ESTABLISHING THE POTENTIAL OF MANGO VALUE CHAIN AS A SOURCE OF INCOME IN URAMBO DISTRICT, TANZANIA.

BY

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN AGRICULTURAL ECONOMICS OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

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ABSTRACT

A study was conducted in Urambo District from mid 2009 to mid 2010 to identify challenges to production of mango; assess the contribution of mango to the HH income and to compare the net income between the producers and traders. Secondary data were collected from District Council Offices, SNAL and internet. Purposive sampling was used to select 10 villages based on potential for mango production. A random sample of 260 mango producers and 40 traders who sell mangoes at the markets of Urambo, Tabora and Dodoma were selected for interview. The cross sectional data were collected analysed descriptively and hypotheses tested. Results show that challenges facing mango industry include poor unreliable markets, lack of fruit processing, poor credit, absence of commercial varieties, pests and diseases and poor transportation. Regression of socio-economic variables on mango income showed that mango production experience, mango trees owned and land size significantly add to mango income ($P<0.01$) whereas labour size and education level reduce the income ($P<0.1$) and the proxy for post harvest loss significantly reduce mango income ($P<0.01$). While currently tobacco adds 47% to total HH income, mango contributes 7 %, but if mango market clears its contribution triples to 21%. Furthermore access to more urban markets such as Dodoma triples the income from mango again to 60% and overtakes tobacco. The hypotheses tested showed significant difference in net gain per sack between traders and producers ($P<0.05$). The study concluded that mango is a potential source of income if efficiently exploited. So the government and NGOs should improve advisory on the crop husbandry, transportation and sensitize fruit processing to make products such as dried mangoes, pickles, juice and jam

in order to improve farmers access to expanding market.

DECLARATION

I Florentine Msafiri Mkenda do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work and that it has neither been submitted nor concurrently being submitted to any other institutions.

_____ _____

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(Msc. Candidate)

The above declaration is confirmed

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(Supervisor)

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DEDICATION

To My Father, Msafiri F. Mkenda though he has passed away, for laying the foundation of my education. May Almighty God rest his soul in peace. My Mother Protasia M. Kimaryo for her love and encouragement during my studies.

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LIST OF ACRONYMS

AEZ	Agro Ecological Zone
DADPs	District Agricultural Development Plans
DALDO	District Agriculture and Livestock Development Officer
Euro GAP	European standards for Good Agricultural Practices
FAO	Food and Agriculture Organization (Of the United Nations)
FU	Functional Unit
GAP	Good Agricultural Practices
GM	Gross Margin
GMP	Good Manufacturing Practices
HACCP	Hazardous Critical Control Point
HH	Household
MRLs	Maximum Residue Limits
MT	Metric tones
NGO(s)	Non Governmental Organization(s).
N-P-K	Fertilizer blended with Nitrogen, Phosphorus and Potassium
pH	Hydrogen ions concentration as a measure of acidity or alkalinity
SACCOS	Saving and Credit Cooperative Societies
TR	Total Revenue
TVC	Total Variable Costs
USA	United States of America
WAEOs	Ward Agricultural Extension Officers.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Global production of mangoes (*Mangifera indica L.*) is concentrated mainly in the tropics particularly Asia and more precisely in India that produces about 12 million metric tonnes a year. Mangoes are produced in over 90 countries worldwide whereby Asia accounts for approximately 77% of global production, and the America and Africa account for approximately 13% and 9%, respectively (FAOSTAT, 2007). In 1999 total world production was 24 420 116 metric tonnes (FAOSTAT, 2000). By the year 1960 mangoes were not commonly known among the consumers outside the tropics and there was virtually no international trade for fresh fruit. In recent years, mangoes have become well established as fresh fruit and processed products in the global markets. International trade of mangoes is dominated by varieties like "Kent", “Alfonso” and "Tommy Atkins".

Mango can be processed to products like mango pulp, juice, squash, jam, pickles, and other several products that have been well introduced and accepted in different market segments in the world (Nanyundaswamy, 1997). According to Chia, (1988) raw mango contains about 81.7% water, 17% carbohydrate, 0.5% protein, 0.3% fat, and 0.5% ash. Also mangoes contain about half the vitamin C found in oranges and more vitamin A than most fruits.

Mango industry in developing countries is not well performing, for instance a case of Kenya mango supply chain faced a number of structural problems in terms of foregone potential income, employment opportunities and absence of locally produced quality fruits

(FAO, 2003b). Tanzania mango is on the list of five top most fruit basket among bananas, oranges, pineapples, and pea. In Tanzania and Africa, processing of mango is less developed and varieties grown are most suitable for local markets (MMA, 2008). According to Niyibigira; *et al.* (2006), Tanzania mango industry particularly in Zanzibar was facing several constraints but the main ones being presence of only few varieties suitable for export, seasonal variability in output; pests and disease problems particularly the Mango fruitfly spp. the *Ceratitis cosyra* and *Bactrocera invadens*, high freight charges, limited cargo space and lack of technical know-how on scientific management practices.

However after the Government and private sector interventions such as expanding nurseries, pricing, extension, training and research eventually increased the Zanzibar's mango export to the Gulf States. The mango export to Gulf States increased from 36 tons in 1992 to 100 tons in 1995 that was worth $ 60 000 and was expected to reach 2 000 tons worth $1 million by the year 2007 of which 30% was to be earned by the farmers. The demand for mango in Gulf States is higher during October to March, which is the off-season for the major suppliers from India and Pakistan.

Jedele *et al.* (2003) reported that mango is an important agricultural product for the economy of the developing countries in the tropics, both for domestic trade and for export. A stronger focus on varieties that are demanded by foreign consumers could improve the countries' fresh mango export situation. It is important for these countries to concentrate on products that offer them comparative advantages – in most cases labor-intensive products. This study concentrates on current gains in the mango value chain and the potential for expanding the gains and welfare through improved production and marketing in the study area.

1.2 Problem Statement and Rationale for the Study

Urambo District main economic activity and source of livelihood for households largely depends on agriculture, particularly the production of flue- cured tobacco with about 45 000 tobacco-farming households (Geist, 2009). The main food crops cultivated are maize, paddy, cassava, sweet potatoes, beans, bambaranuts and sorghum whereas tobacco, cotton, groundnuts and sunflower are cash crops (URT, 2008). Perennial tree crops that grow in the area are coconuts, oil palm, oranges, pawpaws and mangoes.

There is appreciable production of mangoes of different varieties. The main varieties of mango grown in the District are locally named as *embe dodo, bolibo, embe kamba* and *embe sindano.* Mango trees are highly distributed throughout the District in the homesteads of the households, farming plots and in bushes. Substantial quantities of mango fruits are produced annually but little is marketed while the majorities perish on the ground.

Little or no study has been done on whether mango which grows well in the District can be promoted through improved production, processing and marketing to significantly contribute to income of the smallholder farmer. Since making uninformed decision to the community can be socially, economically and politically detrimental, the information generated from this study is expected to fill the gap by searching information that will be the basis for providing advice on necessary interventions required for development of mango sub-sector. Assessment of the social and economic benefits of mango production will give a clear picture on how profitable it is to allocate resources in promotion of mangoes. Government policy makers and other development stakeholders can use the

findings to strategize on supporting the developing of mango production, processing and expanding the domestic and export markets for raw mango and processed mango products.

1.2 Objectives of the Study

1.2.1 Overall objective

To establish the potential of mango production and marketing in improving small holders income.

1.2.2 Specific objectives

(i) To identify challenges towards commercial production of mangoes in the study area.

(ii) To assess the effects of socio-economic variable on income accrued from mangoes.

(iii) To assess the potential of mango contribution to the total income of the household in the study area.

(iv) To compare the net income gained by the producer and traders in the mango value chain.

1.2.3 Hypotheses

There has been hearsay that socio-economic variables of respondents such as mango production experience, age, education level, household labour size, total land size, total cultivated area and number of mango trees owned has effect on income accrued from mangoes in the study area. Also there has been a claim that traders gains very high profit margins compared to the producers. The statements have to be validated by testing the following hypotheses;

i) Total income accrued from mangoes is significantly influenced by socio-economic characteristics of the respondents such as mango production experience, age, education level, household labour size, total land size, total cultivated area and number of mango trees owned and post harvest loses.

ii) There is no significant difference on net gains between producers and traders in the mango value chain.

1.3 The Conceptual Framework

Conceptual framework prevents fragmentation of knowledge statements, bind facts and provide guidance towards collection of realistic data and information (Msangi, 2007). The concept behind the study is that among other sources, mango can be the potential sources of income and livelihood to smallholder mango producer and traders in Urambo if some interventions are done on the marketing functions as well as the factors that influence production of quality mangoes.

The quantity and quality of mangoes produced is important in improving household income if marketing functions are well performed. In addition mango production facilitates environment through afforestation, supply firewood and secure land ownership. Efficient performance of marketing functions for mangoes increases job opportunities, improves human nutrition and more important is increasing of household income. The improvement of household income leads to social welfare such as improved standards of life, such as acquisition of assets, education, healthy services and recreation. The study concentrates on the contribution of mango to the total household income, challenges for production and marketing and distribution of gains by producers and traders (Fig. 1).

