

**VALUE CHAIN ANALYSIS OF TAMARIND FRUITS IN KISHAPU DISTRICT,  
TANZANIA**

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE  
REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN  
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## ABSTRACT

The study was conducted to analyse value chain of tamarind fruits by characterising the actors, assessing socio-economic factors influencing income from tamarind fruits, determining the gross margins, identifying trees ownership regime and challenges encountered in the value chain. Primary data were collected through household survey, market survey, focus group discussion and key informant interviews. A random sample of 176 households, 33 traders and 59 consumers were interviewed to gain their insights on the topic. Low price, limited access to market, lack of market awareness, poor storage facilities, lack of price information and limited number of buyers are the major constraints faced by harvesters in the value chain. Large proportion of tamarind fruits harvested from homestead land, followed by farmland and grazing land. Among the market participants, retailers showed highest gross margin, followed by middlemen and harvesters. The higher margin gained by retailers was due to higher selling price and low inputs costs such as low transport cost and low cost of labour. Regression of socio-economic factors showed that the number of tamarind trees owned and quantity sold significantly contributed positively to tamarind income ( $P < 0.001$ ) while selling price significantly contributed positively to tamarind income ( $p < 0.05$ ). Experience in harvesting significantly reduces the income from tamarind fruits ( $P < 0.05$ ). The contribution of tamarind fruits to household income (3.4%) would have been enhanced under well organised market conditions. Government, NGOs and individual should consider the establishment of fruit processing factory of tamarind fruits into consumable goods such as tamarind juices, tamarind jam, tamarind syrup and candy in order to utilise fully the economic potential of tamarind fruits in Kishapu District.

## DECLARATION

I, Hamza Omari, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted to any institution.

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## **DEDICATION**

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**LIST OF ABBREVIATIONS**

FAO	Food and Agriculture Organisation
FPCF	Finite Population Correction Factor
GM	Gross Margin
HASHI	Hifadhi Ardhi Shinyanga
ICRAF	International Centre for Research in Agroforestry
IFAD	International Fund for Agricultural Development
IFTs	Indigenous Fruits Trees species
IGAs	Income Generating Activities
NTFPs	Non – Timber Forest Products
SNAL	Sokoine National Agricultural Library
SSA	Sub – Saharan Africa
TJC	Tamarind Juice Concentrate
TKP	Tamarind Kernel Powders
TR	Total Revenues
TVC	Total Variable Costs
TZS	Tanzanian shillings
URT	United Republic of Tanzania
VCA	Value Chain Analysis

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background

Worldwide, forests provide a large variety of wood and non-wood forest products (NWFPs) which may enhance economic development when under proper utilisation (Stryamets *et al.*, 2011). NWFPs are defined as all products of biological origin other than wood and they can be derived from wild, plantations forests, agroforestry schemes as well as they can be harvested from trees outside the forests such trees in homesteads (Hangen, 2011). The role of NWFPs in securing and maintenance of food security, human health, cultural value and income generation in different places of the world are widely documented. According to Stryamets *et al.* (2011) about 80 percent of the population in developing countries depend on NWFPs for their nutritional needs, herbal medicine and cultural resources needs for local livelihoods.

Information regarding utilisation of NWFPs from different areas such as south of Sahara could help to put the most important potentialities of these resources into uses (Makonda, 1997). According to Makonda (1997), these resources would foster the development and betterment of well-being of the rural population in developing countries although it is difficult to be achieved since some uses of NWFPs were not put into practical consideration inspite of being viable. Successful commercialisation of NWFPs requires robust information, a good policy and regulations as well as a well arranged institutional environment to be able to boost investor confidence in the forest sector (Barirega *et al.*, 2012).



Tanzania is endowed with high biodiversity natural forests which offer a wide range of NWFPs including gums, resins, bark, tannin, aromatics, latex, wild fruits and vegetables, nuts and medicinal plants to mention few (URT, 1998). Efforts have been made to encourage investment in these NWFPs and product development for improving its marketing in order to utilise the full economic potential and enhance domestication and commercialisation of NWFPs of high demand (URT, 1998). Among the wild fruits tree species, there are a number of tamarind trees producing vast quantities of tamarind fruits which need proper commercialisation in deriving its economic, ecological and environment benefits. However, due to poor market information and underdeveloped marketing channels, data on the performance of tamarind fruits industry is either absent or fragmented. Further, the information regarding processing of tamarind fruits as value addition activities is inadequately known and very little considered in both rural and urban areas.

Kishapu District is endowed with substantial quantities of tamarind fruits with a potential contribution to the household income. According to Hatibu (2010) these fruits are harvested for household consumption while some are traded in the local market to generate income. However, the economic viability of tamarind fruits is not fully utilized due to inadequate marketing information and inappropriate marketing channels which hampers the linkage between harvesters, traders and consumers along the market chain. Value chain represents a full range of activities required to bring a product or service to the final consumer (Lusby and Panlibuton, 2004). It includes all the market participants like producers, wholesalers, processors, suppliers, exporters, retailers and consumers. Value chain can help to reveal links between harvesters of tamarind fruits, traders and market conditions. Also, value chain analysis can help to identify constraints along the chain, clarify the relationships of buyers, traders and producers and finally highlights the

distribution of benefits among the chain participants (Lusby and Panlibuton, 2004). Therefore, this study is designed to explore the marketing potential of tamarind fruits by considering its availability and distribution in different tenure systems, its marketing margins and understand the influence of socio-economic factors on income obtained from tamarind fruits. In addition, the views of stakeholders regarding the challenges and opportunities towards proper commercialisation of tamarind fruits will be identified and analysed.

## **1.2 Problem statement**

The economy of Kishapu District depends on agriculture, livestock, non-farm income and forest income (Hatibu, 2010). Due to the constant droughts, the district is encountered with severe crop failures and livestock loses resulting into low households' income and food insecurity. Therefore, households participating in harvesting and trading the fruits of tamarind as among the alternative ways of generating cash income and for overcoming food insecurity. The fruits of tamarind (*Tamarindus indica*) are harvested and widely traded in rural market centres within Kishapu District, transported and traded in major urban centres of Shinyanga and Mwanza respectively. It is true that the fruits of *Tamarindus indica*, *Adansonia digitata*, and *Vitex doniana* act as reliable sources of food and income for households during the dry season (Mwema *et al.*, 2013). Previous study by Hatibu (2010) in Kishapu District quantified only the households' non cash consumption of tamarind fruits while the cash consumption remains unknown. Trade in tamarind fruits is known to contribute to the households' income by either through cash sales or exchanged with food crops such as maize and sorghum through barter system to supplement food demand. Despite the market potential of Tamarind fruits in rural and urban centres, some quantity remained either unsold or not harvested hence remained on the trees and perished. Further, there is insufficient information on how the fruits of

tamarind are channelled in the market to generate either cash income or to enhance the supply of food crops through cash sale and the action of barter system. Due to this scenario, there is inadequate information on harvesting, processing, distribution and retailing to final consumers; a little information exist on prices, demand, processing and marketing costs and how these influence the marketing margin along its market chain.

Normally, the level of supply and utilisation of tamarind fruits like other wild fruits are controlled by the existence of various land tenure systems. Shilabu (2008) provided an insight on the need for farmers to have land tenure and trees security to motivate their participation in adoption of agroforestry technologies. Under this scenario, the role of land tenure in regulating the supply and utilisation of tamarind fruits is essential. In addition, information on value chain of tamarind fruits is inadequately disseminated among the value chain actors and knowledge on how various socio-economic factors influence income generation from tamarind fruits is limited.

Further, harvesters and traders are inadequately informed on how the tamarind fruits marketing operate to enhance the income of rural and urban dwellers. Kagya (2002) highlighted that there is marketing of wild fruits including tamarind fruits in informal markets with no organised marketing channels due to lack of appropriate marketing information. This causes the products to earn insignificant amount of money which does not contribute substantially in poverty reduction (Kagya, 2002). In order to promote proper marketing of dry land non wood forest products such as tamarind fruits, there is a need to know the essential basic information about the role of harvesters and traders, what quantities collected and sold, how the products are processed and what are its associated processing costs and how the profit is distributed among the market participants (Hatibu, 2010).

Study on value chain will be useful in identifying final markets, to identify and characterise key actors and their activities in value chain, to identify and map chain participants based on their roles they perform (Lusby and Panlibuton, 2004). Assessment of market value will be useful for rural poor people to utilize the social and economic benefits of tamarind fruits and to give a clear observation on how profitable it is.

### **1.3 Justification of the study**

The findings of the study will be used by policy makers, private development stakeholders and other beneficiaries to enhance harvesting and marketing of tamarind fruits in the study area. Such information will be useful in determining the value of tamarind fruits, leading to more rational decisions to promote its economic potential as well as maintenance its sustainable utilization. The findings will create the incentives to harvesters to scale-up conservation of tamarind trees through domestication.

Trade of tamarind fruits which is conducted in Kishapu District fall within the informal sector hence not recorded. Currently, Kishapu District emerged as a main supplier of tamarind fruits in Shinyanga urban and Mwanza city. The previous study conducted in Kishapu District quantified the overall contribution of dryland forest to rural livelihoods (Hatibu, 2010); but did not provide substantial coverage on how the transactions of tamarind fruits from harvesters to consumers are undertaken. No study conducted to critically analyse the value chain of tamarind fruits in the study area.

### **1.4 Objectives**

#### **1.4.1 General objective**

The overall objective of the study was to analyse the value chain of tamarind fruits in Kishapu District, Tanzania.

### **1.4.2 Specific objectives**

The specific objectives of the study were to:

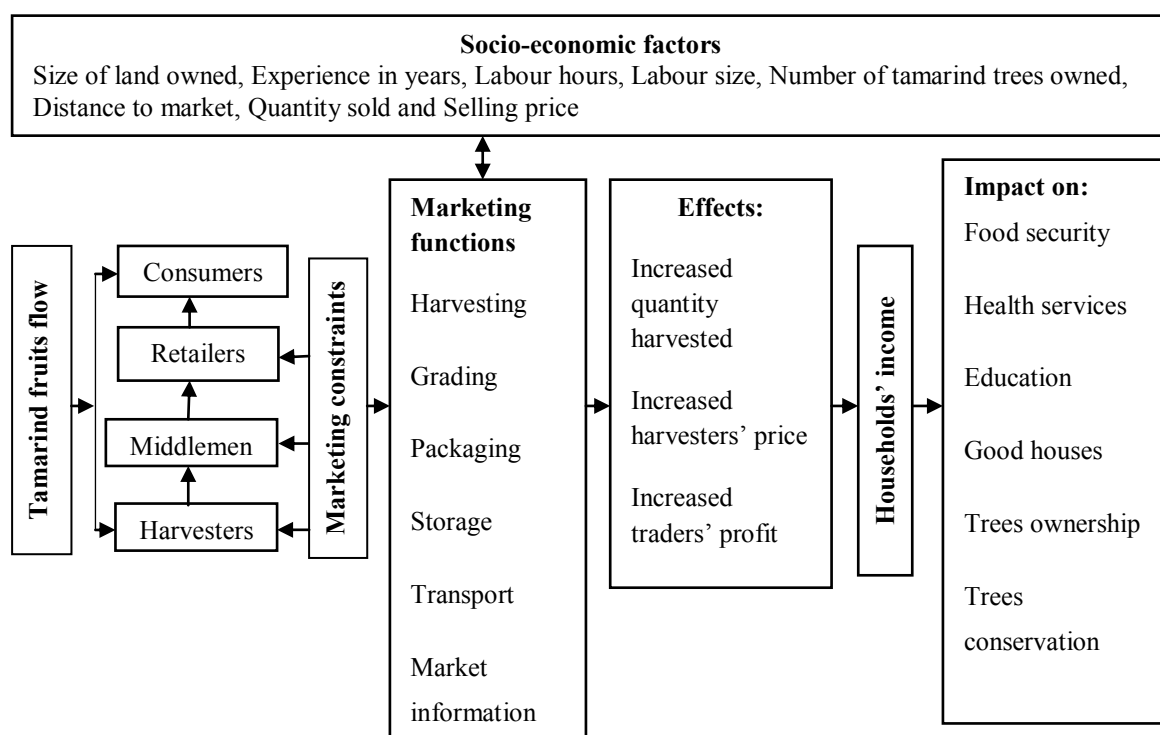
- i. analyse and characterize actors in tamarind fruits value chain.
- ii. estimate profitability in each tamarind fruits value chain node.
- iii. assess the influence of socio-economic factors on income obtained from tamarind fruits.
- iv. analyse challenges towards marketing of tamarind fruits in the study area.
- v. assess the role of land tenure in regulating the supply of tamarind fruits in the study area.

