjele* and *Laelay-Dayu*.

The average holding of a retailer in a year was 51 quintal or 102 cases (wooden box) for tomato, 81.9 quintal for onion and 58.5 quintal or 117 cases (wooden box) of papaya (Table 15).

Table 15. Yearly average volumes of onion, tomato and papaya handled by retailers (per quintal) **Alamata, 2007.**

List of crop type	Statistical measures		
	N	Mean	Std Deviation
Onion	16	81.90	15.19
Tomato	23	51.00	12.40
Papaya	4	58.50	13.00

Source, Survey result, 2008

The survey result indicates, the working capital of retailers rang from 200 to 7000 with an average of 1244.01ETB. Retailers and wholesalers mostly exchange the marketable horticultural crops on credit basis. This alleviates working capital shortage of retailers. Retailers have the chance to take the amount they demand and were expected to pay back at the end of one or two market days depending up on the speed of the market and the volume handled. The common types they handled were onion, tomato, potato, leafy vegetables and rarely papaya.

From the survey, it was observed that the retail area was poorly marked out to retailers that creates problem in the course of buying and selling due to the existence of narrow gap between different retail stalls.

On top of these, stalls were either in open air, or poorly made of plastic and wood constructed for sun and rain protection. Products were exposed to different contamination agents. There was strong lack of consideration in improving the market place by concerned body. On top of this they did not get any training that can capacitate their barging power and business thinking. The major buyers from retailers were clearly final consumers (households), hotels and restaurants.

4.5.1.3. Factors for entry and exit on horticultural marketing

Licensing: Based on the informal survey, almost all rural assemblers and retailers undertake horticultural trading without having license. About 78% of the wholesalers did not have license except those that supplied to different institutions on bidding basis.

As indicated by the Alamata Trade and Industry and Finance and Economic Development Offices retailers with less than 5000 ETB capital are not expected to have business license. These small retailers with less than 5000 working capital were only obliged to be registered commercially and pay about 3 to 10ETB per month, depending on the turnover.

According to this study, though stalls are limiting factor for retailers, there is no strong restriction to enter horticultural marketing with respect to license. Wholesale markets were relatively free to enter the market as far as they had the desired amount of capital and access and availability to different infrastructure that could facilitate their bargaining power.

Capital: Capital is substantially important to undertake any business activity; though Capital is important to all market players, the degree of importance varies among actors. Wholesalers have better access and availability of capital as compared to the other market chain players and critically important for these as they were bulk buyers of products. The system of kind credit from wholesalers alleviates retailers' cash credit demand. Rural assemblers also have the access to get credit from farmers on kind basis due to long cliental relation.

4.5.1.4. Standard and grades

From the agronomic point of view, quality and long shelf life start with production. There are no clearly set standards in Alamata.

Almost all of the traders measure quality onion based primarily on compact dryness followed by size and color. Tomato was also same. Buyers mostly need mature green tomato of large size with good flesh content. Tomato selling was usually by sorting size and level of maturity a buyer demands and papaya buyers preferred matured followed by firm and big size. Due to lack of standard and grades buyers decided price of commodities through eye ball pricing.

4.5.1.5. Packaging

Packaging material for the three crops were different as their properties differed. Onion is collected and packed with sack, and freely arrange on car. In case of papaya and tomato, commonly the wooden boxes and some times' different sizes of baskets (*kirchat*) were used.

4.5.1.6. Transportation

Except for two *Tabias*, about 75 percent of the *Woreda* is plain and easily accessible for animal cart and car transport. Most of the farmers sold their produce at farm level due to the suitable geographical landscape. This helps farmers to sell their produce at farm level and those who did not sell their produce at farm level because of different factors use head load, pack animal and animal cart to transport their product easily either to home or nearest market center.

Onion, tomato and papaya were transported from field to market places with head load, pack animal, animal cart, and Isuzu trucks. The common transportation means of papaya from Alamata to Mekelle was through buses than Isuzu due to its limited production.

4.5.1.7. Storage

Perishable crops like horticultural crops demand efficient and well ventilated storage facilities which could not be affordable to have at household farmer level. Though it is not enough in relation to production capacities of the *Woreda*, three standard storage were constructed by the local administration in the study area to store the vegetable products of farmers. According to the survey, only 9 of the 114 onion producers exercised storage from a week up to two weeks. Of the 47 tomato producers only 5 store for three days. None of the papaya producers practiced storage. This could be probably due to the limited production. Reason for storage was expecting better price and lack of market demand of the produce. The common storage practices made by respondents were to leave on farm field with out pulling, store on the already constructed store by the local administration and primary cooperatives and hipping on the field.

Market information

Access to timely market information on prices and quantities plays a crucial role in reducing the risk of losing money on a market transaction. TAMPA and regional cooperative promotion office collect and distribute price information and amount of supply on selected horticultural and grain commodities to farmers. However, the information was not analyzed, interpreted and designed for future development planning. Market information specifically included information on price, product demand, product supply, market place and buyers and

sellers. According to the survey result, out of the 140 interviewees 81.1 percent had accesses to market information on price and buyers. The sources of information were personal observation, friends, traders and cooperatives. About 95% of the onion, 93% of the tomato and 65% of the papaya suppliers reported that prices have increased over the last five years continually. The most probable reason for increased price was increased demand of crop.

4.5.2. Analysis of market conduct

According to the survey result out of the 114 onion producers only 21 and 5 respondents reported that they produced and supplied to market twice and three times per year, respectively. The rest 78.1percent produced and supply their product to market once per year. Similarly, 89.4 percent of the tomato respondents produced and sold once in a year. In addition to this all papaya respondents (32) produce and supply to market within two or more week intervals throughout the year. With regard to time of getting money from sales of the product 90.4 percent, 93.6 percent and 100 percent of the onion, tomato and papaya producers in that order indicated that, they sell their product for cash. The survey indicated that although, most of these onion and tomato farmers' sell their produce to regular customers come it was not at formal contractual agreement.