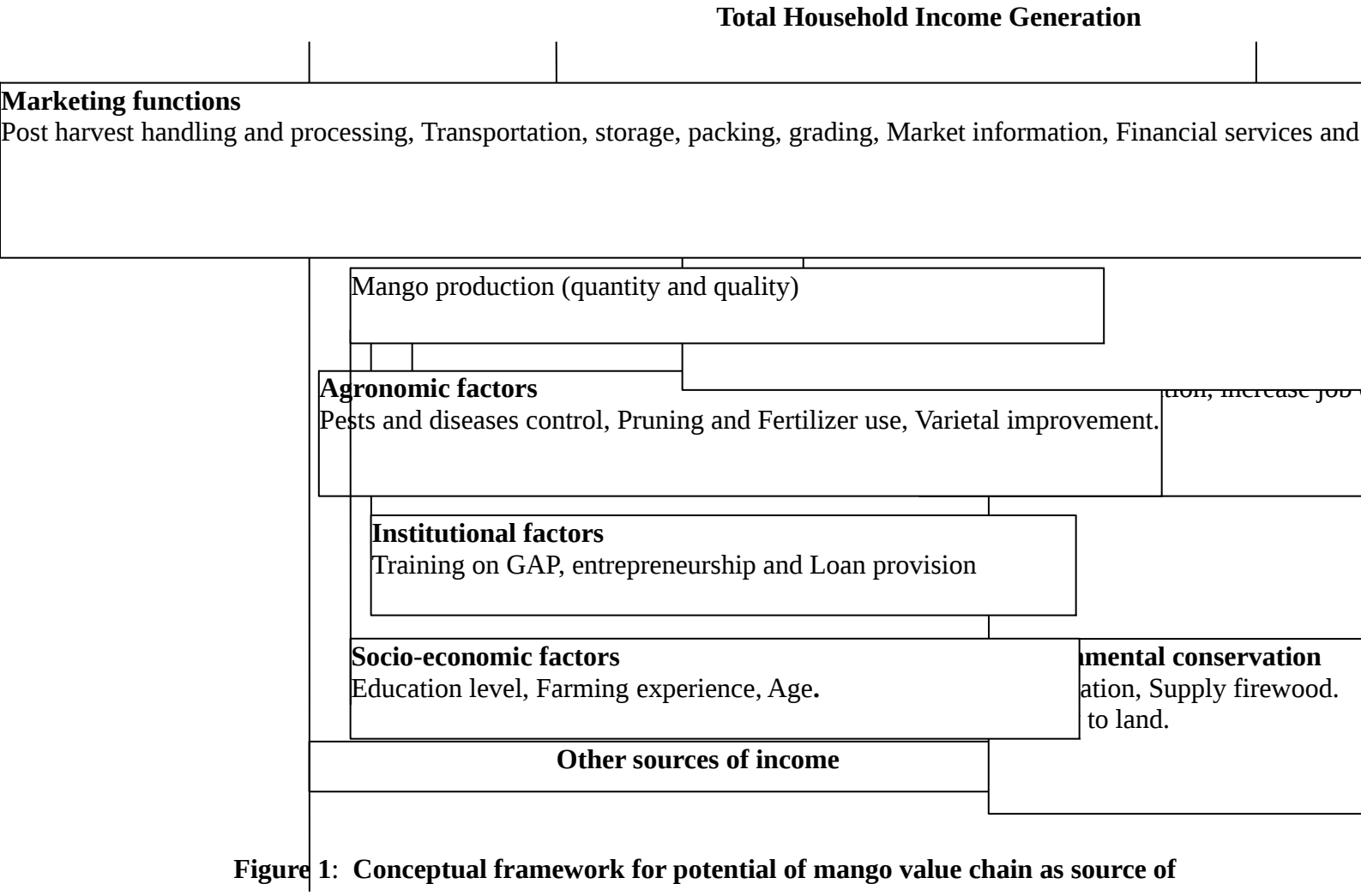

Figure 1: **Conceptual framework for potential of mango value chain as source of income**

1.4 Organization of the Dissertation

Apart from Chapter one, the remaining part of the dissertation is organized into four main chapters. Chapter two presents a literature review describing the mango ecology and husbandry, marketing of fruits, on farm production loses, review of past studies and methodology. Chapter 3 presents the methodology used in this study, followed by results of the analysis and discussion in Chapter 4 and finally winding up with concluding remarks and recommendations in Chapter 5.

1.5 Limitations of the Study

The study was designed to collect cross sectional data due to time and financial constraints and therefore to a great extent the responses given by the respondent, depended on their memory recall whereas if time there was enough the time, series data of three or more years could best describe the situation. To cater for the problems some of the agricultural and marketing records found in villages and in the district were used to validate the responses. Trafficability of roads particularly during rain season is the major problem and the study villages were selected on that basis.

Generally the respondents showed a good cooperation and responsibility only some few obstacles occurred such as absence of some respondents in their places during interview but the situation was rectified by revisiting the places or select another mango producer with similar social economic characteristics.

Gross margin is not a profit figure because fixed costs have to be covered by gross margin before arriving at profit and gross margin can vary from one year to another (Ferris *et al*.,2000). The annual variations in gross margins are due to differences in market prices and efficiency therefore its analysis is just a starting point in the assessment of enterprise. Due to lack of markets, farmers do not bother to incur costs in managing mango production. So the element of cost in production was negligible. Since farmers used to sell mango at farm gate whereby harvesting costs were covered by buyers, then what farmer gain from selling mangoes was treated merely as net gain or profit.

Quantification of volume of mango produced, volume damaged and consumed at home

was difficult since some farmers tend to ignore mangoes and do not bother about knowing either the quantity produced or the quantity taken for home consumption. Also sometimes producers and traders use the locally made non- standardized units called “Tenga” and sometimes mix the units. However the researcher had to do calibrations on the units and adopted only the sacks as units and also in-depth interview was done to enable producer estimate the volume damaged and consumed at home.

The price of labour employed by wholesalers and retailer in different markets for the sake of selling mangoes became difficuilt to estimate since the some business owners or household members involve themselves in selling activities. Therefore to cater for the problem the retailer/wholesaler was asked to state the (time) number of days he/she take in selling a sack of mango the mean pay for a man day in the respective localities was used.

Some difficulties also raised in aggregation of total household income some food crops are produced for home consumption so the market price was used to estimate the income from the food crops. Therefore every crop which was produced by the respondent farmer was given value interms of money and assumed every product consumed at home could be purchased.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Mango Ecology and Husbandry Practices

According to Chia *et al*. (1988) mango grows on a wide range of soil types, from light sandy loams to red clay soil, moderately sloping sites and soil pH ranging from 5.5 to 7.5 and it is best adapted to hot, dry leeward areas that receive less than 1500 mm of rainfall annually. Mangos are large trees and should be planted 10–12 meters apart. Pruning is preferably done in order to remove dead and unproductive branches. Fertilizer may be a 1:1:1 or 1:2:2 ratio formulations, such as 16-16-16 or 10-20-20 N-P-K. During tree establishment, phosphorus (P) is important for root development and for good yields. Grafted trees often become smaller and usually produce fruits in 3 to 5 years in dry areas and seedling trees at least 5 years to come into bearing and trees can remain in production for 40 years or more.

In humid high-rainfall areas mango suffers diseases such as anthracnose that often destroys both flowers and developing fruits, stem-end rot and sooty mold affecting leaves and fruits, powdery mildew affect flowers, leaves and young fruits whereas tip burn is associated with potassium deficiency. Common insect pests that attack leaves, stem and fruits hence affect production both in quality and quantity include mango fruit flies (*Bactocera spp.)*, weevils, scales, thrips, green stink bugs *(Nezara viridula*), mango shoot caterpillar and black twig borer (Chia *et al.*, 1988).

David, (2009) reported that *Bactrocera invadens* attacks mangoes and spread diseases to mangoes. Two thirds of Tanzanian mango producers have been affected by the flies. The fly lays an egg that penetrates and lodges in the fruit, where it hatches a poisonous larva

that causes the mango to rot, form fungus and consequently produce maggots. The problem is increasing and it is becoming one of the major constraints to the development and improvement of mango production.

2.2 Importance of Mango

Mango fruits contain 10-20% sugar, an important source of vitamin A, C, B and small amount of protein, Iron, Calcium and Phosphorus. The green fruit can be used to make curries, pickles, jellies and dehydrated slices whereas the ripe mango makes mango squashes, ice creams, juice, nectar, jam, wine and dried mangoes among others (Nanyundaswamy, 1997). The kernels are used as animal feeds, for soil enrichment and for extraction of starch (Singh, 1986; Morton, 1987).

2.3 Global Mango Production and Trade

Total world mango production was 24 420 116 metric tonnes in 1999 (FAO, 2000) with developing countries accounting for about 98% of total production where as Tanzania occupied the 17th position in the world ranking of mango producing countries as at 2002 (Appendix 3). The total world mango production showed a growing trend of 2.6% since 1996 and by the year 2005 and it was estimated at 28.51 million metric tons whereby only the top ten mango producers were responsible for 85%. India is the largest producer of mangoes, accounting for 38.6% of world production from 2003 to 2005, followed by China 12.9%, Thailand (6.2%), Mexico 5.5%, Indonesia (5.3%), Pakistan (4.5%), Brazil (4.3%), the Philippines (3.5%), Nigeria (2.6%), and Egypt (1.3%). Marketing process involves finding out what customers want and supplying it to them at a profit or directing production in accordance to clear signals from the market place as to what is needed by customers (FAO, 1997c in Hawassi 2006). Overall evaluation of present international

mango trade shows that mangos is a very important export product for several developing countries from Asia, Africa, and Latin America although the trade is relatively small compared to the actual production. This is especially true for Asian mango-producing countries which have an aggregated share of 76% of total world mango production yet the region is only responsible for 25% of all mango exports (Jedele *et al*., 2003).

Although currently only 3% of the total world production of mango is traded globally, this represents a noticeable increase over the quantities traded 20 years ago (Evans, 2008). World export of mangoes increased from 397 623 metric tons in 1996 to 826,584 metric tons in 2005 where as the number one importer during the 2003 to 2005 period was the United States covering one-third of total mango imports (FAO 2007). The most popular export mango cultivars continued to be Kent, Tommy Atkins, Haden, and Keitt, which have fruit with a red bluish, and are less fibrous, firmer, and more suited for long-distance transportation than other types of cultivars (Sauco, 2004). Over the last decade, prices for most mango varieties have decreased about 5% as the fruit becomes more available worldwide, but prices could increase with proper promotional efforts.

There is evidence that the processed mango fruit market globally is increasing (Sauco 2004). Processed fruit products include mango juice, pickled mangoes, mango chutney, mango pulp, mango paste, mango puree, dried mango fruit, mango slices in brine, and mango flour. India is the main exporter of processed mangoes, followed by Pakistan, Brazil, and Zimbabwe. Major importers include the United Arab Emirates, Saudi Arabia, Kuwait, the United States, the United Kingdom, and Canada.

2.4 Sanitary and Phytosanitary Issues and Compliance to International Markets

Muhammad (2008) reported that in 2004 Pakistan ranked 32nd in the number of countries with consignments rejected by the EU due to high levels of pesticide residues where by Maximum residue levels (MRLs) were exceeded. Studies suggest that there was serious misuse of pesticides and traceability of farms and mango market records were non-existent. Such records are essential for mango exports to USA and Europe HACCP and GMP certifications. HACCP needs to be combined with Good Agricultural Practices. EuroGAP certification is a focus for development especially in the mango industry. Specific post-harvest treatments are prescribed for mango exports and countries should commit pest risk assessments and be able to provide evidence of pest free zones.

2.5 Horticultural Situation and Mango Marketing in Tanzania

Tanzania is not ranked internationally in terms of export of mango in spite of holding the 17th position in the world mango production in 2002; however it has a greater potential of generating income from marketing of fruits including mango. A study conducted by the Commonwealth Secretariat (1997) indicated that between 40% and 80% of an estimated production of 2.75 million tons of fruits and vegetables produced in Tanzania are lost due to lack of lack of initiative to develop the domestic and external markets for the crop either through quality improvements by following GAPs or the post-harvest value addition activities such as storage, transportation**,** grading and processing to increase after harvest life. Because of their high perishability, seasonality and bulkiness, fruits and vegetable require special care and attention that requires capital and technological advancement in providing form, time and space utilities (Mayoux, 2003).