### **1.5 The Conceptual framework**

The conceptual framework acts as a basis for discussing the relationships between different groups, individuals or issues and can always be progressively revisited as further information becomes available (Linda, 1999). The concept governing this study is that tamarind fruits can be the potential source of income and food security to smallholder farmers in Kishapu District if some interventions are properly addressed on its marketing functions. The physical marketing of tamarind fruits begins with harvesting and ends with retailing. This was controlled by harvesters, middlemen and retailers. The quantity of tamarind fruits harvested and traded could be influenced by various socio-economic variables which in turn determine the total income accrued from sales. The socio-economic variables include size of land owned, size of labour, labour hours, number of tamarind trees owned by households, experience in years, quantity sold, selling price and distance to market.

Various factors might hinder proper market functioning of tamarind fruits marketing. These factors include lack of market awareness, lack of price information, limited access

to market, poor storage techniques, high transport costs and limited number of traders in the market chain. However, the existence of good interaction of market participants, existence of adequate market information and the provision of good training package could improve overall market efficiency. The improved market efficiency might induce high price paid to harvesters which might encourage them to increase commodity flow in the market, minimises fruits losses, better profit to traders due to reduced marketing costs and finally households income and food security will be improved. Improvement of household income could lead to improved standards of living such as education, healthy services and good houses. In addition, tamarind fruits marketing promotes ownership and conservation through domestication. Figure 1 presents conceptual framework of tamarind fruits marketing.



**Figure 1: Conceptual framework of tamarind fruits marketing**

## CHAPTER TWO

### LITERATURE REVIEW

#### **2.1 The growing market of wild fruits and its processed products**

Wild fruits are seasonal plant products that are often eaten as either snacks or made into juice (Msola, 2007). In most cases, wild fruits are grown naturally, they are rarely managed by human being unless they are domesticated either for nutritional or commercial purposes. Wild fruits are harvested and utilised from either forest land, agricultural land or within homestead area. They offer great potential for income generation if farmers are linked to markets with reduced input costs and improved selling price (Kehlenbeck *et al.*, 2012). These may be sold and eaten either fresh or processed to consumer goods. As there is decline of forest land due to deforestation, wild fruits trees exposed to severe overexploitation and rapid extinction (Akinnifesi *et al.*, 2007). There is increasing interest and attention among researchers and development practitioners to understand clearly the role of indigenous wild fruits to meet the food needs and income of humanity (Akinnifesi *et al.*, 2007). Decline of forest land, expansion of agricultural land and extinction of wild fruits forced rural households to scale up the domestication of wild fruits trees to meet its increased demand. Despite this situation, tamarind trees remain uncut during land preparation which indicates their significant contribution towards households' income although not yet documented.

However, the growing demand of wild fruits have led to its market expansion and supply shortage which created an opportunity for harvesters and entrepreneurs in harvesting and marketing wild fruits in large scale. Large number or majority of indigenous fruits trees species (IFTs) although relatively not much known in global markets but are locally of great importance for food security and income generation (Kehlenbeck *et al.*, 2012).

The scenario can be demonstrated from sub – Saharan Africa (SSA) where there is substantial growing of wild fruits markets to diversify crop production due to economic and human population growth as well as increasing rate of urbanisation (Kehlenbeck *et al.*, 2012). Recently, indigenous wild fruits in East African countries including Tanzania are harvested uneconomical a situation which limits harvesters to explore its overall economic potential. While there is intensive utilisation of wild fruits in some African countries such as South Africa, in Tanzania the knowledge in utilisation of some wild fruits including tamarind fruits is limited. There are many varieties of indigenous wild fruits and its processed products with major commercial possibilities and market potential but they remained untouched due to limited knowledge in market and market awareness (ICRAF, 2005).

## **2.2 Global production and trade of tamarind products**

Tamarind has a versatile fruits that can be value added into a number of different consumer products which include juice, pulp, powder, sauces, sugar coated candies and tamarind kernel powders (TKP) (PARDI, 2011). Researches show that the seeds, barks and stems of tamarind trees have shown a great potential to have medicinal properties. In addition, tamarind seeds are gaining importance as a rich source of proteins and valuable amino acids (PARDI, 2011). Worldwide, the demand for tamarind processed products exceeds its supply hence create the great deficits for tamarind processed products. Currently, it is true that world demand for tamarind is higher with evidence from India showed that low supply of Tamarind caused the prices to rise since 2011 (PARDI, 2011). This situation created export opportunities for international markets for countries with potential sources of tamarind to increase their production volumes and improve product quality.



India, Thailand and Mexico are the three major countries which dominate the production and exportation of tamarind in the world market. It was pointed out that India is the biggest producer and exporter of tamarind in the world which produce about 300 000 tons annually although it is faced with unfulfilled demand (El-Siddig, 2006). Next to India are Thailand and Mexico which produce about 150 000 and 29 600 tons of tamarind annually, Bangladesh, Sri Lanka and Indonesia are also the major producers of tamarind (Mysore, 2011; De Caluwe *et al.*, 2010). The large portion of tamarind produced in India, Thailand and Mexico is exported to Europe, Arab countries and to the United States (Mysore, 2011). It is estimated that United States import over 10,000 tons of tamarind annually (PARDI, 2011). Other minor producers and exporters of tamarind include Costa Rica and Puerto Rico where as small quantities of tamarind is produced in Africa particularly in Senegal, Cameroon, Gambia, Zambia, Kenya and Tanzania (De Caluwe *et al.*, 2010; Varmudy, 2013). Africa on the whole does not produce tamarind on a commercial scale for export but it is widely produced, traded and consumed by the local people (De Caluwe *et al.*, 2010).

In most of the developing countries, production of tamarind is minor depending on naturalised wild stands since the species has not been considered for improvement either by the forestry or the horticultural sectors. While in some countries such as Mexico showed high potential to expand commercial production of tamarind, data on production and marketing of tamarind is rarely available in developing countries including Tanzania. The only existing information is traditional knowledge on cooking and herbal medicine value of tamarind (El-Siddig *et al.*, 2006). The extent of production of tamarind depends entirely on the potential demand for tamarind processed products. The production may range from scattered trees for subsistence use to large scale plantations for commercial purposes (El-Siddig *et al.*, 2006).

### **2.3 The nutritional value of tamarind tree**

Different parts of tamarind tree have got different uses depending on the needs of the consumers. Leaves, seeds, fruit's pulp, flowers, barks and timbers are found to have potential uses throughout the world. In general, tamarind provides some vitamins (vitamins C and B) together with important minerals like potassium, phosphorus, calcium and magnesium which are commonly help to improve a healthy immune system (Varmudy, 2013). The leaves and flowers are used as important components in meals and drinks because they have high nutritive and calorific value (Varmudy, 2013). Of all the above mentioned parts, the value of tamarind tree is largely determined by the fruit's pulp which has a wide range of uses from domestic to industrial purposes.

### **2.4 Different uses of tamarind fruits**

The composition of tamarind fruit's pulp (Table 1) is the key determinant of its consumption for various purposes. Tamarind fruits contains pulp which is nutritious and rich in vitamins B1 (Thiamine), B2 (Riboflavin) and B3 (Niacin) (Varmudy, 2013). While unripe fruits are roasted and eaten, the ripe fruits are mostly consumed either fresh or semi-processed fruits (Robert *et al.*, 2012). Tamarind fruits are highly marketed throughout the world in sauces, syrups and processed foods. The Tamarind fruit's pulp is used mostly for a wide variety of domestic and industrial purposes. The pulp has either sweet or sour flavour and is rich in tartaric acid and sugar contents (Robert *et al.*, 2012). The sweet tamarind is often eaten fresh directly from the pod, the fully grown but unripe fruits are also can be eaten fresh. The pulp is usually removed from the pod and used to prepare juice, jam, syrup and candy.

**Table 1: Composition of 100g edible portion of tamarind ripe pulp**

<b>Constituent</b>	<b>Composition</b>
<b>Proximate</b>	
Water (g)	28.2 - 52
Energy (Kj)	115
Protein (g)	3.1
Fat (g)	0.1
Carbohydrate (g)	67.4
Fiber (g)	5.6
Ash (g)	2.9
Invert sugars (g)	30 - 41
Tartaric acid (mg)	8.0 - 23.8
<b>Minerals</b>	
Calcium (mg)	35 - 170
Iron (mg)	1.3 - 10.9
Phosphorus (mg)	54 - 110
Potassium (mg)	375
Sodium (mg)	24
<b>Vitamins</b>	
Ascorbic acid (mg)	0.7 - 3.0
Thiamine (mg)	0.16
Riboflavin (mg)	0.07
Niacin (mg)	0.6 - 0.7
Vitamin A	15.0 IU

Source: Robert *et al.* (2012)

**Plate 1: Tamarind tree with unripe tamarind fruits**

Source: Varmudy (2013)



**Plate 2: Ripe tamarind fruits harvested**  
Source: Varmudy (2013)

#### **2.4.1 Tamarind juice**

Tamarind juice is the most consumed tamarind processed product which consists of invert sugars, moisture, tartaric acid, proteins, crude fibres, starch and ash (Table 2). Tamarind Juice Concentrate (TJC) is a convenient product, it dissolve easily and reconstitute in hot water. The TJC can be stored for a long periods without getting damage. TJC is prepared by extracting tamarind pulp and soaking in boiling water using the counter current principle. By this process, an extract is obtained containing 20% soluble solids. Then, the extract is separated from the pulp by sieving and is concentrated under vacuum in a forced circulation evaporator. The yield of the concentrate is about 75% of the pulp after cooling. The best quality TJC is obtained by using recently harvested fruits free from insects and rodents damage.

**Table 2: Chemical composition of tamarind juice concentrate and tamarind pulp powder (%)**

<b>Constituent</b>	<b>Tamarind Juice Concentrate (TJC)</b>	<b>Tamarind pulp powder (TPP)</b>
Moisture	30.0	3.5 - 8.8
Tartaric acid (total)	13.0	8.7 - 11.1
Invert sugars	50.0	15.8 - 25
Proteins	2.0	1.7 - 2.4
Starch		20 - 41.3
Ash		2.1 - 3.2
Crude fibre	2.0	

Source: El-Siddig *et al.* (2006)

#### **2.4.2 Tamarind jam**

This is formed by boiling the pulp for about 10 minutes. The pulp is then drained and separated from the seeds. After separation, the sugar is added and the mixture is then cooked again and constantly stirred while boiling until it becomes thick in consistency.

#### **2.4.3 Tamarind syrup**

This is made by boiling immature fruits pulp until it is soft and then strained. Then, the backing soda is added and the mixture is boiled down to remove the rising scum. The juice is again strained and a sugar is added.

#### **2.4.4 Medicinal value of tamarind fruits**

Different parts of tamarind tree may be utilised for medicinal purposes. Infusions, pastes and powder made from fruit's pulp, seeds, leaves, bark and flower can be used to treat either animals or human problems (Varmudy, 2013). The fruit's pulp is most commonly widely used for medical purpose and recently confirmed to show its laxative and diuretic properties in modern medical science (Varmudy, 2013).

Tamarind pulp has been used for a long time as a medicine and even recently it continues to gain popularity as an important source of medicine and medical component. Tamarind fruit's pulp alone or in combination with lime juice, honey, milk, dates, spices or camphor is used to treat a digestive problems and a carminative, used to remedy for biliousness and bile disorders and febrile conditions. Tamarind fruit's pulp has been used in the treatment of a number of ailments such as malaria fever, leprosy, ulcers, eye infections, rheumatism, fungal and bacterial infections, sore throats, wound dressing, restoration of paralysis as well as used to improve loss of appetite.

### **2.5 Tenure systems and utilisation of forest products**

Tenure arrangements have a big role to influence the interactions between a society and NTFPs resources in terms of harvesting and management (Neumann and Hirsch, 2000). Tenure systems provide the rules which determine who gets to harvest the resources, where to harvest, and what quantity to harvest and who benefit from the harvested resources (Neumann and Hirsch, 2000). Therefore, the concept of tenure comprises the ideas of ownership and a corresponding property rights. Under tenure systems, we can define properly the four types of ownership which are state, private, communal and open access. These have a direct determination of the four basic kinds of property rights which include use, transfer, exclusion and enforcement. In addition, tenure systems provide evidence on who controls access to forest lands and resources overlap about institutional arrangements for forest management (Neumann and Hirsch, 2000).

