VALUE CHAIN ANALYSIS OF *SCLEROCARYA BIRREA* PRODUCTS IN TANZANIA: CASE STUDIES OF UYUI AND KILOSA DISTRICTS

ABUBAKARI HAMISI MUNNA

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

2015

ABSTRACT

This study analyzed the *Sclerocarya birrea* products value chain. In this study, 90 respondents were drawn from Kilosa district and 68 from Uyui district: 60 being processing group members and 8 collectors. Data were collected through focus group discussions, key informant interviews and household surveys by use of semi-structured questionnaires and interview schedules. The Sub- sector mapping analysis revealed that *S. birrea* products value chain comprised of collectors, processors and consumers who engage in fruits collection and in making and selling wines and jams to end users. Enterprise budget approach shows that there is unequal distribution of profits; 96% and 6% being accrued by processors and collectors respectively. With the aid of Principal Component Analysis, Multiple regression analysis revealed that processing is statistically significant (β = -0.464, t = -3.264, $p<0.01$) influencing success in commercialization of *S. birrea* fruits though negatively. Lack of market information and linkage, absence of sensitization campaigns, lack of government support, reliance on donor support, lack of awareness on economic value and absence of government and NGOs initiatives cause underutilization and commercialization of *S. birrea* trees. However, availability of trees and external markets, legal recognition of the business, the possibility of the tree to be domesticated and consumers' awareness on *S. birrea* products were identified to be potential opportunities. Also, collection of fruits occurs in private, communal and protected lands either by permission, free access or by payments. Tanzania still lacks NTFPS policy and currently there is no formal government rules guiding harvesting of *S. birrea* products. Therefore, government and NGOs support is a key driver to enhance commercialization and sustainable utilization of *S. birrea* in Tanzania.

DECLARATION

I, Abubakari Hamisi Munna, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work and has never been submitted nor concurrently being submitted for a higher degree award in any other institution.

_____ _____

Abubakari Hamisi Munna Date

(M.Sc. Candidate)

The above declaration is confirmed by:

_____ _____

Dr. Jumanne Moshi Abdallah Date

(Main Supervisor)

_____ _____

Dr. Dino Andrew Woiso Date

(Co-Supervisor)

COPYRIGHT

ACKNOWLEDGEMENTS

My genuine appreciation goes to my supervisors Dr. Jumanne M. Abdallah and Dr. Dino Andrew Woiso for their constant advice, guidance, constructive and critical comments from the very beginning of this work until the final date of submission. I feel privileged to have the opportunity to work under them. I also extend my deepest thanks to Tanzania Forest Fund for funding this research.

My thanks are also extended to the extension officers of Kigwa Village Mrs Teddy Mzobola and Mr Kasimu, Mrs Rweyamamu and Mrs Matata of ARI –Tumbi, Mama Ray of Tabora town and the village chairs and village executive officers of Kigwa, Mbola, Gongoni, Nyali and Ihombwe villages for the support they gave me during data collection. Without them, the survey would have been difficult.

In addition, I extend my thanks to all my family members for their support, especially my parent Hamisi Munna who sacrificed his little resources he has to educate me. May God bless them all! I also take this opportunity to extend my deepest thanks to all the people, institutions and all my friends who facilitated and showed cooperation when I was collecting data and writing this work.

Above all, I extend my special thanks to the Almighty God, for giving me the energy and good health during the entire period of my studies. All glory and honour are in His holy name.

DEDICATION

I dedicate this work to my late mother Aisha Iddi and my father Hamisi Munna, my brothers Yusuph Hamisi and Iddi Hamisi, my sister Halima Hamisi and Mr Athumani Kitiku family for their sacrifice and encouragement during my academic study and all aspects of the research.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS, SYMBOLS AND ACRONOMYS

ARI	Agriculture Research Institute
CARE	Cooperative for Assistance and Relief Everywhere
CBFM	Community Based Forest Management
CRIAA SA-DC	Centre for Research, Information, Action in Africa Southern Africa - Development and Consulting
CTA	Technical Centre for Agricultural and Rural Cooperation
DFID	Department for International Development
FAO	Food and Agriculture Organization of the United Nations
FM	Frequency Modulation
GM	Gross Margin
ICRAF	International Centre for Research in Agroforestry
IFP	Indigenous fruits processing
Ifs	Indigenous fruits
ILO	International labour organization
INPs	Indigenous Natural Products
IRR	Internal rate of return
ISO	International Organization for Standardization
IUCN	International Union for the Conservation of Nature
JFM	Joint Forest Management
KDC	Kilosa District Council
Kg	Kilogram