About 70% of horticultural produce are marketed through collection points where by farmers bring their produce and wait for wholesale traders buy the produce and sell it through commission agents, retailers to final consumers and only 10% of the produce is traded directly from producers to consumers. Fruits and vegetables marketed from producers to exporters and processors are 2% and 4% of all produced fruits and vegetables respectively (TechnoServe, 2007). Jedele *et al*. (2003) reported that an expansion of mango export has a positive effect on both export revenues and social welfare of developing countries particularly in case of Africa which has proven that increased production and export is positively linked with welfare gains.

According to FAO report by Sugar and Beverages Group Raw Materials, Tropical and Horticultural Products Service Commodities and Trade Division our neighbor country Kenya as a good point of comparison mango takes 14.4% of the share of fruit export. How ever Tanzania has a big potential of producing several varieties of quality export mangoes although so far most of the mangoes produced are not suitable for export and production methods are not geared to that purpose. Hence they are mostly consumed locally because of diseases, insects and lack of markets. According to FAO figures, in 2000 Tanzania was the sixth largest producer of mangoes in Africa after Nigeria, Egypt, the Democratic Republic of Congo, Madagascar and Sudan.

Until recently mangoes could only be sold to local market vendors, the first mango processing factory was built in 2008 and now farmers have an option to sell their fruits to factories (Constantine, 2010). Tanzania is also uniquely positioned to export mangoes to Asian countries, which are large producers and exporters of mangoes worldwide. This is because of the advantage that Asian mango season starts from May and ends in August, while for Tanzania the season runs from November to March. The Middle East is also a

good target since its market has no stringent conditions like European and American markets.

2.6 Review of Analytical Approaches

2.6.1 Value chain analysis

A major benefit of value-chain analysis is through the identification of the nature and extent of barriers to entry along the chain. As a result, such an approach is amenable to explain many of the distributional outcomes that occur in the course of globalization as well as the evolution of such relationships over time (Kaplinsky and Morris, 2001). The liberalization of trade and growing integration of the global economy has given an opportunity to many of the world's population to generate higher income and improve the availability of better quality and increasingly differentiated final products (Kaplinsky, 2000).

In Sub-Saharan Africa, opportunities may be constrained by lack of effective and competitive participation of smallholders in the development of agricultural value chains. Key constraints include poor policy decisions with respect to emerging food safety and agricultural health norms and standards, export subsidies by developed countries and high transaction costs for compliance with norms and standards. These constraints may result in either exclusion of smallholders or unequal distribution of benefits. There is a need to manage effective participation of stakeholders in national and international economy, to ensure that incomes are not reduced or further polarized (Kaplinsky, 2000).

2.6.2 Gross margin analysis

Gross margin (GM) of a farm activity is the difference between gross income earned and

variable costs incurred. Gross margin analysis has been widely used in finding the profit in farm activities. It is a simple and powerful tool for economic analysis of introduced technologies (Makeham *et al.,* 1986). Mutayoba (2005) used gross margin of vanilla, coffee, tea, banana and maize in order to establish the relative economic profitability of various smallholders' production Bukoba District. Also Senkondo (1988) used gross margin per hectare for the sugarcane and paddy to obtain the most profitable enterprise.

Comparing gross margins obtained by producers and traders in the value chain is crucial in order to know if the participants' gains are enough encouraging or feebly discouraging as regarding the issue of sustainability of their functions in the chain. Gross margin has an important component of variable costs. Variable costs are the one that changes as level of outputs that are produced changes (Cramer *et al.,* 2001). Gross margin of farm activities is the difference between the Gross income accrued and the variable costs incurred.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Research design

Due to the limited budget and time for fieldwork, a cross sectional research design was used, allowing data to be collected once at a single point in time that was used in descriptive analysis and testing of hypotheses.

3.1.1 Geographical location and description of the study area

Urambo is one among the districts of Tabora region of Tanzania located in the mid-western part of mainland Tanzania on the central plateau between latitude 4° - 5° 55'' South of Equator and longitude 31° -34° East of Greenwich, with the total area of about 2 129 900Ha out of which arable land is summing to 291 144Ha, grazing land is 261 625 Ha general forest is 500 000Ha, land for other uses and features is 598 231Ha and out of the total arable land of 160 000 Ha is cultivated where by the average size holding is 2.0Ha (URT, 2005). It is bounded by Uyui district north east, Sikonge district south, Kahama district north and Kigoma region west. According to the 2002 Tanzania National Census, the population of the Urambo District was 392 000, average growth rate of 4.2 % per annum with current estimates of 500 000 (URT, 2005).

3.1.2 Administration

Administratively, Urambo District has four divisions namely Urambo, Kaliua, Ussoke and Ulyankulu; 23Wards and 97 registered villages. There are also 11 unregistered villages in three wards within Ulyankulu refugees' settlements.

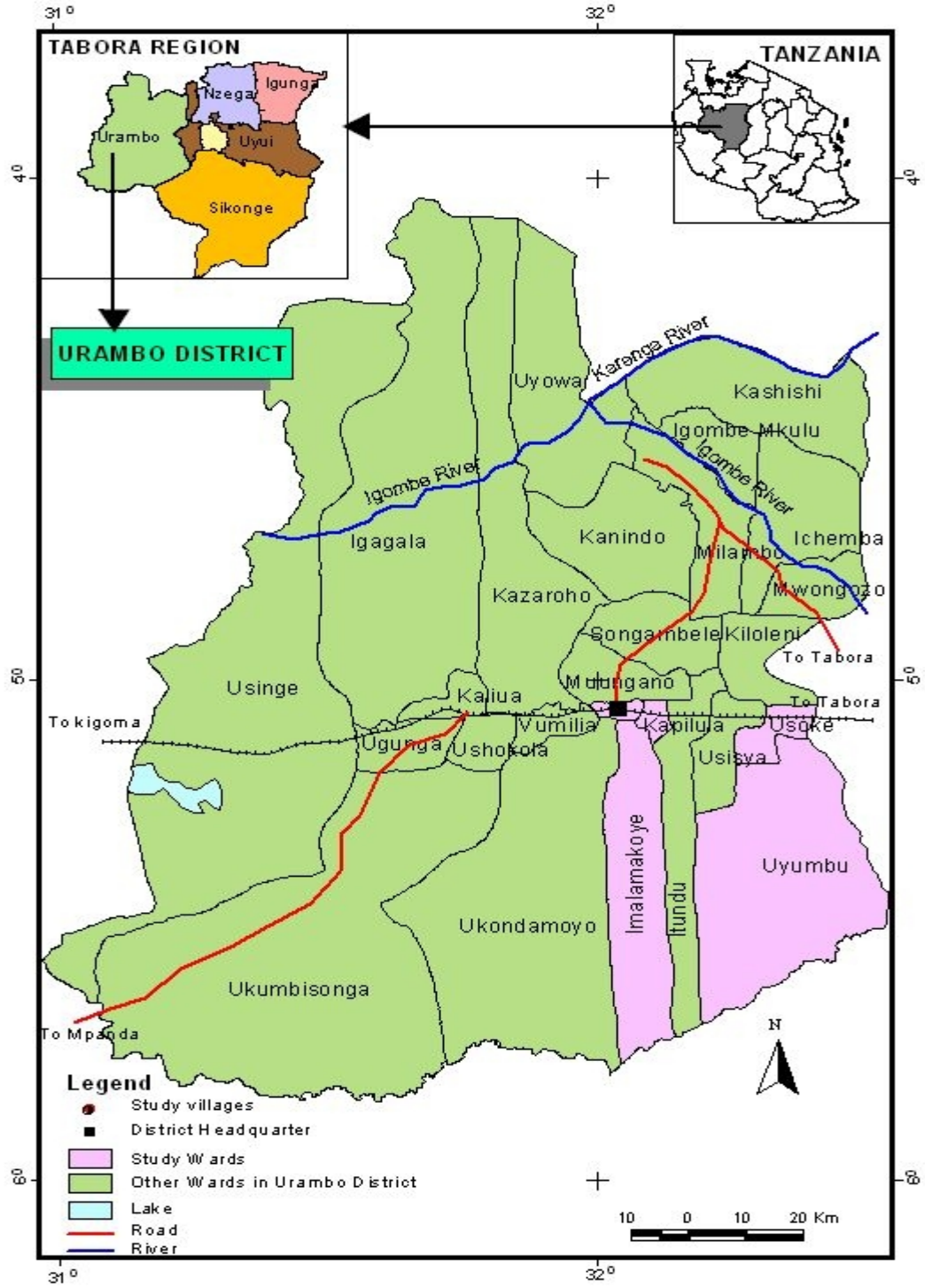

Figure 2: A map of Tanzania showing position of the study area

Source: Tanzania Administrative Boundaries, Ministry of Land and Natural Resources (2002)

3.1.3 Climate

Rainfall: The District receives an annual rainfall ranging from 900mm – 1200mm. The rain starts in November and ends in the April and this is the main crop-growing season. A long dry spell normally occurs between January to February.

Temperature: Urambo District has an annual mean maximum temperature of 30° C and mean minimum temperature of 16.4° C. The temperatures are highest in October just before the start of the rain season, and fall gradually to December and remain relatively constant until May. The temperature is lowest between May and August.

Topography: Urambo District falls in the central plateau of Tanzania an area of low relief lying between 1100m and 1200m above sea level. The District land is plain, which slopes gently down the Malagarasi swamps in the West.

Soil: The District has mostly a well drain medium textured soil. The topsoil is loamy sand or sand loam while the sub soil texture is sandy clay loam. In areas where soils are liable to flooding (mbugas), the soils are deep and predominantly sandy clay loam and clay textured.

Vegetation: The upland vegetation in the District is Miombo woodland mixed up with wetland vegetation of mbuga wooded grassland and mbuga grassland.

Water resources: The District has no permanent rivers although pools of water remain during the dry season in the Igombe River in the north and Ugalla River in the South parts of the District. The District has Lake Sagara in the western side.

Agro- ecological Zones (AEZ): Urambo District is divided into three AEZ, eastern, central and the western zone. They differ in climate, topography, soil characteristics as well as types of crops cultivated.

Eastern Zone: This zone comprises of 19 wards known as Ussoke, Kiloleni, Uyumbu and Usisya (in Ussoke Division). Urambo, Itundu, Vumilia, Ukondamoyo, Kapilula, Imalamakoye, Songambele and Muungano (in Urambo Division). Others are Kashishi, Ichemba, Milambo Kanindo Igombe Mkulu and Mwongozo (in Ulyankulu Division). Kazaroho is the only ward in Kaliua Division, which is found under this zone. The altitude of this zone is medium. The soils of this zone are dominantly loamy sand and sand loam, well drained with medium texture. The soil fertility and available water holding capacity are low. There mbuga areas dominated with sandy clay loam and clay. The rainfalls in this region are well distributed and are monomodal (one season) that measures between 700 – 1000 mm per annum. There are four months (December to March) of wet season and seven months (May to November) of Dry season. The growing season is of five months (December to April). The principle crops grown include maize, cassava, sweet potatoes Rice/paddy, sorghum and legumes, Tobacco, cotton and sunflower and groundouts.