Forest land tenure combines statutory and customary rights and arrangements for the management and use of forest resources (Kaniki, 2010). It is a major determinant in identifying forest resources users in a specified time horizons under specified conditions (Kaniki, 2010). Land and tree tenure is governed the rights of ownership, use and control

over the natural resources such as land and trees (Martial and Asaad, 2014). The level of utilisation of land and tree resources is determined largely by the rights of farmers to use land and trees for income generation and sustaining their livelihoods. These rights need to be clearly obtained and defined in order to encourage farmers' participation in forest conservation and increases their efforts in tree planting. On the other hand, if these rights are not clearly obtained and defined, farmers will reduce their efforts in tree planting activities (Martial and Asaad, 2014). Furthermore, if the rights and tree tenure systems are properly defined and well arranged, the systems can provide better economic incentives for farmers to plant more trees on their own land.

The study of ownership of trees and their products is of significant potential in managing, conserving and consuming tree benefits while still maintaining a balance in the ecosystem and causing minimum damage to the environment (Martial and Asaad, 2014). According to Adaohuru *et al.* (2012) rights to trees ownership are not clearly defined and always there encountered confusion or uncertainty over their utilisation and creation of major incentives under the context of social forestry programmes. Few studies have been conducted to provide significant amounts of empirical evidence on the influence of tenure systems on the process of commercialisation of NWFPs including tamarind fruits. The supply of tamarind fruits in Kishapu District is controlled by different land use systems under specified ownership regime. Therefore, the extent to which these land systems influence the supply of tamarind fruits need to be clearly tapped.

## **2.6 The concept of value chain analysis**

According to Kaplinsky (2000) value chain describes all activities required to bring a product or services to final consumers and its final disposal after use by passing through a series of intermediary phases of production (transformation and input addition).

Under this aspect, value chain seeks to characterize how chain activities are performed and to understand how value is created and shared among the chain participants. Hobbs *et al.* (2000) cited in Nang'ole *et al.* (2011) defined value chain as one aspect of supply chain which reflects the entire vertical chain of activities. Under this concept, value chain involves activities as from production on the farm, through processing, distribution and retailing to the consumer. Alternatively, this describes the entire spectrum from gate to plate, regardless of how it is organized or how it functions (Nang'ole *et al.*, 2011). Further, value chain provides a useful insight which determines income distribution and the identification of appropriate policy to rectify trends towards poverty and inequality (Kaplinsky, 2000). Also, value chain analysis is essential to understand markets and their relationships, participation of value chain actors and identifying critical constraints that limit production and competitiveness of producers (IFAD, 2010).

### **2.6.1 The need for value chain analysis**

Value chain analysis integrate all the factors of production including land, labour, capital, technology and inputs as well as all economic activities such as input supply, production, transformation, handling, transport, marketing and distribution of product to customers and its delivery for final uses (Tchale and Keyser, 2010). Value chain analysis is essential to be conducted as it provides insights on the role of value chain participants and their linkage to improve the market conditions for overall competitiveness of the final product. The competitiveness of any product depends on the efficiency of input supply, farm production, assembly, processing and distribution up to the final delivery point where the good competes in the marketplace (Lusby and Panlibuton, 2004). Value chain participants may also be not aware of their linkages in their operation with other upstream or downstream participants (Tchale and Keyser, 2010).



### **2.6.2 The role of value chain mapping**

Mapping of the value chain is a vital step in which enable to capture the different dimensions of value chain in a particular value chain study. The dimensions of the value chain like product flows, the actors involved in the chain, costs and margins at different levels of value chain nodes are captured by value chain mapping (M4P, 2008). Value chain mapping create awareness of actors to have broad perspective beyond their involvement in the value chain and help them to get an extensive understanding of connection between actors and the value chain processes (M4P, 2008). Value chain mapping also has the role of identifying the location and position of the poor in the value chain as they are primarily targeted population for poverty reduction (M4P, 2008). Therefore, as the resources available are limited, it is crucial to prioritise dimensions of the value chain to be mapped based on the scope and objective of the value chain analysis.

### **2.6.3 Value chain governance and coordination**

Value chain governance express the relationship of buyers, sellers, service providers and its respective regulatory institutions which operate to influence a series of activities required to bring a product or service from inception through production to its end use (Paul, 2010). Value chain governance can be regarded as a useful means for crafting effective policy tools for industrial upgrading, economic development, employment creation and poverty alleviation. It consists of three key determinants; complexity of transactions, codifiability of information and capability of suppliers (Gereffi *et al.*, 2005). Theoretically, value chain governance is based on three factors; the complexity of information and knowledge transfer, the extent to which this information and knowledge can be codified and transmitted efficiently and the capability of the actual and potential suppliers in relation to the requirements of the transactions (Gereffi *et al.*, 2005).

Value chain governance patterns are either not static or strictly associated with particular industries. Value chain governance depend primarily on the details of the interactions between value chain actors, how technologies are applied to design, production and the governance of the value chain itself (Gereffi *et al.*, 2005). In most of the value chains interactions or marketing systems, the area of governance has been given less attention (Dietz, 2011). Value chain governance create a significant potential for capacity building of smallholders within the value chain through lead actors to enable the small producers to strengthen their position in the value chains and escape from poverty (Dietz, 2011).

Further, the value chain governance enforce three key parameters include what is to be produced, how it is to be produced and how much is to be produced (Dietz, 2005). Moreover, value chain governance also determine both vertical and horizontal interactions between actors in the value chain. Vertical interactions exists between actors that perform different functions whereas horizontal linkages exists between actors who perform the same functions in the value chain.

Value chain coordination refers to the management of day to day activities that can be performed in different nodes of the value chain by different actors. These coordinative roles are dynamic and vary from time to time as the number of actors along the chain may change. The main concern of value chain management is how to coordinate the independent players to work together as a whole to pursue the common goal of chain profitability in changing market conditions (Simatupang *et al.*, 2002). Coordination in value chain provides better link to the discrete activities between different chain actors, establishing and managing the relationships between the chain actors who form the major link and organise the logistics for the domestic, national, regional or global value chain perspective (Nugraha, 2010).

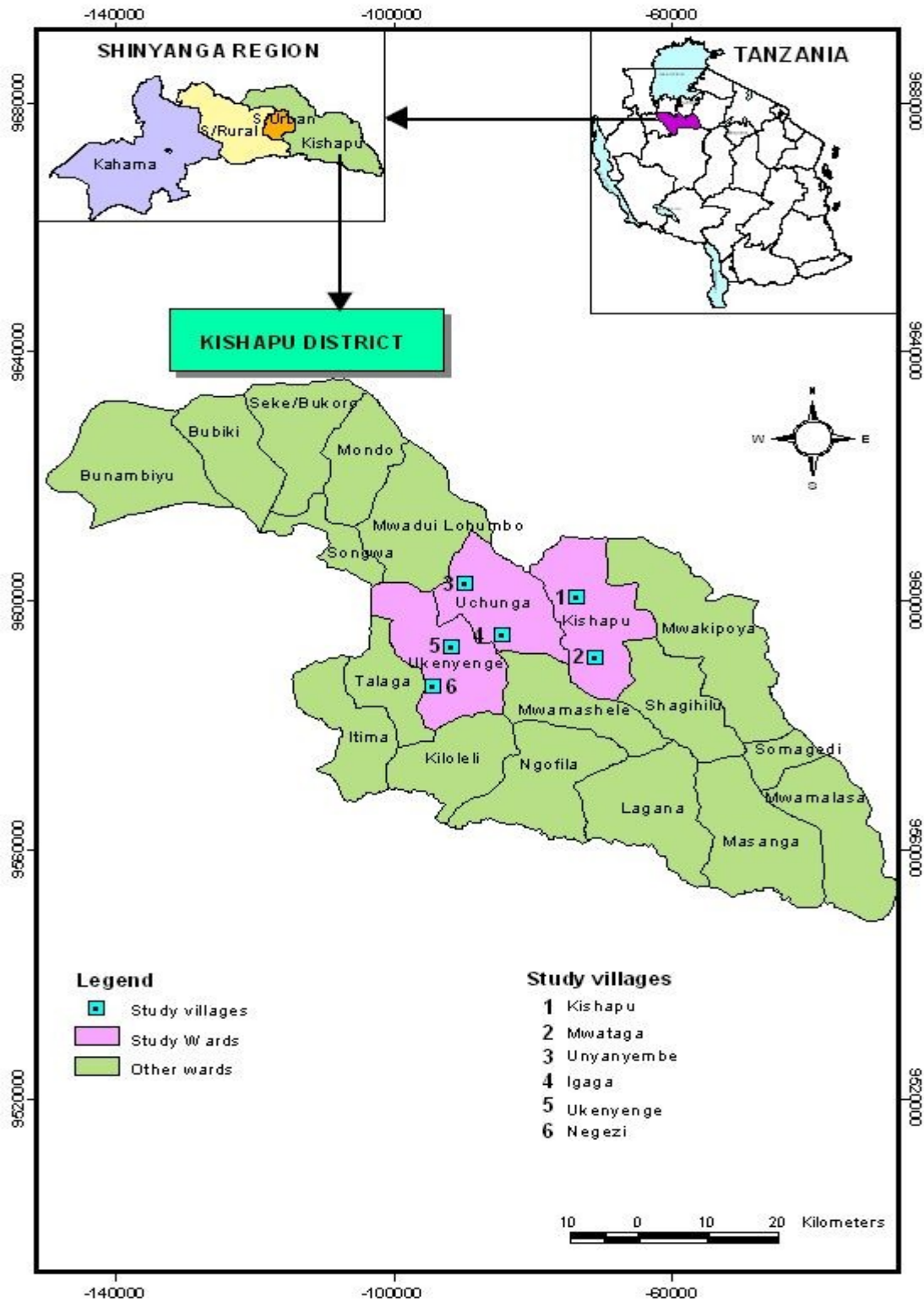
## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.1 Description of the study area**

##### **3.1.1 Location and size**

The study was conducted in six villages of Kishapu District namely Negezi, Ukenyenge, Kishapu, Mwataga, Unyanyembe and Igaga A villages (Figure 1 below). The district is one of the four districts forming Shinyanga Region, other districts are Kahama and Shinyanga rural. The district is located in the South-East of Shinyanga Region and lies between latitude 3°15''S-4°05''S and longitude 31°30''E-34°15''E (URT, 2009). It covers an area of about 4333 km<sup>2</sup>. About 2% of the area is covered by natural dryland forests, 47% is agricultural land, 18% is grazing land, 5% is settlement and 28% is gully and rocks areas (URT, 2009). The District is bordered by Meatu and Iramba Districts in the East, Shinyanga rural and Shinyanga Urban Districts in the West, Kwimba and Maswa in the North and Igunga District in the South.



**Figure 2: The map of Kishapu District**

Source: Kishapu District Council with minor modification

### **3.1.2 Economic activities**

The major economic activities in Kishapu District are subsistence agriculture and livestock keeping which together form about 88.1% of the total economic activities. These are followed by forestry and fishing (6.3%), mining (0.90%), petty trade (0.90%) and others (3.9%) (Hatibu, 2010). Recently, the harvesting and selling of tamarind fruits become increasing due to the expanding market in both rural and urban centres particularly in Shinyanga urban and Mwanza city. The availability of these markets had attracted some villagers to conserve their tamarind trees for sustainable utilisation of tamarind fruits.

### **3.1.3 Climate and vegetation**

The Climate of Kishapu District is a dry tropical climate with temperature ranges from 22<sup>0</sup>C to 30<sup>0</sup>C. The District receives mean annual rainfall ranges from 450mm to 990 mm per annum. Rains start late October or early November and usually unreliable and unevenly distributed. The dominant vegetation in Kishapu District including variety of acacia species such as *Acacia tortilis*, *Acacia polyacantha*, *Acacia nilotica*, *Acacia seyal* and *Acacia senegal*. Other tree species found in the District include *Tamarindus indica*, *Adansonia digitata*, *Balanite aegyptiaca*, *Albizia* species and *Commiphora* species respectively (HASHI-ICRAF, 1997).

### **3.1.4 Topography and soils**

Kishapu District is characterized by flat and gently undulating plains covered with low and sparse vegetation. The District is divided into three agro-ecological zones with soils the characterized as low land with black soil, undulating land with sandy soil and undulating land with calcareous soil (URT, 2003).

### **3.1.5 Population**

According to the 2012 national population census, Kishapu District has a population of 272 990 persons (URT, 2003). The population include 135 269 men (49.5% of total population) and 137 721 women (50.5% of total population). The population growth rate for Kishapu District is 3.9%, and therefore the estimated current population is about 396 685. The ethnic groups living in the study area include Sukuma, Nyiramba and Taturu. Based on this research, the study villages had a population of 13 878 which include 6273 men and 7505 women as shown in Appendix 1.