Km	Kilometre
KMO	Kaiser- Meyer-Olkin
Ltr	Litres
M4P	Making Markets Work Better for the Poor
MATF	Ministry of Agriculture and Food Security
MEAs	Multilateral Environmental Agreements
MEMBO	Maendeleo Endelevu Mbola
ml	Milliliter
ND	Namibian dollar
NGO	Non-governmental organization
NTFPs	Non timber forest products
NWFPs	Non Wood Forest Products
PCA	Principal Component Analysis
R & D	Research and development
SFTZ	Savannas Forever Tanzania
SIDO	Small Industries Development Organization
SNAL	Sokoine University of Agriculture National Library
SPSS	Statistical Package for Social Science
SUA	Sokoine University of Agriculture
TAWLAE	Tanzania Women Leaders in Agriculture and Environment
TBS	Tanzania Bureau of Standards
TFDA	Tanzania Foods and Drugs Agency
UNEP	United Nations Environmental Programme
UNIDO	United Nations Industrial Development Organization

URT	United Republic of Tanzania
USA	United States of America
USD	United States of America dollar
VIF	Variance Inflation Factor
WIPO	World Interlectual Property organization
β	Beta

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Deforestation of tropical forests seriously jeopardizes the biological diversity and climate system of the planet (Schwartzman, 2009). Trees and their products found in communal lands are common property resources and tend to be subjected to over-harvesting and poor stewardship (Akinnifesi *et al.*, 2006). In these lands (Newton *et al.,* 2006), many non-timber forest products (NTFPs) have been harvested unsustainably leading to forest degradation.

In the environmental and development dialogues of the late 1980s and especially in the post-Rio 1990s, NTFPs were first brought to public attention (Belcher and Schreckenberg, 2007). Conservation and development organizations alike, particularly those working in the tropical rain forests promoted the idea that NTFPs production and trade has the potential to supply local people with sufficient incomes to provide them with incentives to maintain the forests (Shackleton *et al.*, 2002, Newton *et al.*, 2006, Belcher and Schreckenberg, 2007). Belcher and Schreckenberg (2006) further notify that there are two principal objectives for promoting NTFPs commercialisation. From the livelihoods perspective, NTFPs commercialisation is expected to increase income and employment opportunities, especially for poor and otherwise disadvantaged people. From the conservation side, there has been much speculation that NTFPs commercialisation can provide opportunities for relatively benign forest utilisation and even create incentives for conservation of individually

valuable species and the environment in which they grow. According to Belcher and Schreckenberg (2007), in order to understand the implications of promoting NTFPs commercialization, there is a need to understand the products' value chain.

The marula tree, *S. birrea* is a drought tolerant, multipurpose and an economically important fruit tree of the *Anacardiaceae* family (Shackleton, 2005, Mollel and Goyvaerts, 2012; Mng'omba *et al.,* 2012) indigenous to Africa. The tree is mostly found in communal lands and presently the greatest threat is the increase of the human population and land clearance for agriculture, wood carving, a breakdown of respect for traditional authorities and the use of wood as firewood (Shackleton *et al.,* 2003; Shackleton, 2005; Mng'omba *et al.,* 2012). The fruits of *S. birrea* are processed to make traditional beer, commercial liqueur e.g. Amarula cream, jams, wine, juice and chocolates while its kernels produce high quality oil used to make edible oils and cosmetics (Mng'omba *et al.,* 2012).