Middle Zone: The zone is comprised of 4 wards known as Ugunga, Kaliua, Igagala and Ushokola (in Kaliua Division). The altitude of this zone is low to medium. The soils of this region are reddish clay loam with moderate available water holding capacity. The fertility of soil is low. There are also mbuga soils dominated with black clay loam and clay. The rainfall in this region is monomodal between 600 – 1000 mm per annum. The wet season is five mouths (December – April). The day season is of six months (June to November). The growing season is six months (December – April). The principal crops

grown are maize, cassava, groundnuts, tobacco, sweet potatoes, beans, sunflower, oily palm and simsim.

The western zone: The zone comprises of three (3) wards known as Uyowa (in Ulyankulu Division) Usinge and Ukumbisiganga (in Kaliua Division). Altitude of this zone is low to medium. The soil fertility is high with medium available water holding capacity. The texture of the soil is clay loam. The rainfall is more than 600 mm per year and is Monomodal.

There are four months of wet season (November, December, and March to April) and dry season of five months (June to October). The growing season is seven (7) months (November to May). The principal crops grown include maize, cotton, oil palm, cassava, rice (paddy), sunflower, simsim, banana and oranges.

3.2 Data Requirement

Both secondary and primary data were required in this study. Secondary data regarding national and global perspective for mango production, distribution and marketing as well as socio-economic profile of the study area. Primary data concerns socio-economic status of mango producer, land distribution and ownership, allocation of land for farming enterprises and household income contributed by each enterprise, farmers perception on commercial mango production, production and marketing of corps including mangoes.

3.3 Sampling Techniques

The respondents aimed at were mango producers and traders in the mango value chain. Key informants included Ward agricultural extension officers (WAEOs), Agricultural

Extension Staffs at district level, ward and village leader. A sample size of 300 respondents was used in this study comprising of 260 farmers and 40 traders. Purposive sampling technique was used to select 5 wards out of which 10 villages were selected from each basing on potential for production of mangoes. A list of mango producers was developed in each of the selected village by the assistant of Ward Agricultural Extension Officers. A total of 260 mango producers was selected for interview and the size of the sub-samples taken in each village was determined by the proportionate availability of mango producers. The simple random sampling techniques were employed to select mango producers from each of the 10 selected villages and 40 mango wholesale and retail traders from Urambo and who sale the mangoes at the three selected markets of Urambo, Tabora and Dodoma. The three markets were selected due to the facts that they are the main destination markets of mangoes from Urambo.

Questionnaire pre-testing was done involving 25 mango producers and 15 traders from the study area in the villages of Usoke and Urambo South before the general survey. This task was undertaken to ensure comprehensiveness of the questionnaire regarding data collection after which some amendments were done to develop a new version.

3.4 Data Collection Instruments

Secondary data were obtained from District Council Offices, Sokoine National Agricultural Library and electronic sources. Primary data were collected during field survey carried out between January and March 2010 using structured questionnaire, key informants interview, direct observation and focused group discussion. The questionnaire was used to interview respondents to capture important information.

3.5 Data analysis

Primary data was verified, coded, cleaned and analyzed using computer based software called Statistical Packages for Social Sciences. The analysis for qualitative characteristics of the mango producers was done by use of frequencies, percentages and means where as descriptive statistics such as maximum, minimum, mean and standard deviations and percentiles was used to analyse the quantitative objectives such as finding of the gross margins and net gains by the agents operating in the mango value chain. Paired T-tests was used to compare the net gains by agents in different levels and different markets.

3.5.1 Functional unit (FU)

A sack is common unit used in the study area for packing mangoes that are to be sold. Due to the fact that most of mango producer do not have mango orchards that follow recommended spacing of which an acre was supposed to have 60 mango trees, the study adopted a sack full of mangoes to be a unit of analysis. Therefore calculations about gross margins, profit margins, their comparisons and hypotheses tests results based on sack of mango produced or sold.

3.5.2 Gross margin analysis (GM)

The measure of profitability was calculated from gross revenue per unit (sack of mango) minus total variable cost of resources used for value addition and be compared by t-test between producers and traders to see if they differ significantly. However the net gain was used insteady of gross margin because it was found that no a single mango producer has

ever used variable inputs in production process.

$GM_i = TR_i - TVC_i$

Where: GM_i = Average gross margin (TSH/sack) TR_i = Average total revenue (Tsh/sack) TVC_i = Average total variable costs (TSH/sack)

Therefore the gross margins were regarded as profit margins.

3.5.3 Comparison of mean profit margins

The Profit margins accrued per sack of mango sold by producers and traders at different levels in the three different markets were compared pair wise.

3.5.4 Hypothesis testing

The hypotheses about equality of means of net income gained per sack of mango sold by the producers and different traders in the value chain were tested at 5% significant level (95% c. level) by using a paired two tailed test at appropriate degrees of freedom.

3.5.5 Regression analysis

A Multivariate regression was undertaken to examine the effect of socio-economic variables such as age in years, education level in years of schooling, household labour size, total cultivated land in acres, mango production experience in years, number of mango trees owned and ratio of unsold over sold volume of mango as proxy for post harvest loses on income accrued from mangoes. The model was chosen because it is simple and can test for the significance of more than one predictor variable influencing the dependent variable at once. Following trials for running the model the variable age of respondents was dropped because knowledge on the subject matter realizes that it has no

relation with income obtained from mango, also its inclusion renders the model insignificant. So the model was re-specified as follows.

$$Y = \alpha + ß_1X_{1i} + ß_2X_{2i} + ß_3X_{3i} + ß_4X_{4i} + ß_5X_{5i} + ß_6X_{6i} + \mu_i \quad \text{.....(1)}$$

Where;

Y= Household income accrued from mangoes (Tshs), X_1 = Education level in years in schooling, X_2 = number of household labour, X_3 = Total cultivated area in acres, X_4 = mango production experience in years, X_5 = Number of mango trees owned by respondent, X6 = ratio of unsold over sold volume of mango as proxy for post harvest loses, α= Regression constant or intercept. $ß_1$, $ß_2$, $ß_3$, $ß_4$ $ß_5$ *and* $ß_6$ are Coefficient estimates for variables X_1,X_2 X_3 , X_4 X_5 *and* X_6 respectively μ = An error term and i = i^{th} observation.

Expected signs for the coefficients of the predictor variables education level, household labour size and proxy for post harvest loses were expected to be negative because of the prior knowledge that farmer tend to escape from less paying enterprises as they acquire knowledge and allocate much of their labour to enterprise that earns more money. Also the proxy for post harvest loses will reduce the income from mangoes that is why it was expected to exhibit a negative sign. On the other hand the coefficients for mango experience, total area owned and number of mango trees owned were expected to show positive signs because experiences means more farming skills giving substantial and qualitable products fetching more income, whereas land and number of trees imply increased production of mangoes and adding to income.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Socio-economic Characteristics of Respondents

The socio-economic profiles of the household have implications towards agricultural production and marketing. They may determine the volume of production, decision making regarding production and marketing, stability of household, literacy level and easiness to adopt innovations and economic activeness. The proceeding subsection presents the characteristics of the household heads such as marital status, age, sex, education level and household head composition by age.

4.1.1 Sex against marital status

Majority of mango producers (82%) were married whereby divorces and separation cases account to 4%. This shows stability of household hence opportunity to concentrate to the economic activities and expansion of income for future prosperity to welfare of the family (Table 1). Single parents for the sampled farmers were 7% out of which female parents were 6% compared to 1% males. This is an indication that males dodge responsibilities of taking care of children born out of marriage, a situation which leads to increasing number of vulnerable children and consequently weaken the social welfare. Fourteen percent of the sample were widowed female parents while only 2% were males. This depicts that under normal circumstances female life span is longer than that of males, like wise males encounter more death risks following nature of their jobs as well as their behaviour.

Table 1: Sex against Marital status Cross tabulation

Marital status	Male		Female		Total	
	Count	Percent	Count	Percent	Count	Percent
Married	207	80	5	2	212	82
Single	2	1	15	5	17	6
Widowed	6	2	14	6	20	8
Divorced	3	1	3	1	6	2
Separated	3	1	2	1	5	2
Total	221	85	39	15	260	100

4.1.2 Age

For the selected 260 mango producers household heads 47% fall under ages of between 18 and 45 years with mean age of 48 years which indicates that about half of mango producers are in the economically active group so the initiatives to promote the crop can be feasible (Table 2).

Table 2: Age category of respondents in years

Category	**Frequency**	**Percentage**
18 to 35	44	17
36 t0 45	78	30
46 to 60	89	34
Above 60	49	19
Total labour	**260**	**100**

4.1.3 Education level

Regarding the education level 20% of the selected mango producer have never attended a formal education class, while the majority 70% had primary level education and the rest 10% have secondary and college education (Table 3). Majority of respondents having at least primary level education indicate that the societies can easily understand some innovation through training and extension and hence become active participants in

promoting production and marketing of mangoes. Training and sensitisation on issues such as GAPs, record keeping fruit processing, financial aspects such as SACCOs, access to markets and financial services is possible for the society that has at least a primary education.

Table 3: Education level of respondents

Category (years)	Frequency	Percentage
No school	51	20
Primary	181	70
Secondary	11	4
College	17	7
Total	**260**	**100**

4.1.4 Occupation

Agricultural production is the main economic activity of the people in the study area. Out of 260 selected households 83% engaged in crop production, 6% livestock keeping, 4% business and 7% formal employment (Table 4). However some of the household heads who had formal employment and business produce crops and keep livestock although not their main activity for their livelihood. For instance maize was found to be cultivated by every interviewed household head due to the fact that maize is a staple food for the people in Tanzania and particularly in the locality.

Table 4: Main occupation of respondents

Variable	Category	Frequency	Percentage
Occupation	Crop production	216	83
	Livestock keeping	15	6
	Business	11	4
	Employed	18	7
	Total	**260**	**100**

4.1.5 Households labour composition by age and mango production experience

The average age of the household head ranged from 24 to 72 years with mean of 48 years. The household size ranged from 3 to 10 members with an average of 6 members per household where by the 75 percentile of the house hold has about 7 members and about (57%) are youth of age between 15 and 45 as shown in Table 2. The average nearly coincides with the statistics on population census of 2005 which came up with average of 5 potential labours force for agricultural activities (URT, 2005). The implication to this is that, large number of labour force in the family which was mainly composed of active youth justifies the workability of the innovations for improvement of mango and gain extra income.