### **3.1.6 Selected wards for study**

Three wards from Kishapu District were selected for the study. The selected wards were Ukenyenge, Kishapu and Uchungu. A total of six villages comprised of two villages from each ward were selected for household survey. The selected villages were Negezi and Ukenyenge from Ukenyenge ward, Kishapu and Mwataga from Kishapu ward, Unyanyembe and Igaga from Uchungu ward. These villages were selected based on the availability of large number of tamarind trees. Also the villages were selected because they participated to large extent in harvesting and selling of tamarind fruits.

## **3.2 Research design**

Cross sectional design was used to collect data from harvesters of tamarind fruits at households' level and transactions at harvesters and traders. Cross sectional research design was chosen because it allows collection of detailed data from respondents at one point in time (Paul, 2010).

### 3.3 Sampling procedure and sample size determination

#### 3.3.1 Sampling procedure

Kishapu District was purposely chosen due to its potential in the supply of tamarind fruits throughout Lake Zone area. Six villages from three wards and four markets were purposely selected based on the availability of tamarind trees and the supply of tamarind fruits in the markets. Also the six villages was selected based on the extent of harvesting and participation in trade of tamarind fruits in the study area. This has made possible due to efforts made by HASHI-ICRAF project and other stakeholders to enhance the conservation and promotion of natural regeneration of prioritized tree species. Simple random sampling was used to select harvesters and traders for questionnaire survey and market survey. Consumers were purposely selected during the market survey.

#### 3.3.2 Sample size determination

A list of tamarind fruits harvesters and traders was developed by the assistance of District Forest Officer, village leaders and markets' leaders. This was used as a sampling frame in which a representative sample of harvesters and traders were drawn (Table 3). 59 consumers were interviewed during the market survey. Considering the time and cost for this research, the following formula was used to select 176 harvesters and 33 traders of tamarind fruits for interview (Lusambo, 2009).

$$n = \frac{n_0}{1 + \frac{n_0}{N}} \dots\dots\dots (1)$$

Where,

n = Sample size for finite population (to be calculated)

N = Sampling frame (a list of harvesters or / traders of tamarind fruits)

$1 + \frac{n_0}{N}$  = Finite Population Correction Factor (FPCF).

$n_0$  = Sample size for infinite population ( $n_0 = 384$ )

Where as sample size for infinite population ( $n_0$ ) was computed by considering confidence limit, population variance and sampling error (SE).

$$n_0 = \frac{t^2 \times \text{Variance}}{SE^2} \dots\dots\dots (2)$$

Where,

t = t – value at 95% level of significance (1.96)

Variance = Variance of population to be sampled

SE = Sampling error

Due to the sampling formula given above, the sample size was computed based on the number of harvesters in each study village and the numbers of traders in selected markets. Since the number of harvesters and traders differ in each study villages and markets, similarly different sample size was obtained for each village and market making a total of 176 harvesters and 33 traders (Table 3 and 4).

**Table 3: Number of households sampled in Negezi, Ukenyenge, Kishapu, Mwataga, Unyanyembe and Igaga in Kishapu district, Tanzania**

No	Name of the village	Number of households
1	Negezi	33
2	Ukenyenge	37
3	Kishapu	29
4	Mwataga	24
5	Unyanyembe	28
6	Igaga	25
	<b>Total</b>	<b>176</b>

A list of tamarind fruits traders was developed in four markets, two markets from Shinyanga urban and two markets from Mwanza city. Table 4 below represent the number of traders surveyed in the selected markets. The four markets were selected based on the number of traders available in the market and quantity of tamarind fruits supplied in the markets annually. A total of 33 traders were interviewed during the market survey.



**Table 4: Number of traders surveyed in Soko kuu, Nguzo nane, Pamba and Kirumba markets**

Name of market	Retailers		Middlemen	
	Frequency	Percent	Frequency	Percent
Soko kuu	6	24	1	12.5
Nguzo nane	8	32	4	50
Pamba	5	20	3	37.5
Kirumba	6	20	0	0
<b>Total</b>	<b>25</b>	<b>100</b>	<b>8</b>	<b>100</b>

### 3.4 Data collection and analysis

#### 3.4.1 Data collection

Both primary and secondary data were collected in this study. Primary data was collected by using questionnaire through household survey and market survey while checklist was used to collect data through key informants and focus group discussion. Secondary data was collected from previous works in published and unpublished documents such as previous reports from District and Regional offices, pamphlets, journals, text books, proceedings and internet for supplementing the primary data. Some of them can be obtained from Sokoine National Agricultural Library (SNAL).

#### 3.4.2 Questionnaire survey

Questionnaire survey was conducted for all 176 randomly selected households between April and June 2015. The respondents were the head of households selected during the survey. The selected households represented harvesters of tamarind fruits in the study villages. The data which was collected at the household level included socio-economic factors that influencing harvesting and marketing of tamarind fruits in the study area. In addition, challenges associated with marketing of tamarind fruits were analysed. Finally, harvesters were asked to give their suggestion regarding the identified constraints for improving marketing of tamarind fruits in the study area. The tool used to collect data during questionnaire survey indicated in Appendix 2.

### **3.4.3 Market survey**

Four markets were chosen for market survey; two in Shinyanga urban and two in Mwanza city. The markets were chosen based on the level of supply of tamarind fruits annually. During the market survey, middlemen and retailer were asked about their characteristics, quantities bought and sold, buying price, selling price and marketing costs associated in tamarind fruits business. Consumers were asked to respond on their perception and preferences towards consumption of tamarind fruits. Questionnaire used to collect data during market survey is attached in Appendix 3 and Appendix 4.

### **3.4.4 Focus group discussion**

Checklist was developed to collect information from key informants or focus groups in order to cross check or to supplement the information given by respondents during the questionnaire survey. The groups of about 10 people were formed and interviewed to gain information about their views and experiences of the topic (Krueger, 2002). The focus group discussion consisted of village leaders, the leaders of village environmental committee, District natural resource officers, District agricultural and extension officers. The key informants were well knowledgeable on the topic and during the discussion they tried to provide detailed information about the issues which were discussed. The checklist used in focus group discussion and key informants is attached in Appendix 5 and 6.

## **3.5 Data analysis**

The primary data was analysed by using Statistical Package for Social Science (SPSS) and Ms excel software. The primary data consisted of both qualitative and quantitative data. The qualitative data of harvesters and traders was done by the use of means, frequencies and percentages while quantitative data was done by the use of maximum, minimum, means and standard deviation.

### 3.5.1 Content analysis

Content analysis was used to analyse qualitative information given during questionnaire survey, key informants and focus group discussion. The information obtained from focus group discussion and key informants were simplified into smallest meaningful units of themes. The information was quantified, coded and broken down into manageable categories of sentences and themes to make their inferences within the text. This type of analysis helps to realise the values and attitudes of the respondents.

### 3.5.2 Gross margin analysis

Gross margin analysis was used to determine the profitability of harvesters and traders in value chain nodes. The gross margin was determined by subtracting total variable costs from total revenues of each trader in the value chain nodes.

Gross margin = Total revenues – Total variable costs

$$GM_{ij} = TR_{ij} - TVC_{ij} \dots \dots \dots (3)$$

Where;

$GM_{ij}$  = Gross margin for actor i at node j

$TR_{ij}$  = Total revenues of actor i at node j

$TVC_{ij}$  = Total variable costs of actor i at node j

### 3.5.3 Regression analysis

Multiple regression model was used to examine the influence of socio-economic factors on the income obtained from tamarind fruits. The model is chosen because it is simple and can test for the significance of more than one predictor variables influencing the dependent variable at once (Mkenda, 2011).

**Model specification:**

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \mu_i \dots \dots \dots (4)$$

Where;

Y = income generated from sales of tamarind fruits,  $\beta_0$  = constant term,  $X_1$  = household labour size,  $X_2$  = labour hours,  $X_3$  = experience in years,  $X_4$  = size of land owned,  $X_5$  = number of tamarind trees owned,  $X_6$  = quantity sold,  $X_7$  = selling price and  $X_8$  = distance from household to market,  $\beta_1 - \beta_8$  are the coefficients estimates of independent variables where as  $X_1 - X_8$  are independent variables,  $\mu$  = error term.

**3.5.4 The unit of measure**

The common unit of measure used by harvesters when selling their tamarind fruits was either sack, tin or kilogramme. One sack comprises of six tins where as one tin comprises of at least 15 kilogrammes. Since most of the middlemen and retailers sell their tamarind fruits either per kilogramme or per packet, the computations about gross margins and marketing margins was done in kilogramme as the functional unit.

**3.6 Pre-testing and pilot-testing the questionnaire****3.6.1 Pre-testing**

The developed questionnaire was improved by reviewing the literature on relevant field of study. It was done before the actual questionnaire survey conducted. The trained fieldwork assistants were used as a proxy for reviewing the questionnaire. This was an important step undertaken as to ensure comprehensiveness of the questionnaire and to allow amendments for further improvement (Mkenda, 2011).

### **3.6.2 Pilot-testing**

Before the actual data collection was done, preliminary visits were done to the villages in order to introduce the study and pilot-testing the questionnaire. The questionnaire was pilot- tested in two villages and two markets with at least ten randomly selected harvesters in each village, three middlemen and five traders from the two selected markets. The Pilot-testing of the questionnaire was done in order to allow amendments of the questionnaire and to practically improve the theoretical training of the field assistants (Lusambo, 2009).

## **CHAPTER FOUR**

### **RESULTS AND DISCUSSIONS**

#### **4.1 Socio-economic characteristics of the households' heads**

Household's socio-economic characteristics are very important factors in determining the annual income generated by household as well as it determine how much income was spent annually.

The results of this study revealed the presence of larger number of men than women as households' head in the sample villages. The results revealed that 58% of sampled households were headed by men while 42% headed by women (Table 4). The results implied that men owned larger proportion of tamarind trees than women who owned only smaller proportion of tamarind trees throughout the study villages. Most of the households' heads in the study area were married by 73.86%, very few were not married (3.98%) and widowed households' heads was 15.34% as indicated in Table 5 below. Other marital status of respondents revealed that 5.68% were divorced while 1.14% was separated. For this case, married households had more chance of involved in various income generating activities including harvesting and selling of tamarind fruits.

Education levels of respondents show that 61.93% attained primary education, 2.84% secondary education, 0.57% college education and 34.66% were either no education or attained informal education. The results of this study also revealed that majority of the households' head were aged between 31 – 45 years (37%) followed by age group of 46 – 60 years (29%), 18 – 30 years (22.7%) and finally above 60 years 11.3%. This result imply that most of the youth owned large number of tamarind trees which were either inherited from their parents or bought from other villagers. Also the results revealed that

apart from other income generating activities, most of the youth were more engaged in harvesting and selling of tamarind fruits than elder people. Only few elders, 11.3% were observed to own a significant number of tamarind trees. This is due to the reason that marketing of tamarind fruits is labour intensive especially in harvesting, shelling and bagging (Mwema *et al.*, 2013). For the traders' side, the results show that about 63.8% were aged between 31 – 45 years followed by age group of 46 – 60 years (24.2%), 18 – 30 years (12.2%) and there was no any trader found with age above 60 years. The results show that there were no elder people who engaged in tamarind fruits business.

**Table 5: Socio-economic characteristics of respondents**

Characteristics	Harvester (N = 176)		Traders (N = 33)	
	Frequency	Percent	Frequency	Percent
<b>Gender</b>				
Male	102	58	26	78.8
Female	74	42	7	21.2
<b>Age</b>				
18 – 30	40	22.7	4	12.2
31 – 45	65	37	21	63.6
46 – 60	51	29	8	24.2
Above 60	20	11.3	0	0
<b>Marital status</b>				
Single	7	4	6	18.2
Married	130	73.9	21	63.6
Divorced	10	5.7	4	12.2
Widowed	27	15.3	2	6
Separated	2	1.2	0	0
<b>Education level</b>				
No school	61	34.7	5	15.2
Primary education	109	61.9	20	60.6
Secondary education	5	2.8	6	18.2
College education	1	0.6	2	6

Age composition of households as shown in table 6 below was range from below 5 years to above 60 years. The majority of households consisted of age range between 18 to 45 years which estimated to be 33.33%, followed by age group between 6 to 17 (27.72%), below or equal to 5 years (21.26%), between 46 to 60 years (9.27%) and above 60 years (8.42%). The result implies that most of the households composed of age group which could be involved in various income generating activities including tamarind fruits business.