The *S. birrea's* products have become articles of commerce in local, national and international markets thereby contributing to local and national incomes in Southern Africa countries (Jama *et al.*, 2007; Ndabikunze *et al.*, 2010). In South Africa for instance, it is estimated that the total value of the commercial marula trade to the rural communities worth USD 160 000 a year (Mng'omba *et al.,* 2012); Moganedi *et al.* (2011) cited that *S. birrea* has been declared a national tree in the Republic of South Africa because of its potential to be developed into a viable commercial crop. Also, (Shackleton *et al.,* 2003) in Namibia estimated the total value of the commercial marula products' trade to rural communities to worth USD 33 000 a

year. However, though Tanzania is known to be richest in diversity of *S. birrea* trees, they are not significantly utilized and commercialized but harvested for timber and veneer (Makonda and Gillah, 2007). The reason for the poor utilization and commercialization, among others; is lack of market information (Woiso, 2011). Any move towards improved utilization and commercialization in Tanzania requires unlocking the market information barrier (Woiso, 2011); of which value chain analysis is vital. In addition, (Akinnifesi, 2007) market and financial analyses in southern Africa show that indigenous fruits contribute to household income, and women and children are the major beneficiaries through value addition and fruit processing.

Where commercial exploitation of indigenous fruits occur for example in west and southern Africa regions, have shown a great potential as much as exotic fruits in providing food security, vitamins and income generation. However, in contrast, indigenous fruits including those from *S. birrea* trees have not been commercially exploited in the East and Central Africa region although a diversity of valuable fruit species exists (Jama *et al.,* 2007). Lack in processing equipments and packaging materials, insufficient capital to acquire processing equipment and lack of markets are the main challenges effectively preventing rural processing groups in Tanzania from focusing on the production of higher value products such as oils and wines (Ham and Akinnifesi, 2006).

1.2 Problem Statement and Justification

1.2.1 Problem statement

S. birrea fruits are utilized extensively in wine industries in the Southern African region and the tree has acquired significant commercial importance since its fruits and other products entered local, regional and international trade (Jama *et al.*, 2007). However, despite Tanzania being the centre of diversity for the species (Akinnifesi *et al.,* 2006; Jama *et al.,* 2007) there is virtually no use and commercialization of fruits or the associated products (Jama *et al.,* 2007). Previous studies (Swai *et al*., 2003); Runyoro *et al.*, 2006; Ndabikunze *et al.*, 2010, Woiso, 2011) documented nutritional values, shelf life, barriers to domestication and commercialization, vegetative propagation, germplasm collection and medicinal values of *S. birrea* in Tanzania. But less has been done to explore at a detailed level the market barriers which are said to be reasons for its low commercialization and underutilization.

However, little is known concerning its value chain in terms of actors and their roles, profitability and its distributions along the chain, constraints and opportunities as well as tenure systems, rules, regulations and policies which govern the harvesting and trade of *S. birrea* products. This study was therefore envisaged to employ the value chain analysis technique to analyze the *S. birrea* products' value chain using Uyui and Kilosa districts as case studies. The selection of these districts was for the case of Uyui district, ICRAF pioneered *S. birrea* fruits processing since 2004 but to time no study was conduct to document on its value chain. The inclusion of Kilosa district in this study was due to its endowment with *S. birrea* trees however these resources are not commercialized and still not known why.

1.2.2 Significance of study

The findings from this study unfold and document the value chain actors and their activities, constraints and opportunities; the information which are important for future policy interventions concerning *S.birrea* value chain governance and upgrading. The findings on tenure systems, regulations, relevant policies, profitability and its distribution are important for informing conservation and economic policy makers on whether *S. birrea* resource base is harvested sustainably or not as well as whether there is equitable distribution of benefits for appropriate policy interventions and hence attainment of conservation-through-utilization paradigm. The findings from this study as well formulate baseline information for further studies and academic references.

1.3 Objectives

1.3.1 Main objective

To analyse the value chain of *S. birrea* products in Uyui and Kilosa districts, Tanzania

1.3.2 Specific objectives

i. To identify the actors and their activities in the *S. birrea* value chain.
ii. To assess the profitability and its distributions in each *S. birrea* value chain node.
iii. To examine the constraints and opportunities existing in the *S. birrea* value chain.
iv. To analyse the tenure systems, regulations and policies governing *S. birrea's* resource access and use in Kilosa and Uyui districts.