4.1.6 Mango production experience, total lands size owned and cultivated land

Results in Table 5 show the producers' experience in mangoes ranges from 5 to 32 years with mean of 18 years. This indicates the producers' familiarity with the crop. The average land size owned by households range from 2 to 14 acres with mean of 8 acres whereas the cultivated land ranges from 2 to 10 acres with an average of 5 acres per household. The study observed that mango cultivation is less expensive farming, only that it is ignored mainly due to lack of markets. If the marketing problem is solved there is an average area for expansion of mango production of about 3 acres per household.

Table 5: Household mango production experience, lands size owned and cultivated

Variable name	Mean	StdD	Min.	N=260 Max.	Percentiles			
					25	50	75	100
Mango experience (years)	18	7	5	32	12	17	23	32
Land size owned (acres)	8	2	2	14	7	8	10	14
Cultivated area (acres)	5	2	2	10	4	5	6	10

4.2 Main Economic Activities in the Study Area

According to the secondary data from the District Agriculture and Livestock department annual reports 2009, crop production and livestock keeping are the dominant economic activities in the area. The common crops grown in the study area are tobacco, maize, legumes, rice, groundnuts, sunflower, cassava, sweet potatoes. Perennials crops includes oil crops namely coconuts and oil palm where as fruits include mangoes, oranges, pawpaws and guavas.

4.2.1 Mango production system

Mango trees are planted haphazardly without proper spacing and intercropped with other annual crops such as maize, tobacco, groundnuts, root crops and legumes whereas others mango trees grow naturally in bushes. There is no cost that is directly associated with mango production because the crop husbandry practices such as land preparation, weeding and pruning are indirectly done during cultivation of other targeted annual crops. There is about four main mango varieties in the study area namely *dodo, bolibo, sindano and kamba.*

4.2.2 Challenges facing commercial mango production in the study area

The 260 interviewed mango producers have stated several constraints to commercial mango production as summarised in Table 6. For instance lack of clear markets for mangoes was reported by the majority (32%). These cause farmers not to allocate resources on mango production. Fourteen percent recommend that lack of commercial varieties was the problem limiting acceptability of mangoes in the markets and thus limited production.

Adherence to good agricultural practices is important in increasing both the quantity and quality of mango produced, likewise efficient operations of the marketing functions such as transportation, storage, grading and fruit processing ensures creation of space, time and form utilities but 10% of respondents pointed the lack of training on mango production and marketing as one of the problem facing the industry. The 5% of interviewed household heads showed lack of awareness of mango markets outside the district limits the sales of mangoes where only few markets such as Tabora, Nzega, Dodoma, Kahama and Mwanza were known and main destination markets for the mangoes from the locality are Tabora and Dodoma. Other factors were reported by the respondents to significantly affect the mango industry whereby 9% reported lack of fruit processing factory, 12% pest and disease damages, 10% poor infrastructure and 8% poor credit facilities.

Table 6: Challenges to commercial mango production

Constraint	Frequency	Percent
Lack of train on mango production and marketing	26	10
Lack of fruit processing factory	24	9
Poor credit facilities	21	8
Lack of commercial varieties	36	14
No clear markets	84	32
Pests and diseases	32	12
Poor transportation infrastructure	25	10
Lack of awareness with external markets	12	5

4.2.3 Farmers' perception on promotion of mango production and marketing

Farmer had various perceptions regarding the possibility of changing the cropping system if mango is well promoted. Farmers stated the crops they would prefer to drop from the farming system and reasons for the preferences where by this reflect their perceptions.

4.2.3.1 Preference to drop some crops if mango is promoted

The majority 65% of the sample claimed that if mango production is promoted and in particular if marketing problems are solved and potential earnings realized from mangoes, the crop to be dropped out of farming system is tobacco whereas 20% suggested dropping rice and the rest 15% groundnuts.

4.2.3.2 Reasons for preferential selection of a crop to drop out

Different reasons were given for the choice to drop tobacco out of the farming system whereby the majority 41% of the sample said tobacco involves a lot of tedious operations, 24% pointed it to be a risky farming where as 8% recommend the problem of endless debts it causes to farmers (Table 7). High dependence of agro-chemicals on tobacco has made farmers borrow excessively. Farm inputs are always delayed, prices of inputs are high and interests on loans are also very high. Although tobacco has a reliable market, prices are unreliable, labour is overexploited and its cultivation degrades the environment. However, farmers preferring to concentrate on mango production so as to replace tobacco if market works, proposed a considerable structural change in farming system and sometime market may fail to work for farmers. Therefore further research is needed to study and design a highly targeted and systematic program that may have to include compensation when markets fail to work.

Table 7: Reasons for selecting the crop to drop

Main reason for dropping tobacco	N= 260	
	Frequency	Percent
Spoil environment	10	4
Labour overexploited	10	4
Unreliable prices	14	5

Very Costfull farming	16	6
Cost full farming	16	6
Delaying of inputs	19	7
Endless debts	20	8
Risky farming	63	24
Tedious operations	107	41

4.2.4 The mango varieties distribution in 2009.

A total of 4610 mango trees were owned by the selected 260 mango producing households whereas the local *sindano* and *kamba* varieties are highly distributed taking 62% compared to 38% of *dodo* and *bolibo* varieties (Table 8). The production of mango ranges from 3 to 7 sacks with mean of 5 sacks per tree and does not differ much according to varieties, currently it ranges from 3 to 7 with mean of 5 sacks per tree. Based on Agricultural extension recommendations of 65 trees per acre, thus yield per acre would ranges from 150 to 420 sacks with mean of 318 sacks per acre. An average sack of *dodo* or *bolibo* mango contains 200 average sized fruits while a sack of sindano and kamba mango contains 1050 fruits.

Table 8: The mango varieties distribution in 2009

Variable		N= 260		
		Sum	Mean	Std. Dev.
Number of trees owned by mango producers	Dodo	710	4	3
	Bolibo	1 044	6	3
	Sindano	1 140	7	7
	Kamba	1 716	12	12
	Total	**4 610**	**29**	**25**

4.2.5 The mango production, consumption and damages in 2009

Summary in Table 9 shows that the mean production of mango fruits were 97.4 sacks per household whereby the local varieties of sindano and kamba are more common interms of number of trees and produce larger share of mango fruits about 66% compared to *bolibo*

and *dodo* varieties that accounts for the remaining percentage. Only 5.5 % of mangoes produced are consumed at home whereas *dodo* and *bolibo* takes 56% of the volume and the rest comprises of *sindano* and *kamba* varieties. This indicates how *bolibo* and *dodo* are preferred by consumers compared to *sindano* and *kamba* even starting by home consumption.

The mango fruit fly which attacks the fruits before and after maturity is a typical pest commonly affecting the mango production. Diseases and pests cause loss of 18.5 % of the total production. How ever some efforts have been initiated by the Urambo district to train three agricultural extension staffs about control of the fruit flies and management of mango tree nurseries a program that has gone parallel with training of three mango producer groups as well as introducing the commercial varieties such as Alfonso, Tommy Atkins, Apple mango and Red Indians to the three centers which all together could supply 15 000 grafted seedlings that would cover 234 acres for the recommended density of 65 plants per acre.

Table 9: Mango production, consumption and damages in 2009

	N= 260					
Variety	Produced		Home consumption		Pests damage	
	Sum	Mean	Sum	Mean	Sum	Mean
Dodo	3 133	17.6	226	1.3	823	4.7
Bolibo	5 551	31.9	413	2.4	1 298	7.5
Sindano	5 751	35.5	221	1.5	918	6
Kamba	10 868	76	284	2	1 759	12.3
Total	**25 324**	**97.4**	**1 144**	**4.4**	**4 798**	**18.5**

4.2.6 Mango sales and revenue for the year 2009

The study reveals that producers sell their mangoes mainly at farm gate to either

wholesalers, retailers or direct to consumers and very few producers transport directly to the local markets within the district. Retailers sell to the consumers or to juice makers.

4.2.6.1 Volume of sold and unsold mangoes in sacks for the year 2009

Also results in Table 10 show that the farm gate price for mangoes averaged 5 985 Tshs per sack regardless of variety. Referring to Table 9 and Table 10 almost 24% of mangoes that was produced was sold, 19% damaged by pests and diseases, 5.5% consumed at home whereas about 51.5 % remained unsold.

Table 10: Volume of fruits sold and unsold at farmgate price in 2009

	N=260					
	Number of sold sacks			Number of Unsold sacks		
Mango variety	Sum(‘000)	Mean	Std. Dev	Sum(‘000)	Mean	Std. Dev
Dodo	1.5	8.8	7.2	0.5	3	1.7
Bolibo	2.4	14.1	8.9	1.4	8.1	5.2
Sindano	0.7	4.5	4	3.8	24.7	23.7
Kamba	1.4	9.5	9.1	7.5	52.3	53.8
Total	6	23.2	11.9	13.3	51	54

4.2.6.2 Revenue collected from mango sales at farmgate price for the year 2009

The total volume of mango sold fetched a total of 36 076 040 Tshs at farmgate price with mean of 138 754 Tshs per household (Table 11). More than two quarters that remained unsold could provide more than twice the income currently obtained by mango producers. This situation reduces the producers’ incentives of improving both quantity and quality of mangoes.

Table 11: Farm gate prices and revenue collected from mango sales in 2009

	N= 260					
	Farm gate price (Tshs/sack)			Revenue collected (Tshs)		
	Sum(‘000)	Mean	S/Dev	Sum(‘000)	Mean	S/Dev
Dodo	1 041	5914	409	9 043	51676	42477
Bolibo	1 041	6032	386	14 806	85582	4160
Sindano	921	6016	428	4 156	27164	4411
Kamba	852	5959	410	8 071	56439	4690

4.2.7 The potential of mango contribution to household total income

This subsection shows the contribution of mangoes to the total household income under current marketing situation as well as estimates of its contribution if all the mangoes could be sold under existing farm gate prices in the locality. The households engage in the production of other fruits, perennial crops and annual crops all of which together with mangoes contribute to the total household farm income.

4.2.8 Production and income from other fruits excluding mangoes

The sampled farmers also engage in the production of other fruits such as oranges, pawpaws and guavas that adds to the household farm income. Orange trees are second from mangoes interms of availability and distribution among households. Table 12 shows the revenue in Tanzania shillings that is accrued from sales of the fruits per year for the households that are engaged with the production of other fruits. The sampled households owned total of 2 943 trees of other fruits with average of 11 trees per household. Oranges takes 1,619 trees which is more than half of other fruit trees at their total holdings followed by pawpaws and guavas. Mangoes brought a larger income summing to about 36 000 000 (Table 12) compared to the combined income of 26 028 000 from oranges, pawpaws and guava. Potential availability of other cultivated fruits including mangoes broadens the justification for the need of improving the mango industry and fruit sub-sector in general. For instance if the fruit processing industry is established, it can be guaranteed for the supply of fruits.