**Table 6: Age composition of sampled households**

<b>Variable</b>	<b>Frequency</b>	<b>Percent</b>
0 to 5 years	121	21.26
6 to 17 years	132	27.72
18 to 45 years	145	33.33
46 to 60 years	82	9.27
Above 60 years	71	8.42
<b>Total</b>	<b>551</b>	<b>100</b>

Note: N = 551 because of a multiple response

#### **4.1.1 Main occupation of the households**

The main occupation of the surveyed households were categorised as crop production, livestock keeping, business and employment (Table 7). The results show that large proportion of harvesters of tamarind fruits were farmers (61.1%), followed by livestock keepers (34.8%), Businessmen (3.8%) and employee (0.3%). This was because most of the surveyed households were engaged in subsistence farming as the main source of income and food security.

Also it was due to the reason that agricultural productivity was declined and farmers participated in harvesting and selling of tamarind fruits to supplement food shortage and



household income. The results is similar to that obtained by Kilonzo (2009), who observed that farmers were the main collectors of NTFPs around Nyanganje Forest Reserve because they are of great economic value. It was reported that, the extent of harvesting and selling of tamarind fruits was increased during the season of low harvest of food crops specifically maize, sorghum, millet and sweet potatoes.

The harvested tamarind fruits was either sold to traders to generate income or exchanged with food crops such as maize, sorghum or millet for maintenance of food security. This finding does not differ from Lema (2003) who observed that farmers in Morogoro rural District obtained cash from sell of NTFPs which in turn used to buy food during food scarcity. Similarly, the results does not differ from Maximillian (1998) who observed that large proportion of farmers (74%) around North Ruvu Forest Reserve in Kibaha District were engaged in collecting the fruits of *Vitex doniana*, *Sclerocarya birrea* and *Tamarindus indica* to augment their income.

**Table 7: Main occupation of households in the study area**

<b>Occupation</b>	<b>Frequency</b>	<b>Percent</b>
Crop Production	174	61.1
Livestock	99	34.8
Business	11	3.8
Employed	1	0.3
<b>Total</b>	<b>285</b>	<b>100</b>

Note: N = 285 because of a multiple response

#### **4.1.2 Size of land cultivated and crops yields per acre in 2014**

Table 8 indicate the mean yield per crop per acre for the surveyed households in the study area. The results shows that millet was cultivated with a mean land size of 10.8 acre per household whereas cotton observed to have a mean yield of 181 kg per acre. Millet and sorghum was the common crop cultivated as staple food instead of maize which observed

to have a mean yield of 2 sacks per acre due to its poor performance in agricultural land. The sampled households had shown higher preferences towards maize consumption than millet and sorghum as staple food commonly used. During the onset of dry season, some households which faced with limited supply of maize they engaged in harvesting and selling of tamarind fruits to compensate the maize deficit. The mechanism of compensating maize shortage was to exchange a certain quantity of tamarind fruits with the same quantity of maize (one tin of tamarind fruits exchanged with one tin of maize) through a barter system. Alternatively, the tamarind fruits were sold with a market price to generate cash which used to purchase maize for the purpose of overcoming food insecurity.

**Table 8: Size of land cultivated and yield in bags per acre and kg per acre for cotton**

<b>Crop</b>	<b>N</b>	<b>Acre Sum</b>	<b>Mean</b>	<b>Yield Sum</b>	<b>Mean</b>
Maize	121	502	4.2	975.2	2
Paddy	30	40	1.3	221.2	6
Millet	55	593.5	10.8	901.5	1.5
Sorghum	82	372.5	4.5	980.5	3
Cotton	51	329.5	6.5	59 585	181
Groundnuts	101	221.5	2.2	804.5	3.6
Sunflower	19	37	1.9	114	3.1
Chickpea	17	38.3	2.3	112	2.6
Sweet potatoes	80	54.2	0.7	460.5	8.5
Peanut	26	22.5	0.9	168.5	7.5
<b>Total</b>	<b>582</b>	<b>2211.3</b>	<b>35.3</b>	<b>4797.5</b>	<b>39.8</b>

Note: N = 582 because of a multiple response

#### **4.1.3 Mean household income obtained from sales of crops in 2014**

For the surveyed households, crops production contributed a mean annual income of 294 110.30 TZS where by cotton was the main cash crop contributed about 886 039.20 TZS equivalent to 37.6% of the total annual household income (Table 9). Despite the potential contribution to household income, farmers claimed high input costs in cotton production which associated with low productivity per acre. It was reported by the surveyed

households that the contribution of maize (7.6%) and sorghum (6.7%) to household income was not sufficient due to low yield while the costs of production was high. The situation forced some farmers to participate in additional income generating activities including harvesting and selling of tamarind fruits as a means to supplement their annual income. Other crops which contributed to household income include millet (8.7%), paddy (13.6%), groundnuts (10.7%), chickpea (9%) and sunflower (6%).

**Table 9: Average income (TZS) obtained from sales of farm crops cultivated by households for the year 2014**

<b>Crop</b>	<b>Average inc./yr/household</b>	<b>Frequency</b>	<b>Percent</b>
Maize	178 000	13	7.4
Paddy	319 200	5	2.8
Millet	205 000	25	14.2
Sorghum	158 173.90	23	13
Cotton	886 039.20	51	29
Groundnuts	252 087	23	13.1
Sunflower	141 533.30	15	8.5
Chickpea	212 857.10	7	4
No crop sold	0	14	8
<b>Total</b>	<b>2 352 890.50</b>	<b>176</b>	<b>100</b>

#### **4.1.4 Contribution of different sources of income to the total household income**

Table 10 provides the summary of different sources of cash income and their contribution to the total annual household income for the sampled households in the study area. The results revealed that the maximum income observed in crop production which contributed about 67 272 000 TZS (50%) per annum whereas the minimum income observed in firewood which contributed about 447 000 TZS (0.3%) per annum. The mean annual cash income ranges from 37 250 TZS for firewood to about 590 105.30 TZS for crop production. Currently, tamarind fruits contributed only about 3.4% of the total household's income despite the prevailing market constraints faced by harvesters and traders in the market chain. Without these market constraints, the contribution of tamarind fruits to household cash income probably would be higher than its current value.

**Table 10: Different sources of income for surveyed households in the study area for the year 2014**

<b>Source of income</b>	<b>Sum</b>	<b>Mean</b>	<b>Frequency</b>	<b>Percent</b>
Crop production	67 272 000	590 105.30	114	49.8
Livestock keeping	32 190 000	402 375	80	23.8
Petty trade	12 742 000	303 381	42	9.4
Remittances	8 829 000	420 428.60	21	6.5
Casual labour	2 107 000	95 772.70	22	1.6
Tamarind fruits	4 610 000	43 490.60	106	3.4
Others	4 030 000	310 000	13	3
Fodder	1 550 000	119 230.80	13	1.2
Charcoal	1 241 000	65 315.80	19	0.9
Firewood	447 000	37 250	12	0.3
<b>Total</b>	<b>135 018 000</b>	<b>2 382 071.50</b>	<b>442</b>	<b>100</b>

Note: N = 442 because of a multiple response

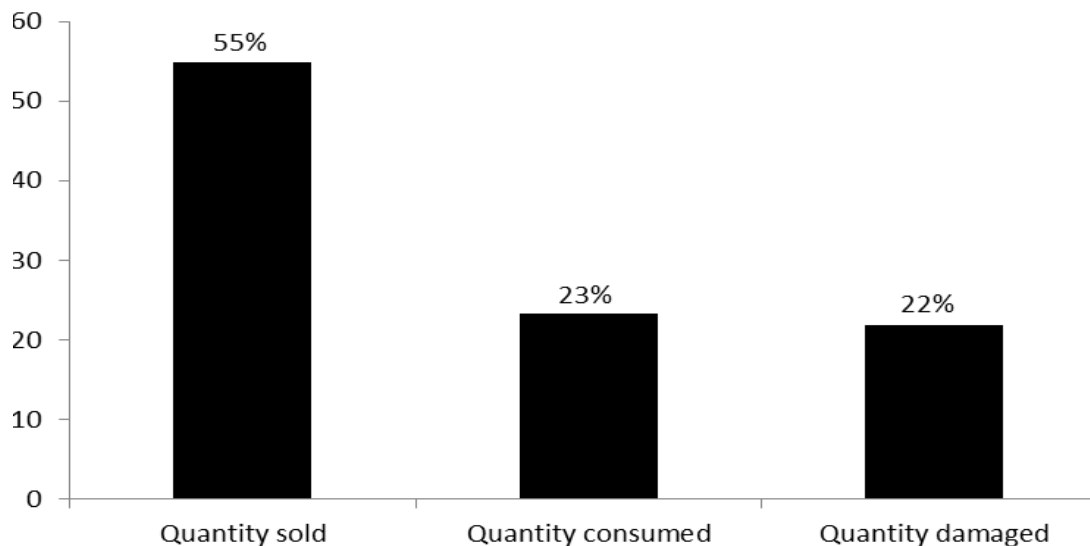
#### **4.1.5 Quantity harvested, consumed, sold and damaged in 2014**

The results in Table 11 show that the total amount of tamarind fruits harvested in the surveyed households. About 357 sacks which is equivalent to 32 130 kg were harvested annually. Of this quantity, only 195.5 sacks (17 595 kg) was sold to generate income whereas about 83.25 sacks (7492.5 kg) was consumed by households and 78.2 sacks (7038 kg) was neither sold nor consumed hence damaged. Among the surveyed households, about 60.2% were involved in harvesting and selling of tamarind fruits whereas 39.8% were experienced stock loss due to fruits damage. The damage was due to either unreliable market or lack of price information which made harvesters difficult to sell the fruits. In addition, poor storage facilities caused the fruits to be attacked by pathogens such as cockroaches and hence lower the market value of the fruits stored.

**Table 11: Quantity of tamarind fruits harvested, consumed, sold and damaged (in sacks) in study area for the year 2014**

Variable	N	Sum	Mean	Std. Deviation
Quantity harvested	176	357	2	2.3
Quantity sold	106	195.5	1.8	1.6
Quantity consumed	169	83.3	0.5	0.8
Quantity damaged	70	78.2	1.1	2

In addition, Figure 3 represents the proportions of tamarind fruits sold, consumed and damaged from the total quantity harvested annually. Under the current market conditions, the proportion sold accounted to about 55%, followed by proportion consumed (23%) and finally proportion damaged which accounted to about 22%. Generally, almost all surveyed households consumed tamarind fruits either for medicine purpose such as in the treatment of some disorders or as a component in their meal such as increasing the flavouring in porridge. Although the harvested tamarind fruits were contributed to the households' income either directly or indirectly, there was some amount which remained not harvested on the trees and hence not quantified.



**Figure 3: Proportion of tamarind fruits sold, consumed and damaged**

#### **4.1.6 Demand and supply of tamarind fruits in the rural market**

Apart from town market opportunity, alternative markets that exist are the villages located in the South east of Kishapu District where there are almost no tamarind trees which provide tamarind fruits. These villages locally are known as “mbugani” meaning that there are no tamarind trees found in the area. In these villages, two categories of market operation identified namely; cash system and barter system. In the cash system, the retailers use cash to purchase a certain quantity of tamarind fruits and sell the fruits to consumers. Also harvesters and middlemen may sell the fruits directly to consumers depending on the demand and supply conditions in the market. In the barter system, a certain quantity of either maize or sorghum from retailers, middlemen and consumers exchanged with the same quantity of tamarind fruits from harvesters. Retailers can either sell their tamarind fruits immediately to consumers by exchanging certain quantity of tamarind fruits with the same quantity of either maize or sorghum. Alternatively, sellers may store their tamarind fruits until the period of low supply to double their selling prices to increase their margins. Under this circumstance, single unit of measure of tamarind fruits is exchanged with double units of measure of either maize or sorghum.

#### **4.1.7 Categories of income from sale of tamarind fruits in 2014**

The harvested fruits of tamarind was sold either by cash through market prices or through barter system by exchanging with either maize or sorghum in a specific unit of measure (tin and sack). Table 12 below show that 33% of the harvesters sell their fruits by cash in varying market prices where as 27.2% sell their fruits through barter system. About 3 176 302 TZS was earned by harvesters after selling 134.7 sacks of tamarind fruits by cash in varying market prices where as 40.8 sacks and 20 sacks of maize and sorghum respectively were obtained by exchanging with tamarind fruits through barter system.

The options to sell either by cash or barter system depend on the ability of harvesters to access market, market prices and number of buyers available at that time.