1.4 Conceptual Framework

The conceptual framework of this study (as detailed in Appendix 3) assumes that tenure systems and both formal and informal regulations such as customary laws and government laws influence commercialization and sustainable harvesting of *S. birrea* resource. In addition, financial access in terms of micro credits and investment capitals, the availability and accessibility of local and international markets and presence of reliable physical infrastructure such as transport and communication networks influence commercialization and sustainability *S. birrea* products trade. Furthermore, involvement of both primary and secondary value chain actors as well as presence of both national and international supportive policy environments which recognize the sector, livelihood and capacity building oriented, promote resource and market access as well as minimization of regulatory barriers influence commercialization and sustainable harvesting of *S. birrea* resource.

1.5 Limitations of the Study

1.5.1 Unwillingness to take part in the study

Some people were unwilling to participate in the study. This was probably due to the fact that many people do not keep records of information concerning collecting and processing of *S. birrea* fruits.

1.5.2 Unavailability of secondary data

Secondary data regarding the amount of fruits collected by collectors per annum were not available due to absence of documentation. Processors as well usually do not keep records regarding the amount of fruits and quantity of products produced

and sold per season. Secondary data presented in this study are based on these value chain actors' memory and recalling. The opportunity cost relating to time spent, transport costs and others costs which are incurred by processors to sell their products have not taken into account in this study because due absence of documentation and processors were not able to recall and make them available to a researcher.

1.5.3 Poor weather and social services

The occurrence of floods in Kilosa district forced the researcher to postpone the data collection exercise for some time. Also the continuous rainfall even after floods made accessibility to some of the study areas such as Nyali and Ihombwe village to be difficult. This slowed data collection work.

In some cases, it was difficult to locate some of the respondents; majority were busy engaged with agriculture activities. Also, the information sought from some of the respondents was based on past experiences; therefore, it was somehow difficult to recall especially considering that majority of the respondents did not keep records. Due to bad weather including frequent rains particularly in Nyali and Ihombwe villages, the process of data collection became difficult and time consuming. The limitations were overcome by spending some addition time looking for respondents and sometimes call-backs and physical revisits were done. Whenever there was rain interviews had to be cancelled until the rain stopped.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Theoretical Background

The literature linking conservation and development presents a number of perspectives on the relationships between biodiversity conservation and development in terms of wealth generation and livelihoods security (Brown, 2002). Traditionally, conservation-oriented literature viewed local community welfare and development as directly conflicting with objectives and practices of biodiversity conservation and development was seen as a problem and a main causal agent of biodiversity loss. However, (Andersen *et al.,* 2007) socio-economic research has established that strict conservation by suspension of the rights of local communities to use forests is problematic in developing countries that have extensive and highly dispersed forest resources and limited capacities for enforcement of legislation and more importantly conservation strategies are needed that work with local communities to ensure they benefit from conservation measures. As a response, (Humle and Murphree, 1999 as cited by Brown, 2002) in the past two decades there is evidence of a major paradigm shift in conservation thinking resulting into new (people-centred) conservation paradigm.

According to Brown (2003), there are three commonly known conservation paradigms namely classic approach which sees local people as direct threat to biodiversity; the populist approach which sees participation and empowerment of local people as a key to finding solutions to more sustainable use of biodiversity and

neo-liberal approach which sees institutional, market and policy failures as undermining biodiversity and the solution is adding value to biodiversity because when biodiversity is more valuable, people will do more to conserve it. According to Schreckenberg *et al.* (2006), securing economic benefits through commercialization of NTFPs such as *S. birrea* products could incentivise conservation or sustainable use is a prevalent discourse and (Brown, 2002; Andersen *et al.,* 2008; and Jensen, 2009) it can be seen as part of a broader dominant neo-liberal paradigmatic or conservation-through-utilization paradigm (Brown, 2002) which stresses complementarities and trade-offs rather than conflicts between conservation and development.