The horticultural producers in Alamata *Woreda* have weak or no organizations that could strengthen their bargaining power from input supply up to output marketing. Due to this, weak linkage among themselves they lack the power to negotiate with different actors to obtain normal profit. As a result they are price takers from input purchase to selling their produce and defaulted in weight almost in all the market chain.

4.5.2.1. Information and Price setting

The survey results indicate that respondents obtained information from cooperatives, traders, local friends and brokers. Market information supply was not transparent between levels that created price discrepancy and differences among selling farmers especially in onion. Wholesalers have got better price information access from their ultimate friends far in Addis Ababa, fogera and/or Mekelle while the other actors like producers did not have the access. This created the information irregularity expressed by low prices at times when it was not. Product selling price, input price and potential buyers coming to the area were the main

market information producers used. As described above wholesalers have better information access and availability either with the help of their partners (ultimate friends) and others. Brokers and local elite producers provided untruth market information to producers and forced to sell at prevailing price telling to the producers as if ample products were being supplied from other region.

Brokers facilitate the market process with out handling any product. The role of brokers in facilitating price information was bounded due to predetermined brokerage charge per ISUZU. Regardless of farmers selling price, brokers obtained 300-350ETB per Isuzu truck load.

According to the survey result 75 percent of the tomato and 85% of the papaya producers believe price was decided through negotiation while 65% of the onion producers' believed that price setting was made by buyers. However, wholesalers were the dominant source of information that could decide the current price and hence 'negotiation' is not real.

4.5.2.2. Trader Behavior on buying

Respondents were requested to comment on buyers' behavior based on some selected characters like better price offering, payment of cash at hand and amount purchase. Accordingly 75% of respondents preferred wholesalers as relatively better buyers though they have their own classic problems and 25% chose consumers as good buyers.

4.5.2.3. Ethics

The lack of modern post harvest handling practice and short shelf life of onion, tomato and papaya crops forced producers to sell at prevailing prices. Knowing this, wholesalers put pressure on producers to sell at low price. Weight defaulting by wholesalers and brokers to producers and watering onion on farm prior up rooting by producers are some of the unethical manner exercised by the different marketing actors.

4.5.2.4. Selling strategy

About 64 percent of the onion and 62 percent of the tomato producers reported that they sold their produce to their regular customers. The selling strategy of the remaining respondent

farmers was open to any buyer. On the other hand, 65.6 percent of papaya producers sell their produce to anybody as far as they offer better price.

4.5.3. Analysis of market performance

The methods employed for analysis of performance were channel comparison and marketing margin. The analysis of marketing channels was intended to provide a systematic knowledge of the flow of goods and services from its origin production to final destination (ultimate consumers). The estimated volume of production of onion was about 3,552.50 quintals, tomato was 1,377 quintals and papaya was 255.33 quintals from which about 3,516, 1,365, and 216 quintals of onion, tomato and papaya, respectively were sold.

Tomato market channels – Eight marketing channel were identified for tomato. None of the channels went out of the region. As can be understood from Figure 2 the main receivers from producers were wholesalers, retailers and rural assemblers and with an estimated percentage share of 44.7, 40.4 and 8.5 percent, respectively.

On top of this, channel comparison was made based on volume that passed through each channel. Accordingly, the channel of producer –retailer –consumer carry on the largest followed by producer-wholesaler-retailer-consumer carry on a volume of 552Qt and 382Qt in that order.

According to Ramakumar (2001) to measure efficiency of channel four parameters required that is volume handled, producers share, total marketing margin, and rate of return,

out of which volume handle, producers share and marketing margin were considered for all the crops under study. Rate of return was left out due to lack of some data.