**Table 12: Categories of income obtained from sale of tamarind fruits in the study area for the year 2014**

Category of income	(N = 176)	
	Frequency	Percent
Cash	58	33
Maize and sorghum	48	27.2
No sale	70	39.8
<b>Total</b>	<b>176</b>	<b>100</b>

#### 4.1.8 Sales of tamarind fruits and revenue obtained in 2014

According to household survey conducted, harvesters sell their tamarind fruits to either middlemen, retailers or direct to consumers in varying quantities and prices. The results shows that about 54.8% of tamarind fruits harvested were sold, 23.3% consumed at home by harvesters whereas about 21.9% unsold and damaged. An average revenue of 23 580.60 TZS per sack per annum was obtained by harvesters for the surveyed households whereas middlemen and retailers obtained an average revenues of 87 625 TZS and 143 500 TZS per sack annually. The average revenues obtained was determined by the volume sold and selling price in each market chain node. Middlemen observed to have an average volume of 49 sacks per trader followed by retailer who had an average volume of 16 sacks per trader and harvesters had an average volume of 2 sacks per household. The average selling price of middlemen was 86 750 TZS per sack, retailers observed to have an average selling price of 145 790.70 TZS per sack whereas harvesters observed to have an average selling price of 23 580.60 TZS per sack.

## 4.2 Profitability in tamarind fruits value chain

### 4.2.1 Marketing margin

The results in Table 13 show that retailers received higher marketing margin followed by middlemen and harvesters. This situation was observed both for Shinyanga and Mwanza traders. The high marketing margin received by retailers was contributed by higher selling price. The lowest marketing margin received by harvester was due to lowest prices paid by either middlemen or retailers. There was no negotiation for harvesters to agree on the buying prices of either middlemen or retailers. The marketing margin of all traders increased during off season because there was limited supply of tamarind fruits in the markets. Under this situation, harvesters, middlemen and retailers increased their margin by selling at higher prices than during on season.

**Table 13: Average buying price, average selling price and marketing margin of tamarind fruits sold in Shinyanga urban and Mwanza city**

Category	Shinyanga			Mwanza	
	Harvesters	Middlemen	Retailers	Middlemen	Retailers
Average buying price (Tsh/kg)	0	353	400	380	1086
Average selling price (Tsh/kg)	262	894	1105.50	1033	2134
Marketing margin (Tsh/kg)	262	541	705.50	653	1048

### 4.2.2 Different costs incurred in tamarind fruits value chain

Harvesting and selling of tamarind fruits were influenced by transport cost, labour cost, packaging cost and market fee paid by either middlemen or retailers in the market. The results in Table 14 below indicates that middlemen incurred higher transport cost than retailer because middlemen were involved in the distribution of fruits to retailers and sometimes directly to consumers. Very small transport cost was observed to retailers since they were rarely transported the fruits from harvesters to the market. Labour cost included harvesting cost, shelling cost, bagging cost, loading cost and unloading cost.



Packaging cost include cost used to purchase the polythene bag. Market fee included the daily fee paid by trader and charged by market administration to cover the daily marketing cost. Generally, middlemen covered higher marketing cost than retailers and harvesters in the market chain. The higher marketing cost incurred by middlemen was due to higher transport cost used to transport tamarind fruits from harvesters to either retailers or consumers.

**Table 14: Different costs (Tsh/sack) incurred by traders during harvesting and marketing of tamarind fruits in the study area**

Category	Shinyanga		Mwanza	
	Middlemen	Retailers	Middlemen	Retailers
Transport cost (Tsh/sack)	3000	250	8000	450
Packaging cost (Tsh/sack)	1000	2250	1000	2333.30
Labour cost (Tsh/sack)	6700	5000	10750	8500
Market fee (Tsh/sack)	782	3876.70	780	4232.50
<b>Total</b>	<b>11 482</b>	<b>11 376.70</b>	<b>20 530</b>	<b>15 515.80</b>

### 4.2.3 Gross margin

The profitability of harvester and traders along the tamarind fruits market chain was computed by subtracting the total variable costs from total revenues of each trader in the market chain nodes. The profit margin varies along the market chain from harvesters, middlemen to retailers due to difference in variable costs and quantities sold in each market chain node. Traders / sellers in the distant markets (middlemen and retailers) earned much more profits than local traders and harvesters. This was probably because of higher demand and higher selling prices observed in the distant markets of Shinyanga urban and Mwanza city respectively. Gross margin of harvesters was obtained by considering the full opportunity costs which were based on the time that harvesters use for harvesting tamarind fruits. The time used for harvesting was taken as equivalent to daily labour wage.

#### 4.2.4 Gross margin for retailers

Generally, retailers had the higher gross margins than middlemen and harvesters as shown in Table 15. The high gross margin obtained by retailers was contributed by the high selling price received in the market. In addition, retailers incurred low costs of labour, low transport costs and low packaging costs. The result was similar to the study conducted by Ntuli (2010) who reported highest gross margin for retailers in banana value chain due to high selling price fetched in the market channel. The situation was observed both in Shinyanga urban and Mwanza city traders with slight difference due to variation in marketing costs.



**Plate 3: Tamarind fruits sold by retailer in Nguzo nane market, Shinyanga urban**

#### **4.2.5 Gross margin for middlemen**

Middlemen had lower gross margin than retailers along the market chain (Table 15). This was contributed by higher transport costs and higher costs of labour incurred in distributing the fruits to the markets. The gross margin obtained by middlemen to great extent was controlled largely by the transport costs which vary with distance from harvesters to the market. However, the gross margin for middlemen was higher in Mwanza city than in Shinyanga urban inspite of higher transport costs incurred by middlemen in Mwanza city. This was contributed by the higher demand, larger volume sold and higher selling prices in Mwanza city than in Shinyanga urban. The results agrees with a study by Mkenda (2010) who observed that a net income gained by traders of mangoes whether wholesalers or retailers increase as one moved along to a more urban market from Urambo due to the higher selling price and larger volume sold. Other costs that determined gross margin for middlemen included labour costs and packaging costs.

#### **4.2.6 Gross margin of harvesters**

Harvesters received the lowest gross margin in the market chain due to low prices paid by either middlemen or retailers. Harvesters received average selling price of Tsh. 353 when they sell their tamarind fruits to middlemen and Tsh. 400 when they sell direct to retailers (Table 15). They characterised by low bargaining power on their selling prices in the market chain. This situation discouraged some of them not participating fully in harvesting and selling of tamarind fruits.

**Table 15: Revenues, costs and gross margin of tamarind fruits sold in Shinyanga urban and Mwanza city**

Category	Shinyanga			Mwanza	
	Harvesters	Middlemen	Retailers	Middlemen	Retailers
Revenue (Tsh/kg)	262	822.22	1138.90	1125	2050
Buying price (Tsh/kg)	0	353	400	380	1086
Variable cost (Tsh/kg)	157	127.60	126.40	228.10	172.40
Gross margin = R - (BP + VC)	105	341.62	612.50	516.90	791.60

#### 4.2.7 Characteristics of consumers towards consumption of tamarind fruits

Market survey was conducted to explore the general characteristics of tamarind fruits consumers in Shinyanga urban and Mwanza city. The variables age, gender, education and occupation of consumers were investigated. Table 16 revealed that about 50.8% of consumers were aged between 31 – 45 years, followed by age group between 18 – 30 years (32.8%), 46 – 60 years (15.3%) and more than 60 years (1.7%) respectively. The results show that large proportion of consumers was youth between 18 – 45 years in almost all surveyed markets. This may be due to the fact that most of the youth were engaged in petty trade such as selling of different juice and ice cream including tamarind juice. Also the results show that about 65.2% of consumers were female and 34.8% were male. The reason for this may be due to the fact that female involved more in domestic food preparation than male. The occupations of consumers show that about 42.4% were petty traders, followed by Hotels and restaurants (27.1%), housewife (20.3%) and domestic servant (10.2%). The higher consumption of tamarind fruits by petty traders and hotels was due to the reason that there was an increased demand of tamarind fruits for preparation meals.

**Table 16: Characteristics of consumers**

Variable	Frequency	(N = 59)	Percent
<b>Age category</b>			
18 - 30	19		32.2
31 - 45	30		50.8
46 - 60	9		15.3
> 60	1		1.7
<b>Gender</b>			
Male	21		34.8
Female	38		65.2
<b>Education level</b>			
No school	8		13.6
Primary	26		44
Secondary	14		23.7
College	10		4
University	1		1.7
<b>Occupation</b>			
Housewife	12		20.3
Petty trader	25		42.4
Domestic servant	6		10.2
Hotel / Restaurant	16		27.1

#### **4.2.8 Perception of consumers on different uses of tamarind fruits**

Consumer survey was done in the four markets during market survey in order to obtain their general perception on different uses of tamarind fruits in Shinyanga urban and Mwanza city. The results show that about 54.2% perceived tamarind fruits as a source of income followed by 18.6% used for increasing food taste, 15.3% used for cooking meat while 11.9% perceived medicinal value of tamarind fruits (Table 17).

**Table 17: Perception of consumers on different uses of tamarind fruits in Shinyanga urban and Mwanza city**

Category	Frequency	Percent
Source of income	32	54.2
Medicinal	7	11.9
Increase food taste	11	18.6
For cooking meat	9	15.3
<b>Total</b>	<b>59</b>	<b>100</b>

#### 4.2.9 Consumer preference towards tamarind fruits consumption

Consumers were asked to give an overview on their preferences towards tamarind fruits consumption. The results in Table 18 revealed that about 37.3% preferred tamarind fruits than other types of fruits due to multipurpose uses of the fruits. This was based on the fact that the fruits can be used to prepare juice, as medicine, increase food taste and also used in meat cooking. It was followed by 27.1% who preferred tamarind fruits due to its medicinal contents as a good treatment of diarrhoea and stomach discomfort. About 22% of consumers preferred tamarind fruits because it was easily available where as 13.6% preferred tamarind fruits because it was cheaper than other types of fruits which had similar uses. This was due to the fact that when the market price for one kilogramme of tamarind fruits ranged from 1000 to 3000 TZS, the market price of oranges and mangoes were ranged from 300 to 500 TZS per orange and 1000 to 2000 TZS per mango respectively.

**Table 18: Reason for preferring tamarind fruits than other types of fruits**

Reason	Frequency	Percent
Multipurpose uses	22	37.3
Medicinal value	16	27.1
Easily available	13	22
Cheaper	8	13.6
<b>Total</b>	<b>59</b>	<b>100</b>

### **4.3 Influence of socio-economic factors on income obtained from tamarind fruits**

In order to understand the importance of tamarind fruits as among the sources of households' income in the area, a multiple linear regression with income from tamarind fruits as a dependent variable (Y) and size of land owned, household labour size, labour hours spent during harvesting, experience in harvesting (years), number of tamarind trees owned by households, selling price, quantity sold and distance from harvesting area to market as independent variables (Xs) was estimated by the method of Ordinary Least Square (OLS). Table 19 below indicates the  $R^2$  of 0.757 which implies that 75.7% of the variation in income from tamarind fruits (dependent variable) is explained by the independent variables (Xs). The results show that four variables were significant. Experience in harvesting (in years) was significant at  $P < 0.05$ ; this implies that most of the experienced harvesters did not participated much in harvesting and selling of tamarind fruits due to small income earned. The unit increase of experience in harvesting and selling of tamarind fruits decreased the income obtained by 0.221 units. Based on this observation, people tend to concentrate more on other income generating activities (IGAs) such as casual labour and petty trade. Number of tamarind trees owned was significant at  $P < 0.001$  and the unit increase in number of trees owned increased the income earned by 0.772 units. This reveals that households which own large number of tamarind trees were able to earn higher income than households with small number of tamarind trees. This was due to the fact that households which own many tamarind trees could harvest and sell large volume of tamarind fruits hence higher income was earned.

Quantity sold was significant at  $P < 0.001$ ; the unit increase in quantity sold increased the income by 0.305 units. This implies that household which sold large quantity of tamarind fruits earned higher income than households sold smaller amount. This may be influenced

by market awareness and ability to access market and market information. Selling prices was significant at  $P < 0.05$ ; the unit increase in selling price increased the income by 0.266 units. This reveals that households which sell their tamarind fruits at higher prices were able to earn higher income than households which sell at lower prices. The situation was achieved only by some households which were able to negotiate and convince either wholesaler or retailer on their selling price. The findings is similar to that reported by Juntwa (2010) who found that quantity sold and selling price both were significant and had a positive contribution to the revenue accrued from banana in Morogoro urban.