2.2 *Sclerocarya birrea*

2.2.1 Origin, distribution, taxonomy and biophysical properties

The absence of *S. birrea* from other tropical regions strongly suggests that clues to its origin lie in the history of Africa's savanna biome (Hall *et al.*, 2002). *S. birrea* is a member of the Anacardiaceae family, along with 650 species and 70 genera of mainly tropical shrubs and woody vines. The *S. birrea* has three recognised sub-species; fruit-bearing species of which *S. birrea* subsp *caffra* is the most ubiquitous and occurs in east tropical Africa (Kenya, Tanzania), south tropical Africa (Angola, Malawi, Mozambique, Zambia and Zimbabwe) and southern Africa (Botswana, Namibia, South Africa and Swaziland) as well as Madagascar. *S. birrea* subsp. *Multifoliolata* occurs in mixed deciduous woodland and wooded grasslands in Tanzania (Shackleton, 2005; Muok *et al.*, 2011; Robinson *et al.*, 2012; Mollel and Goyvaerts, 2012). *S. birrea* is found in scattered low altitude of mixed deciduous

woodlands and wooded grasslands. Altitude ranges between 500-1200 m and the mean annual rainfall between 200 - 1370 mm. The tree prefers on sandy or stony soils and on lateritic crusts (Ruffo *et al.*, 2002). Ripe fruits are collected in dry season, from which kernels are extracted for propagation. *S. birrea* also is propagated by cuttings (Muok *et al.*, 2011) and grafting (Woiso, 2011).

2.2.2 Important uses

According to Hall *et al.* (2002), the range of products, the appreciation and attractiveness of their quality alongside the available alternatives have set apart *S. birrea* as an economic tree of the African drylands.

Fruit: The fruit that is rich in vitamin C is eaten raw or boiled to sweeten porridge. The pulp is used to prepare juice, jam, wine and alcohol. The fruit kernel is edible and produces edible oil which also used to make cosmetics (Ruffo *et al.*, 2002; Hall *et al.*, 2002).

The bark: The bark of *S. birrea* is used to treat a variety of ailments, notably fever, boils and diarrhoea. Also the bark provides medicinal for treating malaria, venereal diseases, diabetes and dysentery/diarrhoea, haemorrhoids, snakebites, liver diseases, inflammations of the spleen, stomach ulcers and pain, gangrenous rectitis, blepharitis, skin inflammation and eruptions, leprosy, ease labour pains, haemorrhagic menstruation, headache, fevers, sore throat/mouth and toothache (Hall *et al.*, 2002).

Leaves: The leaves are used to treat fever, diarrhoea, skin irritations or insect bites, venereal diseases, including syphilis and a tea for treating weak veins/capillaries (Hall *et al.*, 2002). Also, leaves and fruits are chewed for cough treatment (Ruffo *et al.*, 2002).

Roots and woods: Also, in Tanzania roots are pounded up with water and drunk for schistosomiasis and for washing scabies (Hall *et al.*, 2002). A wood of *S. birrea* is can be used for construction, making of furniture, grain mortars, boats, beehives and forage/fruit as fodder by variety of animals (Ruffo *et al.*, 2002).

2.3 Motives for Commercialization of *S. birrea*

NTFPs are indispensable part of the livelihood strategy of communities living in and near forests; they constitute an important source of livelihood for millions of people across the world (Raufu *et al.,* 2012). Forest-based activities in developing countries, which are mostly in NTFPs area, provide an equivalent of 17 million full-time jobs in the formal sector and another 30 million in the informal sector, as well as 13-35% of all rural non-farm employment (Onuoha *et al.,* 2014). In many developing countries, including Tanzania, majority of rural household and a large proportion of urban household depend on NTFPs to meet some parts of their nutritional, health, construction material and income from selling these products (Kimaro and Lulandala, 2013). FAO's experience in community forest management in developing countries has documented important roles of NTFPs which include: income generation for rural development; more equitable sharing of the benefits of forest; and local participation in forest management (FAO, 2001). In economic terms,

NTFPs contribute substantially to national economic growth and international trade. For example, wild plant resources contribute an income of around US$ 1200 per household per year in Southern Africa (Shackleton *et al.,* 2001 cited by Kimaro and Lulandala, 2013). Within the context of new international commitments to address rural poverty such as the United Nations Millennium Development Goals, NTFPs commercialization including *S. birrea* fruits is recognised as having the potential to achieve dual conservation and development goals by increasing the value of forest resources to local communities (Schreckenberg *et al.*, 2006).