Channel-1 Producer--Consumer = 87 Qt

Channel-2 Producer– Retailer –Consumers= 552 Qt

Channel-3 Producer – Wholesaler – Retailer – Consumer= 382 Qt

Channel-4 Producer– Wholesaler – Consumers= 229 Qt

Channel-5 Producer – Rural assembler-Wholesaler – Consumers=8 Qt

Channel-6 Producer – Rural assembler – Wholesaler—Retailer – Consumers=14Qt

Channel-7 Producer – Rural assembler – Retailer—Consumer= 70 Qt

Channel-8 Producer– Rural assemble—Consumer= 23 Qt

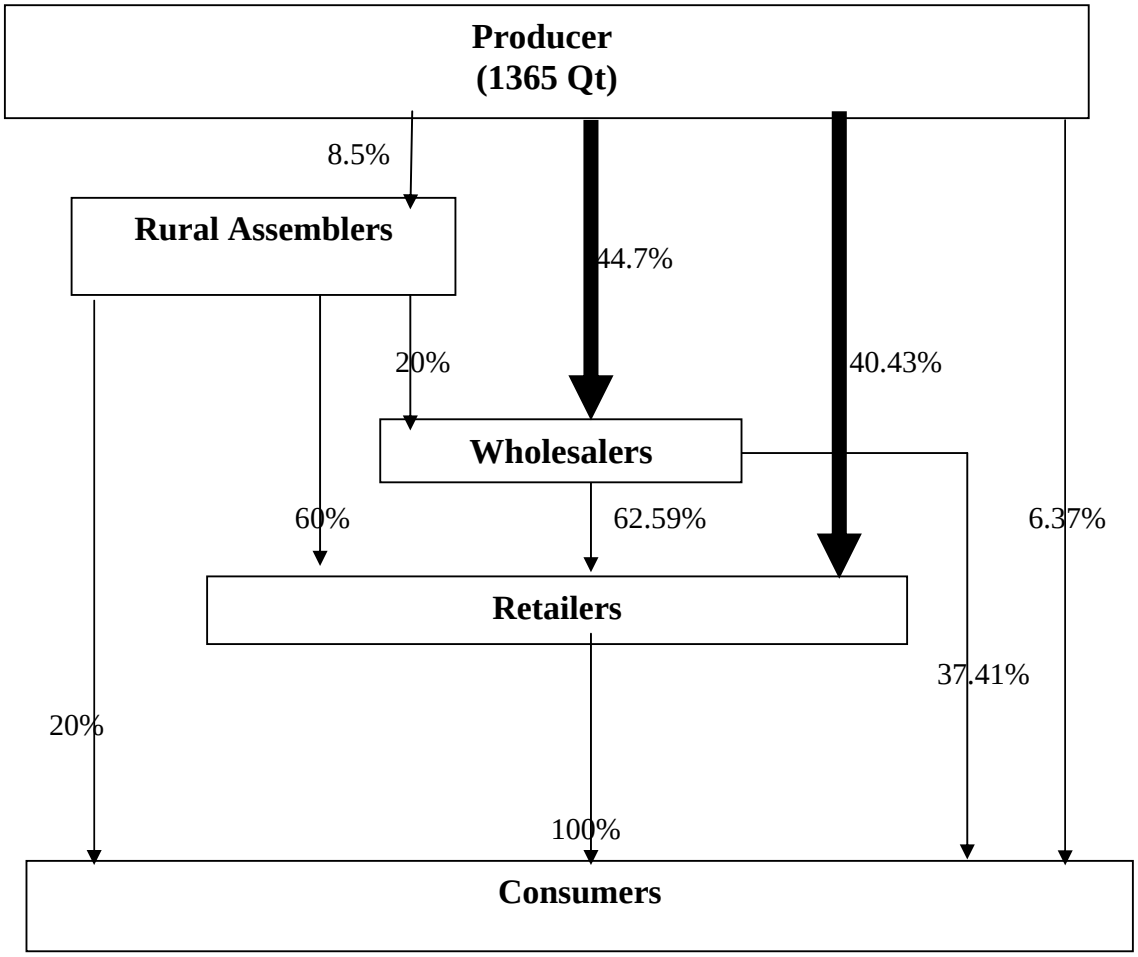

Figure 2. Marketing channel of tomato

- The bold lines indicate strong relation with producers in terms of volume purchase.

Table 16. Average price of tomato at different market levels, % share from consumer price, and gross profit in 2007/08 (Alamata)

Marketing channel participants	Selling price (Birr/Qt)	% (Gross marketing margin)	Profit in Birr/Qt
Producers'	98.99	39.68	60.99
Assembler'	170.50	28.66	24.24
Wholesalers'	249.50	31.66	34.30

Source, Survey result, 2008

TGMM (complete distribution channel) =60.32%

GMM (Assemblers) = 28.66%

GMM (Wholesale) =31.66%

GMM_P (Producers participation) = 39.68%

Table 16 indicates that 60.32 % total gross marketing margin was added to tomato price when it reached the final consumers (wholesaler) at domestic markets. This break down, 28.66% for assemblers (received by assembler) and 31.66% for wholesalers. The profit of farmers per quintal suggests that there is a profit of 60.99ETB per quintal which seems greater than the profit obtained by wholesalers and assemblers which was about 34.30ETB and 24.24 ETB, respectively. Although it is very difficult to camper the profit of farmer with the trader for the reason that farmers obtain this profit for all their efforts on agronomic and marketing practices while wholesalers and assemblers would obtain this much profit even with one to two days. However the result indicated that the tomato market chain performed well.

Table 17 also indicates that 46.93 % total gross marketing margin was added to onion price when it reached the final consumers (wholesaler) at domestic markets. From the total gross marketing margin, 21.07 % was gross marketing margin of assemblers (received by assembler) while 25.86% was that of wholesalers. The profit of farmers per quintal suggests that there is a profit of 117.34ETB per quintal which seems greater than the profit obtained by wholesalers and assemblers which was about 47.80ETB and 35.04ETB, respectively. Similar to tomato, this situation implies that there is good performance of the onion market chain. In this market chain, it indicates, if the market chain further improved in terms of efficiency producers can harvest more than what they had obtained.

Table 17. Average price of onion at different market levels, % share from consumer price, and gross profit in 2007/08 of Alamata.

Marketing channel participants	Selling price (Birr/Qt	% (Gross marketing margin)	Profit in Birr/Qt
Producers'	179.05	53.07	117.34
Assembler'	250.16	21.07	35.04
Wholesalers'	337.40	25.86	47.80

Source, Survey result, 2008

TGMM (complete distribution channel) =46.93%

GMM (Assemblers) = 21.07%

GMM (Wholesale) =25.86%

GMM_P (Producers participation) = 53.07%

Table 18.Average price of papaya at different market levels, % share from consumer price, and gross profit in 2007/08

Marketing channel participants	Selling price (Birr/Qt	% (Gross marketing margin**)**	Profit in Birr/Qt
Producers'	219.35	64.99	108.68
Assembler'	262.00	12.64	16.8
Wholesalers'	337.50	22.37	41.60

Source, Survey result, 2008

TGMM (complete distribution channel) =35.01%

GMM (Assemblers) = 12.64%

GMM (Wholesale) =22.37%

GMM_P (Producers participation) = 64.99%

Table 18 indicates that 35.01% total gross marketing margin was added to papaya price when it reached the final consumers (wholesaler) at domestic markets. From the total gross marketing margin, 12.64% was gross marketing margin of assemblers (received by assembler) while 22.37% was that of wholesalers scrutinize the gross profit of farmers per quintal suggests that there is a profit of 108.68ETB per quintal which is greater than the profit obtained by wholesalers and assemblers which was about 41.60ETB and 16.80ETB respectively. This situation implies that there is good performance of the papaya market chain similar to that of onion and tomato market chain.

Onion market channels- Similar to tomato, about 8 market channels existed. The entire channel ran within the region. Accordingly, wholesalers purchase 75.5 percent of the total onion marketed. Volume passed through was taken as channel efficiency measurement. Based on this, the volume that passed through, producer-wholesaler-retailer-consumer was better that accounts for about 60.4 percent of the total marketed.