The size of land owned by household has a negative contribution to the income earned from tamarind fruits since the household which own large size of land may obtain a significant annual income from harvested crops. The unit increase in size of land owned decreased the income from tamarind fruits by 0.039 units. The results is similar as that reported by Ravi *et al.* (2006) who observed that households possessed large size of land depend very little on income from NTFPs in Bangalore, India. Households' labour size has a positive contribution to the income earned from tamarind fruits since the increased manpower lead to the increased volume of tamarind fruits harvested. The results is similar to that reported by Ravi *et al.* (2006) who observed that household labour size had positive impact in collection of NTFPs and in turn on the income. Similarly, Raufu *et al.* (2012) reported that household labour size has a positive contribution to the income from NTFPs gained by rural women in Osun State, Nigeria. The increase in distance to market decreased the income earned by harvesters for 0.051 due to increase in time required to transport the fruits. The results agrees with a study by Mwema *et al.* (2013) who found that a kilometre increase to the market would decrease the likelihood of a household to participate in harvesting and selling indigenous fruits due to the increase in transport cost.



**Table 19: Regression of income from tamarind fruits against socio-economic factors**

Predictor	Unstandardized Coefficients		Standardized Coefficients		Sig.
	B	Std. Error	Beta	t	
(Constant)	-84655.604	29344.703		-2.885	.006**
SLAOWN	-195.555	393.497	-.039	-0.497	.621 <sup>ns</sup>
EXPYRS	-1915.139	647.626	-0.221	-2.957	.005**
LBHRS	1375.036	3617.314	0.029	+0.380	.705 <sup>ns</sup>
NMBTRWN	22786.089	2177.596	0.772	+10.464	.000***
SEPRCE	10.054	2.837	0.266	+3.544	.001**
QNTTSLD	2577.555	663.023	0.305	+3.888	.000***
DSTMKT	-280.380	428.409	-0.051	-0.654	.516 <sup>ns</sup>
SZLBR	2097.404	7363.159	0.022	+0.285	.777 <sup>ns</sup>

Dependent Variable: Income gained from sales of tamarind fruits,

**Model fit:**

N (valid cases) 176

R Square 75.7%

Adjusted R Square 71.7%

Model (ANOVA) p-value,  $p < 0.001$

**Key:**

\*\*\* significant at  $p < 0.001$

\*\*significant at  $p < 0.05$

ns = not significant

Where by:

SLAOWN = Size of land owned

EXPYRS = Experience in years

LBHRS = Labour hours

NMBTRWN = Number of tamarind trees owned by households

SEPRCE = Selling price

QNTTSLD = Quantity sold

DSTMKT = Distance to market

SZLBR = Size of labour

#### 4.4 Challenges and suggestions in marketing of tamarind fruits in the study area

##### 4.4.1 Challenges towards marketing of tamarind fruits

Several constraints faced by harvesters during marketing of tamarind fruits were discussed and analysed based on their multiple responses. These constraints were either reduce the frequency of selling or discouraged the harvesters in continuing to harvest tamarind fruits for commercial purposes. Based on the results, about 60.8% of the surveyed households harvest and sell tamarind fruits while the remainder households (39.2%) did not participate in commercial harvesting of tamarind fruits. The results show that low price was the biggest constraint faced by harvesters during marketing of tamarind fruits. About 31.4% of harvesters reduced their frequency of selling due to low price paid by either middlemen or retailers (Table 20). This was followed by limited access to market (29.2%), poor storage techniques (16%), high transport costs (13.2%), lack of price information (6.2%) and the presence of few buyers (Middlemen and retailers) (4%). Limited access to market was also a big constraint hindering proper marketing of tamarind fruits due to the fact that harvesters had to travel a long distance towards the market premises where they could find reliable markets to sell their tamarind fruits. The results agrees with a study by Mwema *et al.* (2013) who found that lack of market access, low price, high transport costs, seasonality of fruits and perishability are the major challenges faced by households in marketing indigenous fruits in Mwingi District, Kenya.

**Table 20: Challenges in marketing of tamarind fruits**

<b>Constraint</b>	<b>Frequency</b>	<b>Percent</b>
Low price	71	31.4
Limited access to market	66	29.2
Poor storage facilities	36	16
Lack of price information	14	6.2
High transport costs	30	13.2
Few buyers	9	4
<b>Total</b>	<b>226</b>	<b>100</b>

Note: N = 226 because of a multiple response

#### 4.4.2 Suggestions to overcome marketing constraints of tamarind fruits

Table 21 below present some suggested ways to overcome observed constraints in marketing of tamarind fruits. Harvesters were asked to explore their opinions regarding harvesting and marketing of tamarind fruits in the study area. Improving selling price, improving access to market and improving storage techniques are highly recommended ways to improve marketing in tamarind fruits for harvesters to earn higher returns. Allow price negotiation, increase number of buyers, conduct market awareness and provision of price information also recommended by harvesters as the means of achieving proper marketing of tamarind fruits in the study area.

**Table 21: Suggested ways to overcome marketing constraints of tamarind fruits in the study area**

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>
To improve price	73	29.6
Market awareness to harvesters	12	4.9
To improve access to market	74	30
To improve storage techniques	42	17
Provision of price information	9	3.6
Allow price negotiation	20	8.1
Increase number of buyers	17	6.9
<b>Total</b>	<b>247</b>	<b>100</b>

Note: N = 247 because of a multiple response

#### 4.5 Land tenure and ownership of Tamarind trees

The results of land tenure and ownership show that almost all village land belonged to customary land system and there was no statutory system in the study villages. Throughout the study villages, the sources of tamarind fruits were privately owned and three land use categories were identified as a source of tamarind fruits. Large part of respondents harvested their tamarind fruits from homestead land (43.2%), followed by farm land (40.9%), farm land and homestead (13.1%) and grazing land (2.8%) as indicated in Table 22. There was no common regulations which governing the utilization

of tamarind fruits in the study area. Each household has its own power and responsibilities to control and restrict others in accessing tamarind fruits without permission of the owner. There was no either village forest land or public land which reported to supply tamarind fruits throughout the study villages.

**Table 22: Sources of tamarind fruits harvested in 2014**

<b>Response</b>	<b>Frequency</b>	<b>Percent</b>
Private forest / Grazing land	5	2.8
Farm land	72	40.9
Homestead	76	43.2
Farmland and homestead	23	13.1
<b>Total</b>	<b>176</b>	<b>100</b>

## CHAPTER FIVE

### CONCLUSIONS AND RECOMMENDATIONS

#### 5.1 Conclusions

Harvesting of tamarind fruits was done to a large extent by smallholder farmers who faced with a problem of low yield of food crops especially maize, sorghum and sweet potatoes hence they are food insecure. Large quantity of tamarind fruits was sold during the period of low yield of food crops as an alternative way of overcoming food shortage as well as for supplementing household's income. Among the identified market participants, retailers observed to gain higher gross margin than middlemen and harvesters. This may be due to the fact that retailers sell their fruits in urban centres where by large number of consumers were found. In addition, large quantities of tamarind fruits were sold by retailers due to high turnover of consumers. Contrary, middlemen were encountered with higher marketing costs than retailers hence they received low return compared to retailers. Harvesters gained the lowest margins because they were most affected by identified marketing constraints

The contribution of tamarind fruits to household income and food security under the current market condition was low because not all fruits were sold due to the identified marketing constraints. This contribution would have been appreciably increased when the marketing constraints are well addressed to improve market conditions. The regression results of socio-economic variables indicates that there was strong relationship or influence between households income and number of tamarind trees owned, quantity sold and selling price. Based on the regression results of socio-economic analysis, harvesters required to increase the ownership of tamarind trees and quantity sold in order to expand their income from tamarind fruits. This can be achieved by enhancing domestication of tamarind trees in both cropping land and homesteads. Middlemen and retailers are

required to increase their buying prices so as to motivate harvesters in conserving, harvesting and selling of tamarind fruits.

The analysis of marketing challenges affecting proper contribution of tamarind fruits to households' income was done. The results show that low selling price, limited market access, lack of market awareness, poor storage facilities, lack of price information and few numbers of buyers were the factors which limit income from tamarind fruits. The middlemen and retailers are the ones who decide the buying prices for tamarind fruits in the marketing channel. Harvesters have no power to negotiate on their selling prices when selling their fruits to either middlemen or retailers. Due to the above mentioned marketing challenges, some villagers unable to harvest and sell their tamarind fruits hence it remained on the trees, not consumed and finally perished. This quantity might increase the income of harvesters and traders if it was harvested and sold under proper market conditions. Improvement of marketing functions particularly storage, handling, processing, price and transportation will enhance the contribution of tamarind fruits to the total households' income.

Analysis of land tenure and ownership revealed that the sources of tamarind trees were privately owned in customary land system. Throughout the study villages, large quantity of tamarind fruits was harvested from homestead, followed by farm land where as only small quantity was supplied from privately owned grazing land. There was no either village forest land or public land which reported to supply tamarind fruits throughout the study villages.

## 5.2 Recommendations

- i. Further research should be conducted to quantify the production of tamarind fruits per tree and assessing its consumption for both rural and urban consumers.
- ii. Market research should be conducted in order to identify the potential demand and supply of Tanzanian tamarind fruits in the national and international markets in order to increase the net gain from sales.
- iii. Traders of tamarind fruits form group association to facilitate in searching the markets for expanding both local and external markets. Available market opportunity should be identified, assessed and the potential market should be promoted.
- iv. Stakeholders who engaged in agriculture and forest products marketing should facilitate to raise awareness of local community on market access, market awareness, prices and market networking.
- v. Harvesters are advised to strength their bargaining power while they sell tamarind fruits to traders. Also they can add value to their fruits by either processing or improving packaging and sell to higher price in the market.
- vi. District council should incorporate the role of minor forest products such as tamarind fruits in its annual plan of operation so as to diversify the sources of income at household level and district level.

- vii. Since the supply of tamarind fruits is higher in the study villages, government, NGOs and other stakeholders advised to initiate the establishment of fruit processing factories for tamarind fruits into various consumable goods such as tamarind juice, tamarind jam, tamarind syrup and candy. This will enhance fully utilisation of economic potential of tamarind fruits as well as create opportunity for employment among the youth for both rural and urban areas.
  
- viii. Government and NGOs should facilitate farmers by providing training on market knowledge such as processing, storage and link them to markets in order to promote marketing of tamarind fruits by selling more until to off season.



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## APPENDICES

### Appendix 1: Population of the study villages

<b>Villages</b>	<b>Men</b>	<b>Women</b>	<b>Total</b>	<b>Households</b>
Negezi	1033	1185	2218	378
Ukenyenge	1403	2070	3473	578
Kishapu	1104	1314	2418	334
Mwataga	830	1001	1831	288
Igaga	637	657	1294	222
Unyanyembe	1266	1278	2644	365
<b>Total</b>	<b>6373</b>	<b>7505</b>	<b>13878</b>	<b>2165</b>

## Appendix 2: Questionnaire for harvesters of tamarind fruits

### A. Identification variables

Identification Number	
1. Time the interview starts	
2. Name of interviewer	
3. Date of interview	
4. Questionnaire/household number	
5. Interviewee: 1) <i>Household head</i> 2) <i>Spouse</i> 3) <i>Others (specify)</i>	
6. Gender of interviewee (1= male, 2= Female)	
7. Age of interviewee	
8. Village (Area) name	
9. Ward	
10. Division	

### B. Household Socio-economic characteristics

11. What is the size of your household?.....

12. Indicate household size as a determinant of labour size for the year 2014.

Age in years	Under 5	6-17	18-45	46-60	Above 60
Male					
Female					
Total					

13. Marital status: a) Single b) Married c) Divorced

d) Widowed e) Separated f) Others (Specify).....

14. Level of education:

a) No school b) Primary education c) Secondary education

c) College education d) University education

f) Others (Specify).....



15. What is your main occupation? a) Crop Production b) Livestock

c) Business d) Employed e) Others (Specify).....

16. Indicate the production and revenue obtained from farm crops for the year 2014.

Type of crop	Acres cultivated	Yield harvested	Revenue obtained
Maize			
Paddy			
Millet			
Sorghum			
Cotton			

17. Do you own livestock? a) Yes b) No

18. If yes in question 17 above, indicate the number of livestock owned and revenue obtained from livestock for the year 2014.