2.4 Value Chain Analysis and its Importance in *S. birrea* Commercialization

In the mid 1980s, Porter developed the value chain analysis as an instrument for identifying the value of each step in the production process (Magar, 2008 and Nang'ole *et al.*, 2011). Hellin and Meijer (2006) defines a value chain as the full range of activities which are required to bring a product or service from conception, through the different phases of production involving a combination of physical transformation and the input of various producer services, delivery to final customers and final disposal after use. On other hand, Morales-Nieto (2009) defines the value chain analysis as the detailed description of sequential primary and support activities within a commodity and service system that turns inputs into value added outputs.

Kaplinsky *et al.* (2000) have pointed out three main reasons why value chain analysis is important in this era of rapid globalisation. The first one deals with the growing division of labour and the global dispersion of the production of components in which systemic competitiveness has become increasingly important. The second one

is efficiency in production which is the only necessary condition for successful penetration into global markets and the last one is the entry into the global markets which allows for the sustained income growth, that is, making the best of globalisation requires an understanding of the dynamic factors within the whole value chain. Value chain analysis in a narrow sense focuses on the primary activities in the chain such as production, transportation, processing, marketing and information exchange. Value chain analysis in a broad sense also encompasses the 'rules of game' that is the governance of the chain as well as the support services such as quality certification (Da Silva and De Sauza Filho, 2007).

Value chain analysis has emerged on the new research agenda for NTFPs (Jensen, 2009) because (Velde *et al.*, 2006) these products are linked to final consumers through value chains. In NTFPs commercialization, value chain analysis helps to assess the number of actors involved and their roles, the volume and the prices of the products, the commercialization margins, the economic profitability and its distribution, the value addition techniques, value chain governance and upgrading, constraints and opportunities existing along the value chain (Marshall *et al.,* 2006; Magar, 2008; Ingram and Bongers, 2009; Ingram, 2010). Through value chain analysis, it is possible to determine who benefits from participation in the chain and which actors could benefit from increased support or organization. One can supplement this analysis by determining the nature of participation within the chain to understand the characteristics of its participants (M4P, 2008).

2.5 Value Chain Mapping

Mapping means giving visual representation business actors along the value chain and the connection between them, illustrating the entire production (or service delivery) process from the beginning (raw materials, conception, design, input supply etc.) to the final consumer (ILO, 2007). UNIDO (2011) further add that mapping is about drawing a preliminary visual representation of the structure of the value chain and detecting its main characteristics. UNIDO (2011) emphasize that chain maps are the core of any value chain analysis and a value chain map usually illustrates the way the product flows from raw material to end markets and indicates how the industry functions. According to UNIDO (2011), the following diagnostic parameters should guide mapping exercise;

Products: In the very beginning one needs to define the nature of the product whose value chain is to be analyzed. It makes a difference if a product is raw or processed.

Functions: The generation and marketing of each industrial product involves a number of different transformation processes. It is the function of the different firms engaged in the value chain to carry out these processes; through this value is added and the product transforms and finally reaches the consumer. Depending on the product, these processes can be very different. Common functions in value chains are input supply, production, assembly, processing, wholesale, export and retail.

Value chain actors: These are the firms and individuals who assume different functions in the value chain, engaging directly in production, processing, trading and

marketing. They usually become the owner of the product and/or take active market positions. Often certain actors can have more than one function.

Flow of product and end-markets: These establish the main connections between the different actors in the value chain. It may be sufficient for a generic map to depict which types of actors deliver products to each other. However, frequently it is also interesting to find out how many products are delivered. The map should also indicate the end-market(s) to which products flow.

Business interactions: The mapping exercise should reveal information about the type of business transactions actors engage in. Usually, for products to pass from one to the other, firms establish certain contractual arrangements. Vegetable growers for instance often engage in contract farming, where a supermarket or food processing company stipulates production protocols to ensure stable quality and characteristics of primary products.

Service provision: The map should include reference to the types of services that support the functioning of the chain, including transportation, packing and handling, business services such as consulting and accounting, quality and process certification, financial support, etc.