Channel 1 Produce---- Consumer= 31Qt

Channel 2 Producer-----Retailer = 401 Qt

Channel 3 Producer----- Wholesaler ------Retailer------- Consumer = 2124 Qt

Channel 4 Producer---Rural assembler---Wholesaler--Retailer--Consumer=228Qt

Channel 5 Producer----Rural assembler----Retailer----Consumer = 72 Qt

Channel 6 Producer-----Wholesaler-------Consumer =531Qt

Channel 7 Producer-----Rural Assembler-----Wholesaler---- Consumer =57 Qt

Channel 8 Producer-----Rural assembler------Consumer=72 Qt

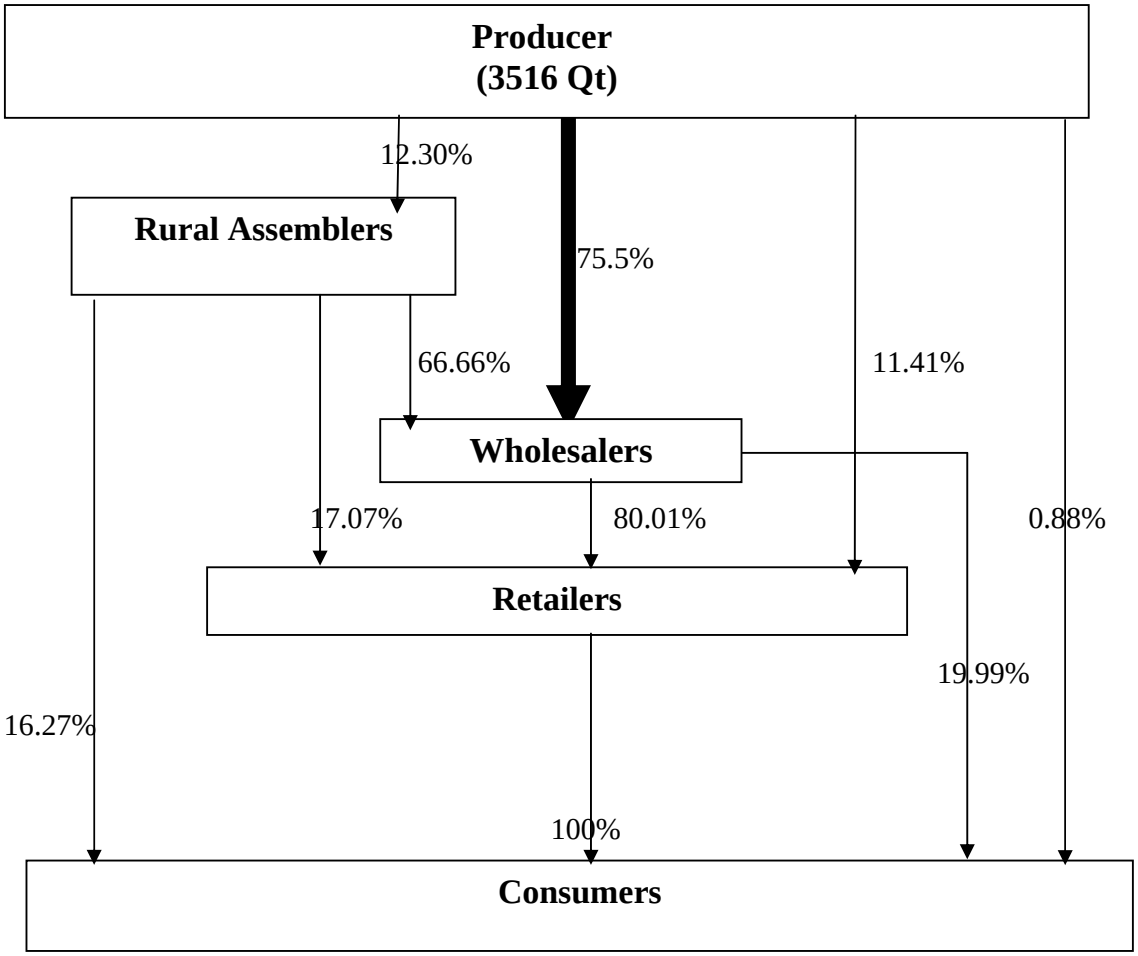

Figure 3. Marketing channel of onion

Papaya market channels- Similar to tomato and onion about 6 market channels existed. The entire channel ran within the region. According to the report, processor purchase 50 percent of the total papaya marketed. Volume passed through and producers share were taken as channel efficiency measurement. Based on this, the volume that passed through, producer-processor-consumer was better in that accounts about 50 percent of the total marketed.