Table 12: Production and income from other fruits

Fruits type	Other non-mango fruits trees owned by HH			Revenue from sales of other non-mango fruits in 1000Tshs		
	Sum	Mean	Std.Dev	Sum	Mean	Std.Dev
Oranges	1 619	8.3	5.9	19 428.0	99.6	71.4
Pawpaw	657	4.1	2	4 599.0	28.4	13.8
Guava	667	3.8	2	2 001.0	11.5	6.1
Total	**2943**	**11.3**	**7**	**26 028.0**	**100.1**	**76.5**

4.2.9 Production per acre and HH mean income from crops in 2009

The interviewed mango producers also use their land to cultivate major food and cash crops such as tobacco, maize, rice, legumes, groundnuts, sunflower, cassava and sweet potatoes so as to meet their food and cash requirements.

4.2.9.1 Land cultivated by the households and crops yields per acre

Results in Table 13 show that for a single household, the total land used to cultivate major food and cash crops averages to 9.1 acres. Maize takes 18% of the land and is a common crop cultivated by every interviewed farmer in the area indicating that it is a staple food whereas tobacco takes 13 % of area cultivated by household. However yield to every of the crop indicated in the table is below potential yield expected when farming practices are properly used at farmers' level of technology. This is indicative of low productivity of inputs such as land and labour, a gap which can be filled through application of good agricultural practices and expansion of agricultural markets that will motivate producer.

Table 13: Mean acreage per HH and yield per acre in sacks and kgs for tobacco

		N= 260	
Crop enterprize	**Land (acre)**	**Yield(sacks/kg)**	**Yield potential**
Tobacco	1.2	608	960
Maize	1.6	18	32
Rice	1.4	15	28

Legume	1	2	6
Groundnuts	1.6	4	8
Sunflower	0.9	7	10.8
Cassava	0.8	8	12
Sweet potato	0.6	5	7.2
Total	**9.1**		

4.2.9.2 Mean household income accrued from crops in 2009

Production of annual crops by the sampled households, provided a mean annual income of 1 567 600 Tshs where by tobacco itself as the main cash crop provided 740 000 Tshs which is equivalent to 47% of the total income (Table 14). This may be perceived that even though tobacco production is below recommended yield but the crop is more paying, although the opposite is true if we consider high cost of inputs, high input loan interests, and costs it take to cure environmental, health and social injuries caused by tobacco production.

Table 14: Price/unit (sacks and kg for tobacco) and revenue /HH in Tshs in 2009

	N=260	
	Price (‘000) per sack or per kg	Revenue ('000,000)
Tobaco	2	0.74
Maize	22.1	0.38
Rice	22	0.17
Legume	83.3	0.06
Groundnuts	62. 1	0.11
Sunflower	16. 7	0.04
Cassava	13.9	0.04
Sweet potatoes	13.4	0.02
Total (Tshs)		**1.57**

4.2.10 The position of mango contribution to household total income

The sources of household income in the study area are summarised in Table 15. The overall household income per year ranges from 590 000 to 7 924 000 with mean of Tshs 2 170 924. Tobacco as the leading sub sector contributes 35 % of the mean household

income. However under current production and marketing situation mangoes contribute 149 419 (7%) of the mean household income of the mango producer. As indicated in the preceeding subsections, mentioned income comes out of only 24% mangoes that are sold where as 19% are damaged by pests and diseases, 5.5% is household consumption and 51.5% remained unsold. This implies that only a quarter of mangoes produced were sold and if all the mangoes that were available for sell had access to market even under the current price its contribution to the household income could triple to 21%.

Table 15: Different sources of income to the household in 1000 Tshs

Enterprise	N=260			
	Minimum	Maximum	Mean	Percent
Other Field crops	222 000	1 879 000	861 104	40
Tobacco	358 000	6 800 000	765 742	35
Mango	8 000	288 000	149 419	7
Non-mango fruits	10 000	359 000	100 108	5
Livestok/fish	63 000	2 068 000	135 285	6
Business	880 000	2 060 000	62 846	3
Employment	720 000	2 280 000	73 031	3
Other sources	61 200	612 000	23 389	1
Total income	**590 000**	**7 924 000**	**2 170 924**	**100**

4.2.11 Regression analysis results

Ordinary Least Square (OLS) method was used to estimate the relationship between total income accrued from mangoes against socio economic variables such as education level, number of available household labour force, experience in mango production, number of mango trees owned, total cultivated area and ratio of unsold over sold volume of mango as proxy for post harvest loses. This method was prefered because it is simple and gives a straight line that fits the sample of XY observations in the sense that it minimizes the sum of the squared (vertical) deviations of each observed point on the graph from the straight line. It assumes the observations in the variables are normally distributed so confidence intervals and tests for the estimated value of "*a*" and "ß" are easily computed. The Ordinary Least Squares (OLS) estimators are best linear unbiased estimators (BLUE)

among all unbiased linear estimators or most efficient because of having smallest variance. Lack of bias means that the difference between the expected value of the estimator and the true parameter is negligibly equal to zero. So there is confidence that the estimator is closer to the true population parameter being estimated. Also because of having minimum variance coupled with lack of bias becomes an efficient estimator having the smallest confidence interval and is more likely to be statistically significant than any other estimator. It is a consistent estimator because of having asymptotic unbiasness in the sense that as the sample size increases the estimator approaches more and more the true parameter. However, non-linear estimators may be superior to OLS estimators by being unbiased and having lower variance but since it is often difficult or impossible to find the variance of unbiased non-linear estimators, however, the OLS estimators being linear remain by far the most widely used.

Table 16 results shows that, the model is strong 66% fit for explaining the variation in income obtained from mangoes and the coefficients for predictor variables such as education level in terms of years in schooling and household labour force exhibited negative signs statistically significant ($P<0.1$) implying that increasing awareness on profitability of crop enterprizes makes the farmer to reduce concentration on less paid crops, so allocate more of their labour to more paying crops and cause significant reduction of the total income accrued from mangoes. Furthermore another variable that is included in the regression is a proxy for post harvest losses which is the ratio of unsold over sold volume of mango that also its coefficient exhibited a negative sign statistically highly significant ($P<0.01$) indicating increasing the ratio, very highly reduce the mango income. So interventions such as training farmers on GAPs, improving transportation,

investment on mango processing into products such as dried mango, juices, pickle, jam and nectar will reduce post harvest losses, expand market and adds to mango income.

Also the estimated relationship show the coefficients for land owned by farmer in acres, years of experience in mango production and number of trees owned altogether exhibited positive signs highly significant (P<0.01) implying very highly significant addition to mango income. This is due to the fact, that farmers holding large lands had opportunity of having many trees and considerable harvest; whereas mango experience implies farmers have developed necessary farming skills for mango husbandry so increased output. It follows that the interventions such as provision of improved mango seedlings, followed by sensitization campaigns will significantly add the share of mango to the HH income.

Table 16: Regression of Income from mangoes against socioeconomic variables

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	182047.2	17028.05		10.69	0.000***
Education level(Years)	-6381.3	3861.83	-0.06	-1.65	0.100*
Number of HH labour	-3878.3	2270.38	-0.08	-1.71	0.089*
Area owned (Acres)	3488.5	1521.02	0.10	2.29	0.023**
Mango experience(Yrs)	1817.9	427.32	0.16	4.25	0.000***
Mango trees owned	5402.15	276.48	0.93	19.54	0.000***
Unsold/sold	-160415.9	10183.08	-0.73	-15.75	0.000***

Dependent Variable: Income from mangoes

Adjusted R = 0.66

*** means significant at 1% or very highly significant
** means significant at 5% or highly significant
*means significant at 10% or significant

4.3 Capital Used for Purchasing Mangoes as a Proxy for Firm Size

The results in Table 17 show that capital used by wholesaler to purchase mangoes was greater compared to that of retailers in the three markets. This is due to reasons that wholesaler is a distributor so that node collect and then distribute and therefore handle more volume than a retailer in the chain. Dodoma wholesaler's capital ranges from 268 800 to 483 800 with mean of 381 000 Tshs whereas 75 percentile ran with a capital of 414 000 Tshs. In case of wholesalers at Tabora markets the mean capital was 311 900 and it was ranging from 282 500 to 367 600 whereas 75 percentile capitals were 345 100 Tshs. The capital operated by wholesaler at Tabora is smaller than that of Dodoma wholesalers which accounts for the addition of transport costs to cover a larger distance. Urambo wholesaler capital is smallest in comparison to all the three markets. Retailers' capital for the three markets follows the same manner.

Wholesalers and retailers at Urambo markets operates with a very small capital of about half of that used by other traders in the distant markets of Tabora and Dodoma. The low capital owned by the trader operating in the locality is among the indication of poor marketing in the locality whereby exchange involves low value and low volumes.

Table 17: Size of capital for traders operating in the markets in 1 000Tshs

		Capital used for purchasing mangoes that was sold (Tshs)					
		Dodoma market		Tabora market		Urambo market	
Statistics		Whole salers	Retailers	Whole salers	Retailers	Whole salers	Retailers
N		7	4	6	7	7	9
Mean		381.0	356.2	311.9	240.8	152.3	130.6
Std. D		64.6	25.2	33.6	27.8	12.8	33.1
Min.		268.8	333.9	282.5	207.4	127.2	95.4
Max.		483.8	390.4	367.6	290.8	167.7	194.5
Percentiles	25	354.0	335.7	286.1	214.5	145.9	109.2
	50	380.6	350.3	298.2	237.1	156.8	121.8
	75	414.0	382.7	345.1	253.5	158.1	153.6

4.3.1 Volume of sales, cost, prices and net gain per sack of mango in markets

The average of mangoes volume traded, cost incurred and profit gained per sack by different categories of farmers operating in the three selected markets showed a general tendency of increase along way Tabora to Dodoma markets as shown in Table 18. An average of 24 sacks, 45 sacks and 60 sacks of mangoes were sold by traders at Urambo, Tabora and Dodoma markets respectively whereas total cost per sack averages to 13 000, 15 000 and 20 000 Tshs for mangoes sold in Urambo, Tabora and Dodoma respectively. The trend of cost increase follows the fact that the cost of marketing operations such as transport, handling and levies increases with volume and distance along which the consignment is moved. Further more, the average wholesale prices of 21 500Tshs and 39 700Tshs per sack likewise the volume 51 bags and 63 bags traded in Tabora and Dodoma markets respectively are relatively higher compared to the average of 26 bags at Urambo sold at 14 000Tshs per sack. Moreover net income per sack obtained by a trader whether wholesale or retailer increase as one moves along to a more urban market from Urambo, Tabora to Dodoma (Table 18). Similarly Appendix 7 show that height of the vertical columns of the bar graph increases as one moves to more urban markets from Urambo, Tabora to Dodoma. This signifies the presence of high demands and promising markets for mangoes in urbanized markets.