2.6 Economic Profitability, its Distribution and Role in NTFPs Commercialization

According to Schaafsma *et al. (*2014), understanding the spatial distribution of the quantity and economic value of Non Timber Forest Product (NTFP) collection gives insight into the benefits that local communities obtain from forests, and can inform decisions about the selection of forested areas that are eligible for conservation and enforcement of regulations. Ingram and Bongers (2009) further add that a holistic view of NTFPs market chain valuation can provide insight on links between NTFPs based activities and their contribution to livelihoods and therefore an understanding of the importance of NTFPs to populations; this in turn can guide how their potential development, governance and management.

In addition, (Andel, 2008) further argues that because the market chains of many NTFPs are seldom monitored, the social and economic importance of these products is often underestimated and (Ingram and Bongers, 2009) knowing the real value of NTFPs market chains is important to address governance issues in market chains. The governance arrangements in a market chain have critical implications for how values are determined and benefits are distributed in market chains (Arnold and Pérez, 2001). Furthermore, (Andel, 2008) in order to identify sustainable harvest levels, it is essential that basic information is available about those doing the actual harvesting, what quantities are taken out from the forest, how the product is processed, how it is marketed and who profits from the trade. Owiredu (2008) further notify that equitable distribution of the returns to value addition along the chain is vital to keep it functioning.

2.7 Constraints in Commercialization of *S. birrea*

According to Andel (2006), in South Africa for instance, the major constraints of the marula industry are (i) the supply of marula fruits exceed the demand for industrially processed marula products. As a consequence, the extractors get low prices from the buying companies (ii) although traders are able to coordinate their harvesting of fruit and reduce spoilage, the poor coordination of transport results in great losses and (iii) most consumers know the marula fruit but there is no significant current demand for traded products. In addition, Mahlati (2011) notify that illiteracy, poor physical infrastructure and limited market knowledge, lack of a fair transaction governance mechanism and inadequacy of government intervention in supporting new industries are other challenges.

Regarding international trade, Mahlati further point out that certification and its associated elements in terms of lack of information and knowledge, the high cost of certification and lack of capacity to implement required systems such as record-keeping is a major challenge. Other challenges include; (i) Country-based regulatory requirements. For example, in Zimbabwe the Statutory Instruments 112 of 2001 of the Forestry Act prohibits exporting of unprocessed or semi-processed forestry produces. There is also a requirement for a Phyto-sanitary Certificate from the exporting country; the requirement which also extends to the receiving country (ii) Payment of export and import tariffs in an environment of loose transactional arrangements where payment for consignment is very often greatly delayed with marula suppliers undervalued (iii) Marula oil and raw products have a short shelf life (iv) Indiscriminate imposition of non-tariff barriers, e.g. plant and disease

regulations, and adherence to ISO 2000 standards to protect local industry (v) Insufficient knowledge by customs officials about the marula product, complicated further by the absence of a harmonised system for certification of South African natural products and (vi) At a higher level, the problem could be non-alignment between multilateral environmental agreements (MEAs) and international trade agreements.

2.8 Tenure Systems, Regulations and Policies in NTFPs Use and Commercialization

According to Neumann and Hirsch (2000) an analysis of land and resource tenure is an appropriate place to begin an examination of the socio-political aspects of NTFPs commercialization. In addition, Wyberg *et al.* (2002) notify that as is the case for all non-timber forest products (NTFPs), a range of laws and policies impact the management, use and commercialisation of marula. These include laws and policies that directly concern NTFPs, or marula, such as natural resource, agriculture, forestry, and environment laws; measures on land tenure and resource rights; and a range of economic and financial measures such as trade and taxation. Relevant laws and policies are manifested at the international, regional, national, district and local levels. Wynberg *et al.* (2002) further add that the equitable and sustainable use of non-timber forest products (NTFPs) especially from important species such as *S. birrea* for both subsistence and cash purposes is strongly influenced by tenure and regulatory controls and norms at a local level, and national policies and legislations at a higher level. Tenure arrangements and local formal and informal regulations are important in providing the rules for governing who can harvest a resource, where

they can harvest, how much they can harvest and for whose benefit (Neumann and Hirsch, 2000). These institutions also provide the framework for sustainable use and management (Wynberg *et al.,* 2002). Neumann and Hirsch (2000) inform that the widely accepted classification of tenure systems defines four types of ownership that is state, private, communal and open access.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Description of the Study Areas

3.1.1 Kilosa district

3.1.1.1 Geographical locations

Kilosa is one of the six districts in Morogoro region with an area of 14 245 km^2 making up about 20% of the Region (KDC, 2010). The District lies between 6°S and 8°S, and 36°30'E and 38°E. It borders Tanga region to the North and Morogoro district to the East. In the South, it is bordered by the Kilombero district and part of Iringa region (KDC, 2010).