Channel 1 Producer – Consumer=22 Qt

Channel 2 Producer- Retailer--consumer = 33Qt

Channel 3 Producer –Rural Assembler-Wholesaler – Retailer – Consumer = 10Qt

Channel 4 Producer– processor---Consumer = 108 Qt

Channel 5 Producer –processor---- Retailer--Consumer = 15 Qt

Channel 6 Producer – Wholesaler –processor--- Consumer =28Qt

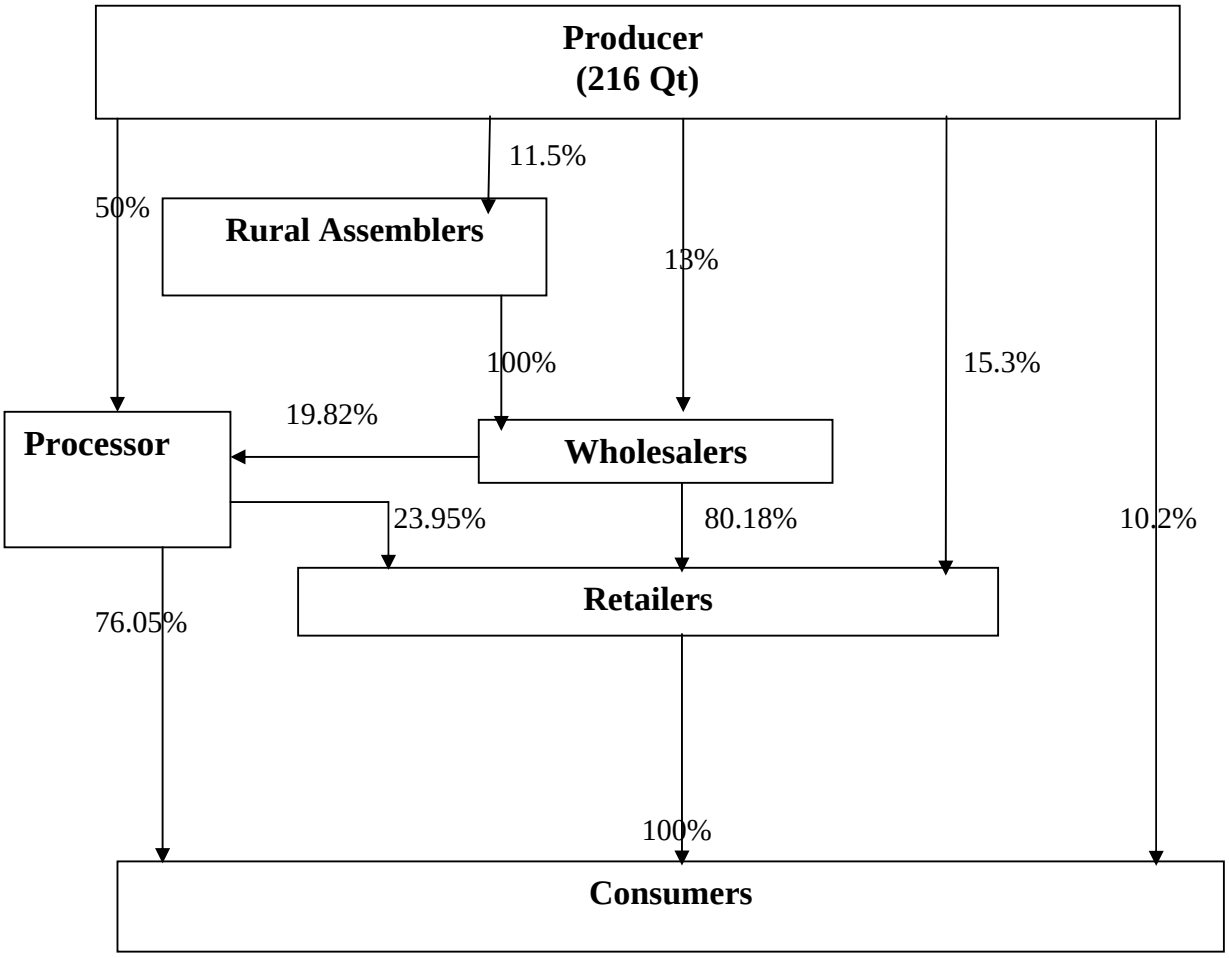

Figure 4. Marketing channel of papaya

4.6. Major Production and marketing constraints

There are factors that hamper the production and marketing of horticultural crops in Alamata. According to the sample respondents, weak extension support service, limited land holding, lack of water, lack of access to credit, insufficient product handling, outbreak of disease and pest, limited supply of improved seed and shortage of human labor from the production side and unfair price quotation, lack of standards and lack of strong cooperative from the marketing side are some of the most important problems reported by sample respondents of onion, tomato and papaya producers. Based on this, the production and marketing problems have been discussed below.

Production problems

Land- Survey result indicated that lack of land as a problem was mentioned by 54.4%, 41.3% and 38.7% of onion, tomato and papaya producers in that order.

Labor- Horticultural production is one of the labor-intensive activities. It demands labor right from land preparation up to packaging. About 80%, 84% and 18% of onion, tomato and papaya producers, respectively reported labor shortage as a major constraint. Hiring labor is a common practice in the district.

Credit- Lack of horticultural production credit provider and unavailability of credit on demand was indicated as constraints by 64.8%, 18.2% and 18.2% onion, tomato and papaya respondents, respectively.

Insufficient product handling - Lack of proper pre and post harvest handling practice. Absence of well ventilated storage, watering prior uprooting onion farm field were also constraints that result in poor quality onion and ultimately low price.

Pest and disease- Prevalence of pest and disease like powdery mildew on papaya, onion tripe, and root rot in the case of onion and problem of African ball worm and cutworm in the case of tomato are the most important pests and diseases reported.

Prevalence of frost- production of tomato from October up to January is difficult due to occurrence of heavy frost in the study area.

Weak extension support service; - Although the number of development agents assigned to work in each *Tabias* looks adequate to support farmers right from land preparation up to post harvest handling but they lack technical capability to support the farmers of their interest. As a result, most of the farmers producing without the use of fertilizers and are forced to sell their produce right after harvest at prevailing price and watering prior uprooting on field ultimately results in low quality onion.

Limited input supply- seed are supplied from Addis Ababa, Fogera and other part of the country by private dealers that lacks on time delivery, certification and desired Varity. As a result low production and viability were common phenomenon.

Marketing problem

Unfair price quotation- in the study area repeated low pricing was reported at peak supply periods that were not based on the actual supply and demand interaction but information collusion created by buying actors. The intermediaries used to decide on the price of products particularly onion products. The benefit of Wholesalers overweighs than others and they control the market chain.

Lack of standards- Repeated weight cheating and lack of price discrimination were common problem practiced by wholesaler and brokers' .Due to this problem there were no clear and well known quality and grade in the District.