Table 18: Volume of sales, costs, prices and net gain per sack of mango traded

Variable	Urambo		Tabora		Dodoma	
	Whole saler	Retailer	Whole saler	Retailer	Whole saler	Retailer
N	7	9	6	7	7	4
Total sacks traded	26	21	51	39	63	57
% of total 257 sacks traded	10	8	20	15	25	22
Marketing cost/sack -MCS (‘000Tshs)	2 .5	4 .15	3.5	5.5	7.6	12.3
Selling cost/sack-SCS (‘000Tshs)	3	4	4.3	4	4	5
Buying price/sack –BPS(‘000Tshs)	5.9	6.15	6.2	6.1	6.1	6.3
Total cost/sack=MCS+SCS+BPS	11.4	14.3	14.	15.6	17.7	23.6

(‘000)						
Selling price/sack-SPS (‘000Tshs)	14.	22.5	21.5	29.6	39.7	58.4
Gain/sack=TCS-[MSC+SCS+BPS]	**2.6**	**8.2**	**7.5**	**14**	**22**	**34.8**

4.3.2 Net Income gained per sack of mangoes sold by producers and traders

Farm gate price of a sack of mango averaged to 6 000 Tshs regardless of variety Table 19. Since producers do not directly incur cost in the production of mangoes due to the fact that they intercrop with annual crops, therefore what is gained per unit of products sold is just the price. The common unit used is sack which contains about 200 mangoes fruits for the *dodo* and *bolibo* varieties where as sindano and kamba varieties takes up to 1050 fruits per sack. Due to the fact that sindano and kamba varieties are less marketable compared to *dodo* and *bolibo* they are negligibly transported outside the region.

Net income gained from selling an average single sack of mango differs according to trader category, market place and variety sold which altogether determine the marketing costs such as transport, handling, loading and offloading, storage and levies. As discussed in the preceeding section, traders selling at Dodoma market gains about three times compared to those operating at Tabora and Urambo markets. If a farmer could manage to sell all the mangoes available for sale at current prices, mango enterprise would account 20% of the current total household income. Further more if mangoes could be sold at mean wholesale price of 39 700 Tshs offered at Dodoma market giving profit of 22 000 Tshs which is about three times the farm gate price then, contribution of mango to the total household income could reach up to more than 60%.

Table 19: Average revenue gain per sack of mango sold by Urambo producers

Type of mango	Average revenue per sack
Dodo	5 900
Bolibo	6 050

Sindano	6 000
Kamba	5 950
Average	6 000

4.4 Product Flow and Prices of Products in the Markets

Results indicated in Fig. 3 show that, the total number of sacks of mangoes that flowed in different markets via the different categories of trader was 257 sacks equivalent to 100% whereby 18% flowed to Urambo, 35% Tabora and 47% Dodoma. Generally the consignment handled by the wholesalers was larger compared to retailers and the vise versa for the prices. This follows logically that wholesalers would handle more volumes to sell to several retailers each handling less volume. The smaller volume of mango flowed to traders operated in Urambo market compared to higher volumes flowing to urban markets of Tabora and Dodoma. This implies that the urban markets are larger compared to Urambo market which is also a production area.

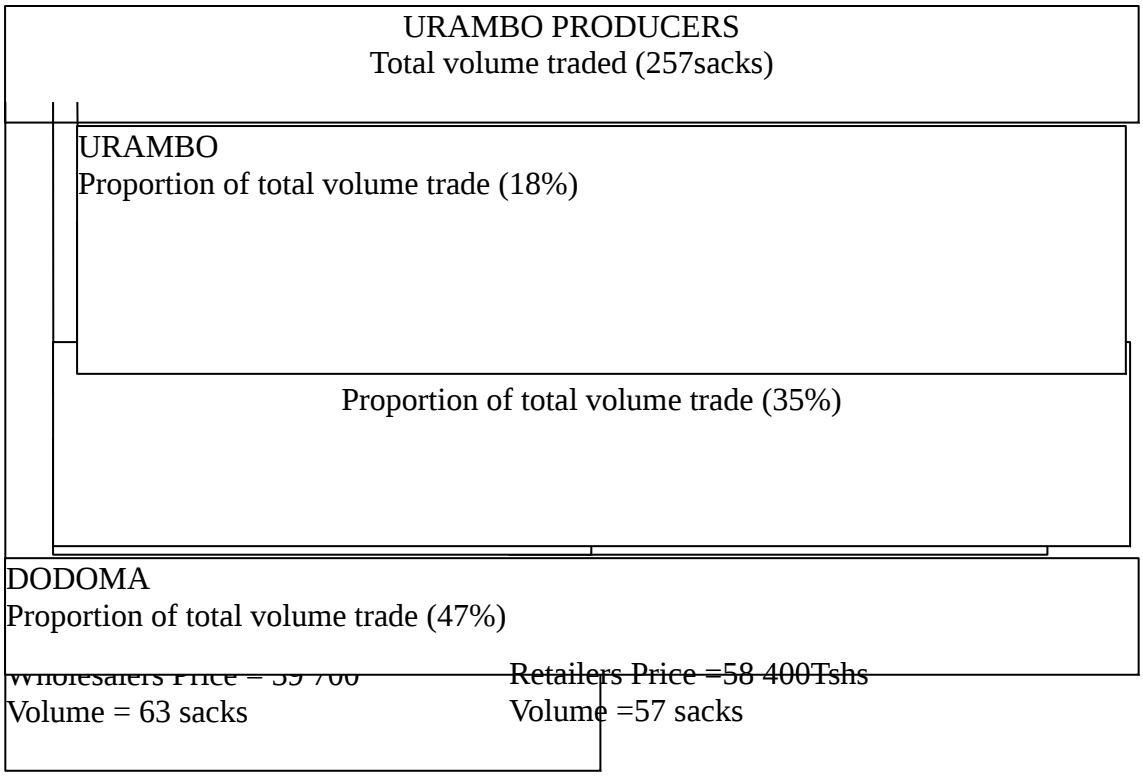

Figure 3: Flow chart for product and prices in markets

4.5 Paired Comparison and hypotheses testing for equality of profits

This section intends to test the hypotheses that there is no significance difference on net gains between producers and traders in the mango value chain. The hypotheses about equality of means of net income gained per sack of mango sold for the paired samples of the value chain agents were tested at 5% significant level (95% confidence level) by using a paired two tailed test at appropriate degrees of freedom as shown in Table 20. The results show that at 1% level of significant there are significant differences between mean gains per sack sold for all the given pairs of marketing agents.

Traders in the markets gain more than producers with exception of Tabora and Urambo wholesalers who gains less profit per sack than producers. If producers could sell their mangoes as retailers at Dodoma market they could get additional 30 200Tshs per sack or extra 16 150 Tshs per sack if act as wholesaler at the same market. However this has never been possible, farmers have always remained low price takers in the local markets. Itika, (2005) found similar results that small holder farmers remains weaker, disadvantaged and locked in the bottom section of the chain regardless of whether the value chain activities are increasing or decreasing at domestic level. Therefore producers can achieve high profit margins through horizontal integration whereby producer firms can join to form collective efforts in marketing and do vertical integrations where they collectively can add value to their produce through either processing or transportation and sell to the highly paying markets.

Furthermore results in Table 20 also imply that the high margins were associated with

urban markets whereas farmers can't manage to access due to lack of capital, time, knowledge and market information and consequently the industry continue to remain unprofitable to them.

Table 20: Paired Samples T-Test for differences between net gains per sack in Tshs

Paired samples	Paired Differences					t	df	Sig. 2-tailed
	Diffs. Mean	Std. Dev.	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
1 Dodoma vs. Tabora retailers	21894	1790	895	19046	24742	24.46	3	0.000
2 Dodoma vs. Urambo retailers	27225	3281	1641	22004	32446	16.60	3	0.001
3 Tabora vs. Urambo retailers	5656	1812	685	3981	7332	8.26	6	0.000
4 Dodom retailers vs. producers	30197	1996	998	27021	33372	30.26	3	0.000
5 Tabora retailers vs. producers	8113	1109	419	7087	9138	19.35	6	0.000
6 Urambo	2361	1097	366	1518	3204	6.46	8	0.000

	retailers vs. producers								
7	Dodom vs. Tabora wholesalers	14163	1768	722	12308	16018	19.62	5	0.000
8	Dodoma vs. Urambo Wholesale	16146	969	366	15251	17042	44.10	6	0.000
9	Tabora vs. Urambo Wholesale	2072	1199	489	814	3330	4.23	5	0.008
10	Dodoma Wholesalevs. producers	12571	1046	395	11604	13538	31.80	6	0.000
11	Tabora Wholesale vs. producers	-1495	944	386	-2486	-504	-3.88	5	0.012
12	Urambo Wholesale vs. producers	-3576	362	137	-3910	-3241	26.13	6	0.000

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

i) Mango production is cheap compared to other crops because it does not involve too much costfull operations; it is intercropped with annual crops and grows in a range of soils even in marginal land.

ii) Mango is produced in large quantities in the study area but very little is sold due to dominance of local varieties that are not preferred in markets.

iii) Contribution of mangoes to the total household income under the current situation is low because not all mangoes which are available for sale access market that offer reasonable prices.

iv) Improvement of marketing functions such as transportation, handling, storage, and processing as well as marketing research will appreciably increase the contribution of mangoes to the total household.

v) Mango is more environmental friendly as it adds trees to the land compared to tobacco which causes deforestation, environmental toxicity through fertilizer and agrochemicals.

vi) Although farmers showed preference to mango production and even to replace tobacco if market works, this will involves structural change in farming system where by sometime market may fail to work for farmers.

5.2 Recommendations

i) Expanding the supply of seedlings for internationally traded commercial mango varieties such as Alfonso, Tommy Atkins and Red Indians to farmers in the study area is required in order to boost up the volume of mangoes marketed as well as income of the poor fruits producers. Farmers should be sensitized to stop intercropping mango with tobacco in order to avoid pesticides with very long residual toxicities such as copper and zinc fungicides. This will allow farmers to market organically grown mangoes in the future.

ii) Government and NGOs should provide training to about business know-how, mango processing and general adherence to good agricultural practices (GAPs) particularly how to control production constraints such as diseases, pests. Farmers should also be trained on proper use of agro-chemicals in order for their products to meet MRL-maximum residual level required by the international markets; enabling traceability of products, meeting international quality standards as well as gaining international certification for the product.

iii) Farmers should collectively join to form farmers SACCOs or Tanzania Farmers Groups Network to enable access of knowledge, market information and credits**.** They can add value to their produce through either processing or transportation and sell to the highly paying markets.

iv) Governments and other development agencies should direct efforts towards promotion of mango marketing for instance involving farmers to initiate projects that will expand marketing facilities such transportation vehicles,

mango storages facilities and establishment of fruit processing factory, establishing the few market places in the district that is convenient for mango producers and buyer to meet for exchange.

v) The government and NGOs should also facilitate farmers groups through training, financial services, credits provision and link to markets in order to be able to establish fruits micro-processing units and make some mango products such as dried mangoes, juice and jam in order to promote mango marketing and increase shelf life of mangoes so as to sell up to off-season.

vi) The Government and NGOs should allocate more funds to research on the demand and supply for Tanzanian mangoes in the national and global markets as well as researching on fruit flies that, currently to large extent affect the quantity of mango produced and quality of standards required in markets.

vii) Farmers preferring to concentrate on mango production so as to replace tobacco if market works, proposed a considerable structural change in farming system. Therefore further research is needed to study and design a highly targeted and systematic program that may have to include compensation when market fails to work.