Types of animal	Number	Ownership by gender			Revenue obtained
		Male	Female	Both	
1. Cattle					
2. Goats					
3. Sheep					
4. Donkeys					
5. Chicken					
6. Ducks					
7. Pigs					
8. Other (Specify).....					
Grand Total:					

19. Indicate other types of assets owned by your household in the year 2014.

Asset	Quantity	Unit value (Tshs)	Total value (Tshs)	Ownership by gender		
				Male	Female	Both
Tractor						
Ox-plough						
Ox-carts						
Sprayers						
Hand-hoes						
Machetes						
Sickles						
Bicycles						
Land						
Motor car						
Other (Specify)...						
Grand Total:						

20. Indicate the source and income obtained by each members of households aged 18 years and above in 2014.

Household member	Gender	Age	Marital status	Education level	Main occupation	Income (Tshs) in daily/weekly/monthly/annually
	1) Male 2) Female		1) Single 2) Married 3) Widowed 4) Divorced 5) Separated	1) No school 2) Primary 3) Secondary 4) College 5) University 6) Others(specify) ..... ..... ..... .....	1) Employee 2) Formerly employed 3) Casual labourer 4) Farm crops 5) Livestock 6) Business 7) Tamarinds 8) Non tamarinds 9) Remittance 10) Firewood/charcoal 11) Fodder 12) Others (specify)...	

21. Indicate how did the income obtained above was spent by your household in 2014.

Expenditure category	Amount (Tshs)
Clothing	
Shelter	
School fees	
Medical expenses	
Remittance	
Social contributions	
Fuel	
Ceremonies	
Transport (fare)	
Other expenditure (Specify).....	

## C: Harvesting and Marketing of tamarind fruits

22. For how long have you been involved in harvesting of tamarind fruits?.....
23. Where do you harvest tamarind fruits?
- a) Village land forest reserves    b) Unreserved forests in village land
- c) Private forest land    d) Farm land
24. What is estimated distance from your household to where you harvest tamarind fruits?.....
25. How many hours do you spend per day in harvesting Tamarind fruits?.....
26. What quantity of Tamarind fruits do you harvest per season?.....
27. How many days do you spend per season in harvesting Tamarind fruits?.....
28. After harvesting, what do you do with Tamarind fruits?
- a) .....
- b) .....
- c) .....
29. What is the use of tamarind fruits harvested?
- a) Selling      b) Consumption
30. What are the quantity used for selling and consumption for the year 2014?
- a) Selling.....      b) Consumption.....
31. What quantity of Tamarind fruits damaged or perished in 2014?.....
32. How do you perceive the trade of Tamarind fruits? a) Most valuable
- b) Average      c) Less valuable    d) Not valuable
33. Have you ever planted/own a Tamarind trees in your land? a) Yes    b) No
34. If yes in question 33 above, mention the number of tamarind trees planted/owned in your land .....
35. Do you participate in harvesting and marketing of fruits other than tamarind fruits?
- a) Yes                      b) No

36. If yes in question 35 above, indicate the quantity collected, quantity sold and revenue obtained from each fruit variety.

Variety	Quantity collected	Quantity sold	Revenue obtained

37. If you are asked to expand production and collection of tamarind fruits from your farming land, which crops will you drop out from your farming system?.....

38. What are the reasons for dropping?

- a).....
- b).....
- c).....

39. What is the price per unit of measure of the crop you would drop in question 37 above? .....

40. Do you know any markets of Tamarind fruits? a) Yes b) No

41. If yes in question 40 above, mention the markets you know.....

42. How far is your household from the market in 41 above?.....

43. What kind of measuring instrument do you use in determining the unit of sale?

- a) Scale b) Bundle c) Tin d) Others (Specify).....

44. Do you receive market information? a) Yes b) No

45. If yes in 44 above, what kind of market information do you receive?

- a) Price b) Product quality c) Fruits highly demanded d) Others (Specify).....

46. Do you transport Tamarind fruits from your harvesting areas to the market place?

- a) Yes b) No

47. If yes in 46 above, what is your transport cost per transaction? Tshs.....

48. Do you keep records? a) Yes b) No

49. If yes in 48 above, what kind of records are you keeping?

- a) .....
- b) .....
- c).....

50. At which months did you record the highest and lowest sales?

	<u>Months</u>	<u>Quantity</u>	<u>Price</u>
Highest	.....	.....	.....
Lowest	.....	.....	.....

51. How do you sell your tamarind fruits?

- a) Daily                      b) Weekly                      c) Monthly

52. How many times did you sell your Tamarind fruits?.....

53. What was an average sale per transaction? Tshs.....

54. Who is the main buying agent of your tamarind fruits?

- a) Consumers    b) Wholesalers    c) Retailers    d) Others (Specify).....

55. Indicate the quantity and price for each buying agent.

Buying agent	Quantity	Average Price
a) Consumers	.....	.....
b) Wholesalers	.....	.....
c) Retailers	.....	.....
d) Others (Specify).....	.....	.....

56. What reasons made you to sell your fruits to the buying agent in 51 above?

- a) Reasonable prices
- b) Reliable market
- c) Reliable payments
- d) Others (Specify).....

57. For the past two years, please provide information on amount harvested and sold.

2013		2014	
Amount collected (kg)	Amount sold (kg)	Amount collected (kg)	Amount sold (kg)

58. Have you ever given any training about Tamarind fruits? a) Yes      b) No

59. If yes in question 57 above, what kind of training you have given?

- a) Harvesting      b) Storage      c) Processing      d) Marketing

60. What are the constraints towards harvesting of Tamarind fruits?

- a).....b).....c).....

61. What are the constraints towards marketing of Tamarind fruits?

- a).....b).....c).....

62. What should be done to in order to overcome the constraints you have mentioned above?

- a) .....b).....c).....

D: Information on Land Tenure

63. Does your household own land in this area? a) Yes      b) No

64. If yes in question 63 above, how many acres and what tenure regime is governing the ownership?

Types of land	Acres	Ownership type	
		Formal (statutory)	Customary
Farmland			
Forestland			
Settlement			
Others (specify).....			

65. How did you obtain the owned land?

Land category	Acquired methods			
	1	2	3	4
Farmland				
Forestland				
Settlement				
Others (specify).....				

1= Bought 2 = Rented 3 = Given by village government 4 = Inherited

66. Do you know the types of forestland ownership that exist in your village?

a) Yes                      b) No

67. If yes in question 66 above, mention them:

.....

68. Do you know the name of the area where you harvest Tamarind fruits?

a) Yes                      b) No

69. If yes in question 68 above, mention the area and its ownership category.

Name of area	Ownership category

70. How do you rank the extent of harvesting of Tamarind fruits from ownership category you have mentioned in 69 above?

Land category	Score

71. In your opinion, what should be done to improve the availability of Tamarind fruits from the identified land tenure systems?.....

Time the Interview Ends: .....

“Thank you very much for your cooperation”

### Appendix 3: Questionnaire for Traders of Tamarind Fruits

#### A. Identification variables

Identification Number	
1. Time the interview starts	
2. Name of interviewer	
3. Date of interview	
4. Questionnaire number	
5. Gender of interviewee (1= male, 2= Female)	
6. Age of interviewee	
7. Village (Area) name	
8. Ward	
9. Division	
10. District	
11. Region	

#### 12. Marital status:

- a) Single                      b) Married                      c) Divorced                      d) Widowed  
 e) Separated                      f) Others (Specify).....

#### 13. Level of education

- b) No school                      b) Primary education                      c) Secondary education  
 d) College education                      e) University education

#### B: Information on trade operation and experience

14. For how long have you been involved in trade of tamarind fruits?.....

15. Have you been involved in other business? a) Yes                      b) No

16. If yes, mention the type of business and revenue accrued

Type of business	No. of years	Revenue

17. Apart from tamarind fruits, what are the other types of fruits are you dealing with?

Types of fruits	Business level		
	Middlemen	Retailer	Wholesaler



18. From what value chain nodes do you purchase tamarind fruits you sell?
- a) Collectors                      b) Wholesalers                      c) Middlemen
- d) Retailers
19. After purchasing, what do you do with Tamarind fruits?
20. Which of the value chain nodes do you sell your Tamarind fruits?
- a) Wholesalers                      b) Retailers                      c) Consumers
- d) a, b and c
21. Where is Tamarind fruits which you sell come from?.....
22. What mode of transport do you use to carry your Tamarind fruits to the markets?
- a) Bicycle                      b) Motorcycle                      c) Animal
- d) Bus                      e) Lorry                      f) Train
23. How long it takes to finish selling your stock purchased?

Stock (Quantity)	Month bought	Month of stock end

24. Where did you get marketing information for Tamarind fruits?
- a) Through market agents                      b) Through visit and investigation
- c) Through media                      d) Others (specify).....
25. Who set the price for Tamarind fruits?
- a) Collectors                      b) Wholesalers                      c) Retailers
- d) Consumers                      e) Others (Specify).....
26. What are the criteria used in setting price for Tamarind fruits?
- a) Marketing cost                      b) Supply and demand
- b) Interest of market agent d) Others (Specify).....
27. Do you know any other sellers of Tamarind fruits in this market?
- a) Yes                      b) No

28. If yes in 27 above, how many and what are their names?
29. What are the other types of fruits do other traders sell?.....
30. Gross margin analysis

On season		Off season	
Buying price (Tshs per kg)	Selling price (Tshs per kg)	Buying price (Tshs per kg)	Selling price (Tshs per kg)

31. What is an estimated gross margin of Tamarind fruits per kg?.....
32. What problems are you facing in your tamarind fruits business?.....
33. What should be done in order to overcome the problems stated in 32 above?.....

### Section C: Marketing cost and Revenue from sale

34. What kind of marketing costs do you incur and what is the revenue accrued from Tamarind fruits trade in the year 2014?

Type of cost	Unit cost Tshs per unit of measure
Number of kg purchased for sale	
Buying price per kg	
Marketing cost	
Package	
Loading	
Transport	
Offloading	
Cost of labour	
Market fees	
Taxes	
Selling price per kg	
Other costs (fare, meal & accommodation)	
Revenue from sale of tamarind fruits	

Time the Interview End:.....

“Thank you very much for your cooperation”

**Appendix 4: questionnaire for consumers of tamarind fruits**

Name of Enumerator.....

Questionnaire Number.....

Date.....

1. Name of respondent.....

2. Village / Street.....

3. Ward.....

4. District.....

5. Region.....

6. Age.....

7. Sex: a) Male b) Female

8. Marital status: a) Single b) Married c) Divorced

d) Widowed e) Separated f) Others (Specify).....

9. Level of education: a) No school b) Primary

c) Secondary d) College e) University

10. Why do you prefer tamarind fruits? a) Easily available b) Cheaper

c) a and b d) Other (Specify).....

11. What other fruits have the same uses as tamarind fruits?

12. Among the fruits you have mentioned in 11 above, which fruits do you prefer most?

13. What quantity of tamarind fruits do you purchase per week?.....

14. How much money do you spend for the quantity you have mentioned in 13 above?

Tshs.....

15. How frequently do you purchase tamarind fruits?

a) Daily b) Weekly c) Monthly d) Seasonal

16. Where do you buy tamarind fruits?.....
17. How do you perceive on the price? a) High b) Average c) Low
18. How do you comment on the supply of tamarind fruits in the markets?
  - a) Adequate b) Inadequate c) Average
  - d) Limited
19. What problems are you facing regarding the availability and consumption of tamarind fruits?
  - a) Limited supply b) Price fluctuations c) Seasonality
  - d) Others (Specify).....

**Appendix 5: Checklist for Focus Group Discussion**

1. What are the main sources of income in your village?
2. In your opinions, what is the status of collecting and marketing of Tamarind fruits?
3. Who are the main buyers of Tamarind fruits?
4. What is your roles in collection and marketing of Tamarind fruits?
5. Describe the ownership of land/trees where Tamarind fruits are collected.
6. What are the challenges facing villagers in collecting and marketing of Tamarind fruits.
7. What are your recommendation to improve collection and marketing of Tamarind fruits?
8. Provide the list of households (people) involved in collecting / harvesting Tamarind fruits.

“Thank you very much for your cooperation”

**Appendix 6: Checklist for Key Informants**

- 1 (a) Why are Tamarind fruits traded?
  - (b) On average, what is the income from Tamarind per household per year?
2. Explain efforts made towards promotion of Tamarind fruits trade.
3. What are the challenges associated with Tamarind fruits trade?
4. Who are the major buyers of Tamarind fruits from harvesters?
5. How is tamarind fruits measured during trading and what is the price?
6. In your opinion, what should be done to promote Tamarind fruits business?
7. What are the tenure systems governing Tamarind fruits harvesting?
8. Provide comments regarding the marketing of Tamarind fruits.

**“Thank you very much for your cooperation”**