Lack of strong cooperatives- Although there are many multipurpose, irrigation and one union cooperatives in the study area which were established to safeguard farmers' and rights over their marketable produces, farmers were exposed to baseless traders, ultimately sell their produce at low price. On top of this, local traders and elite farmers went to weaken the limited activities under taken by cooperatives. To cite an example in 2005, union of the *Woreda* took a contract agreement on behalf of the farmers' to supply about 500quintal of onion in one round to the Mekelle wholesalers who were suppliers of Mekelle University and military crew at a price of 125ETB per quintal. Volumes of supply and price agreement were to be renewed after 500quintals were supplied. Knowing this, the local traders and elite farmers rose the price of onion per quintal to 135ETB and diffused untruth information to the

producers as if union and *Woreda* office of agriculture took the difference in agreement with wholesalers, due to this price collusion, the producers stop providing to the union, eventually the agreement terminated. Right after termination of the contract price decline down to 80ETB per quintal knowing that the contract could not be functional again. Beside this, the existing cooperatives lacked skill and capacity on how to go about on horticultural marketing.

Opportunities of the *Woreda*

Alamata is one of the naturally endowed *Woredas* though it has some production and marketing constraints. Some of the potentials to mention are the following. The *Woreda* is very suitable to produce not only horticultural products but also other market oriented commodities of cereal, pulses and/or animal production. Of the potential crops tropical fruits like papaya, guava, mango, banana, orange, avocado and grape vine. There is also good potential for vegetable production including onion, tomato and green pepper. Sesame, cotton, vernonia, paprika, safflower, Teff, sorghum, Maize and improved local animals for milk and meat production are some of the potential. On top of this, relatively fertile arable land and abundant under ground water potential are some to mention.

The natural proximity to Mekelle and being found on the main road to Addis Ababa and bordering to Amhara national regional state are the opportunities that enhance level of commercialization.

The conducive government policy in general and special attention to the district in particular as one of the development corridor, explained by expansion of deep wall irrigation, deployment of extension workers in each *Tabias* based on their potential and an increased infrastructure facilities like mobile and wire less telephone, electric power and all weather roads could facilitate fruit and vegetable production and marketing.

The other opportunity is the existence of none governmental organizations like IPMS Ethiopia that creates market linkage with different market actors. On top of this it facilitates experience and knowledge sharing within and outside the district and the existence of world vision Ethiopia that supply improved seed on farmers demand, experience and knowledge sharing outside the district. Moreover, the marketing researches undertaken by TARI graduate and under graduate students are worth to mention here. Tigray Agricultural marketing Promotion Agency that gives price information on selected commodities of the major market places on weekly basis is another opportunity to the district.

5. Conclusion and Recommendation

5.1. Summary and Conclusion

Productivity and productions of horticultural crops like tomato, onion and papaya had been increased over the last five years due to the increase attention of the government to irrigation facility. As a result production and market related problems are becoming complex over space and time in Tigray in general and the study area in particular.

Horticultural production and marketing of the study area have mainly constrained by lack of stable seed supply system, weak extension support, lack of appropriate pre and post harvest handling, and limited landholding at farmer level followed by weak market linkage and knowledge by the different marketing actors.

The focal point of this thesis was to analyze the market chain of fruit and vegetables in Southern zone of Tigray Alamata *Woreda* with a specific crop focus on onion, tomato and papaya. The selection of the crops is mainly based on their relative importance and marketability. The specific objectives included assessing the production and marketing support services of extension, input supply, credit and marketing, analyzing the structure of production costs and determining profitability of production, the structure-conduct and performance of the market; analyzing the determinants of supply and lastly identifying major constraints, opportunities of production and supply. A number of respondents at all stages of the marketing channel were interviewed. The analysis was made with the help of descriptive and econometric tools both SPSS version 12 and stata9 software were employed.

A total of 140 producer respondents' (135 males and 5 females) drawn from five *Tabias* in Alamata, 30 retailers from Alamata towns and 5 brokers, 6 rural assembler and 9 Wholesalers were interviewed using structured questionnaires. Rapid market appraisal with the help of focus group discussion and key informant discussion were the other primary data collection techniques employed. Secondary data collection was also the other means in the process.

The major crops grown in Alamata District are teff, Sorghum and Maize. The largest land allocated was to teff for about 0.96 ha, sorghum 0.80ha, and 0.49ha for maize. Papaya from fruit, onion and tomato from vegetables are the major ones. In the area, onion, tomato and papaya are produced mainly for market. Average size of land allocated for onion, tomato and papaya per household in 2007/08 was 0.38, 0.19h and 0.06 hectares with standard deviation of 0.37, 0.12 and 0.06 respectively. This was on the average 21.11percent for onion and 10.56 percent for tomato and 3.33percent for papaya of the total land.

The average family size was about 6.02 of which the active labor force was 3.33 per household. The Alamata office of Agriculture and Rural Development is the main extension support giving institution. On average three development agents are deployed in each *Tabias* with the help of whom 1.42 percent of respondents got weekly extension service, 0.71 percent have got extension service in two weeks, 0.71 percent have got extension service any time required, 8.57 percent have got extension service with no regular program and the remaining 88.57 percent of respondents reported no extension contact at all. The common inputs used were seed and to a very limited extent pesticides. The application of fertilizer was almost none, for alluvial soil deposits because of flooding from the upper water shed and lack of experience applying on irrigated areas. The widespread types of onion varieties being grown were Bombay Red and Adama Red. Roma VF was wide growing tomato variety and the common seed for papaya was improved dwarf variety and local once. The average seed rate applied was about 1.56 kg per hectare in the case of tomato, 3.46 kg per hectare in onion and about 2147 in number per hectare for papaya. Except 8 onion and 5 tomato producers credit was not common for horticultural production in the district.

The estimated production cost per hectare was 5,445.76ETB for onion, 5,196.52ETB for tomato and 2,909.82 ETB for papaya. The largest share in the case of onion, tomato and papaya was labor that accounts for about 40%, 33% and 61% percent from the total cost of production in that order.

The average profitability obtained per hectare was 11,293.09 ETB for onion, 8,823.02ETB for tomato and 11,432.93 ETB for papaya for farmers (producer) and 47.7ETB from onion 34.3 ETB from tomato and 41.6 ETB from papaya for wholesalers per quintal in that order.