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APPENDICES

Appendix 1: Questionnaire for Mango Farmers

DIVISION……WARD……....VILLAGE…….DATE……..NUMBER…

A: BASIC INFORMATIONS

1.	Sex	1.Male	2.Female			
2.	Age (Years)		18-35 years	36-45 years	46-60years	Above 60
			1	2	3	4
3.	Marital status	1.Married	2.Single	3.Widowed	4.Divorced	5.Separated
4.	Education level	1.No school	2.Primary	3.Secondary	4.College	5.University
5.	Main occupation	1.Crop Production	2.Livestock	3.Bussiness	4.Employed	5. Others……

6. Indicate the household size and composition of workforce for the year 2009

Age category in years	Under 5	6 to 15	16 to 45	46 to 60	Above 60
Number in each category					

B: PRODUCTION AND MARKETING OF MANGOES

7. How many acres of land do you own/hire for your economic activities? ……
8. How many years since you are doing mango production……
9. Have you ever given any training about production, marketing and processing of fruits? Yes… No...
10. What are the obstacles behind your commercial mango production?……..., ……
11. If all the production and marketing are solved and you want to expand production which crops will be dropped out of your farming system ……, ……,
12. Reasons for drop ……..

13. Among the following who is the main buying agent of you produce? 1. Wholesale 2. Broker (selling agent) 3. Retailer 4.Consumer

14. Do you know any mango market outside the district 1. Yes … 2.No…..

15. If Yes for the just preceded question above mention the markets you know……..

16. Fill the following table about production, costs and revenue from mangoes for the year 2009.

Variety	Dodo	Bolibo	Sindano	Kamba
Number of trees				
Number of Sacks produced				
Number of Sacks consumed				
Number of Sacks damageg by pests				
Number of Sacks sold				
Production costs				
Market costs				
Revenue from sacks sold				

C: PRODUCTION AND REVENUE FROM OTHER NON- MANGO FRUITS.

17. Fill the following table about number trees and revenue obtain from selling of commonly produced fruits that are not mangoes for the year 2009.

Variable	Oranges	Pawpaw	Guava
Number of fruit trees			
Revenue			

D: PRODUCTION AND REVENUE FROM OTHER CROPS

18. Indicate the production and revenue from tobacco and other field crops for the years 2009.

Crop	Acres cultivated	Yield obtained	Revenue obtained
Tobacco (kg)			
Maize (bag)			
Rice (bag)			
Legumes (bag)			
Groundnuts (bag)			
Sunflower (bag)			
Casava (bag)			
S.Potato (bag)			

D: INCOME AND EXPENDITURE PROFILE

19. What were the sources of income for your household in 2008/2009 and how did you spend?

Category of income source	**Amount(Tshs)**	**Expenditure category**	**Amount (Tshs)**
On Farm Activities		(i).Stapple foods and snacks	
(i). All Other cash crops		(ii).Tobacco/ cigarette smoking	
(ii). Tobacco		(iii).Cold and alcoholic drinks	
(iii). Mango		(iv).Clothing	
(iv)Non-mango fruits		(v). Shelter: Rent, Construction, Beds, Mattresses, chair/table, coaches,	
(v) Livestock k		(vi).School fees	
		(vii).Medical expenses	
Off farm activities		(viii).Fuel: Wood/kerosene/Petrol	
(vi). Business		(ix).Remittance to relatives	
(vii. Formal employment		(x).Social contributions	
(viii).Others (specify)		(xi).Purchase of new assets	
		(xii).Transport(Fare, cargoes carriages)	
		(xiii). Ceremonies	
		(xiv).Others spending	

THANK YOU VERY MUCH FOR YOUR COOPERATION

Appendix 2: Questionnaire for Mango Traders

DIVISION……WARD……...VILLAGE……DATE…….NUMBER……..

A: BASIC INFORMATIONS

1.	Name the market that you sold largest volume of mangoes in 2009?.....					
2.	Sex	1.Male	2.Female			
3.	Age (Years)……		(1)18-35	(2) 36-45	(3) 46-60	(4) Above 60
4.	Marital status	1.Married	(2).Single	3.Widowed	4.Divorced	5.Separated
5.	Education level	1.No school	(2).Primary	3.Secondary	4.College	5.University
6.	Main occupation	1.Crop Production	(2).Livestock	3.Bussiness	4.Employed	

B: BUSINESS OPERATION AND EXPERIENCE

7. How many years you are doing mango business?.....
8. Mention the main varieties of mangoes that you sell in the market ……,
9. From what value chain agent do you mainly purchase mangoes that you sell (main purchasing node)? …….1. Farm gate 2.Wholesalers 3.Retailers
10. Which of the following agents did you sell mangoes (operating nodes) in 2009? 1. Wholesalers 2.Retailers 3.Consumers 4. The 1, 2, &3
11. Which of the following buying agents purchased largest quantities of mangoes from you (main operating nodes) in 2009? 1. Wholesalers 2.Retailers 3.Consumers
12. Do you use your own transport to the market? 1. Yes 2. No.
13. What mode of transport do you frequently use to carry produces to the markets?

    1) Bus 2) Bicycle 4. Animal drought 5. Lorry 6.Train
14. What are the problems that face your mango business?……..,……., ……
15. Do you know any International market for mangoes? 1. Yes 2.No.
16. If Yes for question 14 above, mention any International markets for mangoes ……

C: MANGO TRADING, COST AND REVENUE

17. Fill the following table about purchases, marketing cost and sales of different mango varieties for the year 2009?

		Mango variety			
		Dodo	Bolibo	Sindano	Kamba
Number of Sacks Purchased for sale					
Number of fruits per sack					
Buying price per sack					
Marketing cost	Package				
	Loading/offloading				
	Transport				
	Market fees				
	Others (fare, meal, accommodation)				
	Labour cost for selling one sack				
Selling price per sack					
Revenue from mango sales					

"THANK YOU VERY MUCH FOR YOUR COOPERATION"

Appendix 3 : World Mango Production (Top 20 Countries) Ranking Country Production (Metric Tonnes)

1	India	11,400,000
2	China	3,130,000
3	Thailand	1,750,000
4	Mexico	1,523,160
5	Pakistan	1,036,000
6	Indonesia	891,566
7	Philippines	880,000
8	Nigeria	730,000
9	Brazil	542,000
10	Egypt	326,063
11	Haiti	260,000
12	Madagascar	210,000
13	Viet Nam	209,400
14	Cuba	207,770
15	Democratic Republic of the Congo	198,226
16	Sudan	194,000
17	United Republic of Tanzania	190,000
18	Guatemala	187,000
19	Bangladesh	187,000
20	Dominican Republic	185,500

Source: FAO STAT 2000.

Appendix 4: World's top ten mango producers, 1996–2005. in MT

Countries	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2003–2005
	(1,000 metric tons)										(%)
India	11,000	11,000	10,230	9,780	10,500	10,060	10,640	10,780	10,800	10,800	38.58
China	2,074	2,410	2,562	3,127	3,211	3,273	3,513	3,571	3,582	3,673	12.90
Thailand	1,181	1,198	1,088	1,462	1,633	1,700	1,700	1,700	1,700	1,800	6.20
Mexico	1,189	1,500	1,474	1,508	1,559	1,577	1,523	1,362	1,573	1,679	5.50
Indonesia	783	1,088	600	827	876	923	1,403	1,526	1,438	1,478	5.29
Pakistan	908	914	917	916	938	990	1,037	1,035	1,056	1,674	4.48
Brazil	593	508	469	456	538	782	842	1,254	1,358	1,000	4.30
Philippines	898	1,005	945	866	848	882	956	1,006	968	985	3.53
Nigeria	656	689	731	729	730	730	730	730	730	730	2.61
Egypt	203	231	223	287	299	325	287	319	375	380	1.28
Others	3,248	3,230	3,347	3,656	3,597	3,731	4,001	4,327	4,242	4,308	15.34
World Total	22,733	23,773	22,584	22,584	24,730	24,973	26,634	27,609	27,822	28,508	100.00
Source: FAOSTAT 2007.											

Appendix 5: World's top ten mango exporting countries, 1996–2005. in MT

Countries	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2003–2005
	(1,000 metric tons)										(%)
Mexico	148	187	209	204	207	195	195	216	213	195	22.64
India	27	45	47	38	39	46	42	179	156	223	20.25
Brazil	24	23	39	54	67	94	104	138	111	114	13.18
Pakistan	18	25	39	41	48	52	48	60	82	49	6.94
Netherlands	21	25	17	37	34	43	33	58	51	69	6.42
Peru	11	6	11	20	21	27	35	40	60	58	5.71
Ecuador	0	2	7	0	26	34	30	38	41	40	4.31
Philippines	40	45	53	35	40	39	36	38	36	25	3.61
Thailand	8	9	10	10	9	11	9	8	33	2	1.55
China	12	7	9	10	5	5	15	22	10	4	1.31
Others	80	104	87	103	132	121	127	126	127	135	14.08
World Total	391	478	529	552	628	666	673	923	920	913	100.00
Source: FAOSTAT 2007.											

Appendix 6: World's top ten mango importing countries, 1996–2005 in MT

Countries	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2003–2005
	(1,000 metric tons)										(%)
United States	171	187	197	219	235	238	263	278	276	261	32.70
Netherlands	25	34	35	63	62	70	71	91	76	98	10.62
United Arab Emirates	28	37	48	48	42	46	52	62	58	51	6.82
Saudia Arabia	10	16	14	9	28	36	35	40	42	51	5.32
China	36	40	47	33	33	34	38	47	57	19	4.91
Bangladesh	5	9	0	11	21	21	14	43	37	36	4.63
United Kingdom	16	18	18	23	22	27	24	32	37	47	4.63
Germany	13	17	17	24	23	25	28	32	33	37	4.11

France	18	23	22	31	26	26	27	32	35	35	4.09
Malaysia	14	6	21	1	20	27	31	26	45	19	3.59
Others	61	68	66	84	114	106	101	142	148	173	18.58
World Total	398	454	486	545	628	656	684	825	843	827	100.00
Source: FAOSTAT 2007.											

Appendix 7: Gains per sack sold by traders in Different markets