Survey result indicated that an estimated volume of 3,552.5Qt of onion, 1,377 Qt of tomato and 255.33Qt of papaya were produced in the 2007/08 from which about 3,516Qt of onion, 1,365Qt of tomato and 216Qt of papaya were marketed. Farmers' average selling price for a kilogram of tomato was 0.99 ETB, 1.79ETB for onion, and 2.19 ETB for papaya. The average yield per hectare according to the sampled farmers was 145.22 Qt for tomato, 97.22 Qt for onion and 123.98 Qt for papaya. The main market places were PA level and near roadside. The largest receivers in the case of onion were wholesalers, in tomato rural Assemblers and retailers and for papaya processors and wholesalers.

Better access, to roads, telephone and other improved infrastructural situation characterized the *Woreda.* The marketing channel of the three crops was through the interconnection of different performer specifically producers, wholesalers, rural assemblers, retailers, transporters, brokers and consumers. Among the different market players, brokers and wholesalers were the main actors in the system. Wholesalers looked to have power over the whole channel due to easy access to up to date information resulted in an unfair market behavior especially in onion marketing during peak production period.

Onion, tomato and papaya produced in Alamata are consumed almost all within the region. Of the estimated marketed onion about 20 percent went to Mekelle, 70 percent to Adigrat and Shere, 10 percent to Axium Adiwa and Humera. Similarly, of the total marketed output almost all tomato and papaya were consumed in Mekelle and Alamta.

Average profit received by producers for each crop per quintal was 117.23ETB, 60.99ETB and 108.68 ETB from onion, tomato and papaya per quintal, respectively. On the other hand average profit assemblers' received was 35.49ETB, 24.24 ETB and 16.8ETB from onion, tomato and papaya per quintal in that order. Similarly wholesalers acquired a profit of 47.8ETB, 34.30ETB and 41.6ETB from onion, tomato and papaya per quintal in that order. Retailers also obtained a profit of 30.04ETB, 24.3ETB and 16.5ETB from onion, tomato and papaya per quintal, respectively.

Survey result indicated that, retailers of Alamata average product handled per individual per year were 81.9 Qt onions, 51 Qt tomatoes and 58.5 Qt papayas. Retailers did not get any support in terms of capacity development from local government as well as from different NGOs in product handling, management and business making. On top of this retail stalls were poor and exposed to strong sunshine and heavy rain. There were no strong supports made by government to improve the market centers for instance in improving facilities like sound constructed stalls, sewerage and sanitation. Had it been a due attention was paid to retailers and strengthen their competence; it would have been easy to manage the overall market by retailers. As a result, product loss would have been put aside and fair price for consumers with better quality of produce might have been supplied and eventually valuable to producers.

The marketing system for onion, tomato and papaya was predominantly constrained by a number of troubles like shortage of irrigated land, weight cheating, un fair pricing of products by wholesaler, brokers and watering farm field prior up rooting by farmers and weakened cooperative agreement with strong wholesaler by local traders to producers were some of the major once. Though there was some attempt to alleviate the problems it was not sufficient, as a result farmers were suffering a lot.

The drawbacks in the quality of extension service was among the strong problems mentioned apart from pest and disease challenges, price instability and lack of reliable, adequacy, and timelines market information.

Concentration ratios manipulation from 29 onion wholesalers based on their daily load indicated no oligopsonistic market behavior. The four firm concentration ratios were lower than the standard, 33 percent. The concentration ratios manipulation basing the four firm criteria indicated only 24.56 percent concentration guarantee the absence.

Estimation of determinants of marketable supply with the help of logarithmic production function model revealed that number of oxen own, age of household head for onion producer, number of oxen own for tomato and quantity produce for papaya in 1999 E.C was found significant. All were with expected signs as prior hypothesized.

In general analysis of the study can be concluded as a corner stone to understand the onion, tomato and papaya market chain system. The increasing of farmers in production and

marketing of fruits and vegetables apparent by increasing land allocation and increasing number of participating market actors were indicators for commercialization.

Fruit and vegetable marketing is a means of income providing business opportunities for all actors in the market chain including the producers, brokers, transporters, traders, and processors. The role of brokers in horticulture marketing is significant. They isolate the producers from the traders and make price margins often to the disadvantage of the producers. Therefore government attention is needed in improving the inefficient market chain through strengthening institutions like cooperatives.

The mode of production of horticulture particularly vegetables is almost year round. This means producing these crops create wider employment and income opportunity to producer households. As a result the abundant cheap labor force existing in the rural area is being utilized for production. However, the extension support service given for the crops under study is insignificant. Therefore government should give due attention in improving the quality.

The Seed supply of the study crops are fare from other areas, this exposes for higher cost and use of low quality seeds. Therefore government attention is required to start seed production within the *Woreda* particularly for onion.

5.2. Recommendations

Based on the results of this study, the following recommendations are given so as to be considered in the future intervention strategies which are aimed at the promotion of horticulture production and marketing in the study area Alamata *Woreda.*

Fruit and vegetable production should be intensified and diversified to satisfy the wider regional market demand and to gain normal profit for all market actors. Diversification is one way of improving bargaining power of producers. On top of this cropping calendar between June and September should be shifted to other periods of the year that relives producer from unexpected rain and existence of frost for onion and tomato particularly. Moreover, the existing weak extension support services should be improved.

To tempt intervention to increase quantity produced of papaya per unit area of land through proper utilization of land resource in the district**,** the quantity produce for papaya at the farm level affected marketable supply of papaya positively and significantly. Nevertheless, increasing landholding size cannot be a choice to raise fruit and vegetable marketable supply since supply of land is limited by nature. Hence, boosting productivity per unit area of land is better alternative to increase quantity produced in turn increase marketable supply of papaya. This is relying on intensive farming rather than on extensive one. On top of this, the production side of onion and tomato should be studied that may constrain marketable supply of the two crops under study than its supply side.

Oxen are one of the inputs in vegetable production and the number of oxen owned by household was found to be a significant factor that affected farm level onion and tomato marketable supply in the district. Hence, conditions should be facilitated for farmers to own oxen or other mechanism that can substitute oxen like tractor.

Cultivation and marketable supply of horticultural crops demands massive working labor force as a result this study indicated that age of household headed was significant and negatively related for onion and hence to fully participate older age households on cultivation of horticultural crops there is a need to introduce simple technology that can minimize higher demand of labor force.

The seed supply system of onion is from Addis Ababa, Fogera, Melkasa and other parts of the country, this exposes the producer to different problems. Like, lack of on time planting, to purchase low quality seeds, unfair price quotation, therefore there is a need to start with the production of onion seeds in Alamata Woreda either at private or cooperative level and/or create strong and institutional linkage with those that can produce best quality seeds and can provide on time with fair price. On top of this pest and disease occurrences should be managed, before they cause a destructive impact on production.

Training on pre and post harvest handling has to be given to producers and development agents so as to cease field watering prior onion harvest and failure to store to few weeks and hence improve the shelf life of the study crops that can generate a better income to producers and relatively even supply for consumers. Further more, the already started construction of relevant standard stores has to be strengthened.

Group organizations like irrigation cooperatives, water user association and union are assumed to play significant role in improving the bargaining power of the horticulture producers and creating employment opportunities. However, the informal survey shows up that the cooperative societies in the study areas had weak organizational structure, low capital and lack of member's sense of ownership and lack of infrastructure and hence this leads to poor contribution in market stabilizing of the producers output. Therefore corrective measure should be taken by government and non- government bodies in general and by members of the cooperative in particularly in alleviating the infrastructural, capital and knowledge gap of the cooperative to strengthen their role in input and out put marketing of horticultural crops.

The survey result indicated that the overall horticulture (onion, tomato and papaya) marketing system was found to be traditional and underdeveloped, fragmented and inefficient. Thus, government actions are required to certify and scrutinize competing horticulture product traders to ensure achievement of minimum standard weighing units and quality standards in order to facilitate the horticulture production and marketing process. On top of this, Cooperatives and traders should work together to increase the efficiency of the market and to gain normal profit in the market chain.

Production of horticultural crops particularly onion, tomato and papaya seems profitable as indicated from the survey result and hence great attention should be given to the mode of production and marketing side to seek stable income from it for all market players.

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7. Appendix

Appendix table 1- Farmers' sampling distribution

Name of the Tabias	Farming system	Onion, Tomato and/or papaya Growers			Sample Selected		
		Male	Female	Total	Male	Female	Total
Tumuga	Cereal/livestock	160	7	167	40	1	41
Limaot	Cereal/livestock	95	2	97	24	0	24
Laelay-Dayu	Cereal/livestock	127	9	136	32	2	34
Kulu-Gezelemlem	Cereal/livestock	37	0	37	9	0	9
Gerjelle	Cereal/livestock	119	8	127	30	2	32
Total		538	26	564	135	5	140

Appendix table 2. Land allocation pattern for vegetable production and out put level in Alamata District in irrigated area from 2004 to 2008

number$	Crop type	unit	2004			2005			2006			2007 1$^{s\ round}$			2008 1st round only	
		ha	ha	Qt	ETB	ha	Qt	ETB	ha	Qt	ETB	ha	Qt	ETB	ha	
1	Vegetables	ha	104	4880.87	778353	447.4	24824	4252909.5	484.8	35083	5088131	1048	91317	13037718	619.6	57497.45
•	Onion	ha	16.5	1721.77	172177	122.4	14446.98	1805872	182.2	10458	3610716	739.2	70780	8664860	576	55296
•	Pepper	ha	79.2	643094	643094	271.1	1084.32	1084320	219.7	1529.2	1034150	241.9	1073.6	1636038	31.26	250.08
•	Tomato	ha	6.62	105856	105856	39.19	6466.76	646676	75.44	12070	958660	93.83	13304	2322045	10.3	1699.5
•	Others	ha	2.03	12186	12186	14.64	2825.91	716041.22	7.697	2056.4	565105.4	21.68	6161.5	415175.4	2.07	251.875
2	Spice	ha				6.5	67.5	53250				0.29	1.78	1340		
3	Cereals + pulses	ha	50.5	1008.96	151344	61.25	699.43	317835	695.5	15860	2406500	837.1	13388	2602160	393.7	5932.64
•	Cotton	ha				18.33	366.5	183250	44	792	25000					
•	Maize	ha		1008.96	151344	3.25	58.5	9360	530.5	11278	1691700	721.9	12273	2209167	262.6	4728.24
•	Sesame	ha				14.85	163.295	114306.5	14	70	35000		310		5.5	38.5
•	Chick pea	ha										38.8	340.15	139500	10	80
.	Teff	ha										33.35	464.73	135067.5	95.2	952
.	Others	ha				24.83	110.87	10918.5	98	3558	654800	42.8		118425	19.6	133.9
	Total	ha	155	5889.83	929697	515	25390.4	4623994.5	1180	50942	7494631	1935	104705	15641218	1013.3	63430.1
	Number of beneficiary	number				1205			4912			3892			3343	

Appendix table 3. List of wholesaler of tomato and average product handled

List of firms(F)	Average load in Isuzu	Destination
F1	1/week	Mekelle
F2	2/week	
F3	1/week	
F4	1/day	
F5	2/week	
F6	0.5/week	

Appendix table 4. list of papaya wholesalers and average product handled

List of firms (F)	Average load in Isuzu	Destination
F1	2/week	Mekelle
F2	1/week	
F3	.5/week	
F4	.5/week	

Appendix table 5. Multi-collinearity test with VIF

variable	Tolerance	VIF
Age	0.819	1.240
Total land owned	0.685	1.460
Quantity produce	0.893	1.120
Distance from production to main road	0.939	1.065
Oxen	0.834	1.198
Family labor	0.575	1.7328
Family size	0.387	2.581

Appendix table 6. Contingency Coefficient

	education level	sex	Ext cont	MIF
Education level	1			
sex	0.058	1		
Ext cont	0.094	0.071	1	
MIF	0.161	0.033	0.216	1