3.1.1.2 Climatic conditions

The District experiences an average of eight months of rainfall (October–May), with the highest levels between February and March. The rainfall distribution is bimodal in good years, with short rains (October–January), followed by long rains (mid-February–May). Mean annual rainfall ranges between 1000 and 1400 mm in the southern flood plain, while further North (Gairo division) has an annual rainfall ranging from 800 to 1100 mm. The mean annual temperature in Kilosa is about 25°C.

3.1.1.3 Population

The population of Kilosa district is 438 175 (URT, 2012). The District has three major ethnic groups; (Wa) kaguru in the North, Sagala in the central zone and

Vidunda in the South. However, many people from other ethnic groups have migrated to the area over the last decades.

3.1.1.4 Forestry

Most of the forests are found in the western part of the District, particularly around the Eastern Arc mountain range, and include forest reserves, public forests and community forests (Shishira and Yanda, 1997). The District has ten forest reserves covering an area of 106 983 ha and are all managed centrally through the Tanzania Forest service Agency. Most of the forests are located on steep slopes around the catchment area of the Wami river system, while the rest are found on gentile sloping terrain within and around Mikumi National Park. Community forests are found within villages while public forests are all forest outside the forest reserves, which are not controlled by villagers. These forests are exploited for various purposes such as poles, timber, firewood and charcoal but are also used for hunting wild animals.

3.1.2 Uyui district

Uyui is one of the six districts of the Tabora region in Tanzania. It is bordered to the North by the Nzega and Igunga districts as well as the Shinyanga region, to the South by the Sikonge district, to the west by the Urambo district and to the East by the Singida region. Uyui has an area of about 11 806 km^2. The District has three divisions which are Igalula, Uyui and Ilolangululu. The main tribes which are found in the District are Sukuma, Nyamwezi and Waha. According to the 2012 Tanzania National Population Census, the population of Uyui district is 396 623. The forest conservation initiative in this District is through participatory forest management.

Some forests are under Community Based Forest Management (CBFM) and others are under Joint Forest Management (JFM).

3.2 Research Design

A cross-sectional research design was used in this study**.** This design was chosen because it allows collection of in-depth data on respondents at one point at a time and suitable for description purposes as well as the determination of relationships between variables (William, 2002). The target interest of this research were *S. birrea* fruits collectors, middlemen, processors, transporters and retailers but during the reconnaissance survey it was found that fruits collectors and processors were the only primary actors existing in *S. birrea* products value chain. Therefore, household surveys were implemented on these value chain actors. The study was undertaken for about four months from December 2013 to March 2014.

3.3 Sampling Procedures and Sample Size

The first household survey was conducted in two villages in Uyui district namely Kigwa and Mbola using purposive and multi-stage sampling techniques. The selected villages were among the villages benefited from Ministry of Agriculture and Food Security (MATF) and International Centre for Research in Agro-forestry (ICRAF) 2004-2006 project titled "*Introduction of Indigenous Fruits Processing Technology to Rural Communities in Tabora, Uyui and Sikonge Districts"*. These are also the only villages where fruits collectors and processors were still engage in the business though poorly advanced. The approach used to select sample size varied between the two districts. In Uyui district, a multi-stage purposive snowball sampling method was

employed since little was known about the population of those who engage in *S. birrea* fruits collections and processing. The approach is supported by Barry (2007) who inform that the snowball method is appropriate where too little is known of the population beforehand in order to allow random sampling.

Discussions with key informants from processing groups in each village revealed the presence of only four collectors in each village who used to supply fruits. They were all involved in the study. Also through discussions with district officials it was revealed that there is only one processing group in the sample villages which engage with not only *S. birrea* fruits processing but also other indigenous fruits (IFs). Each processing group in each village was comprised of more than 30 members. Each group was then dismantled and each member was individually interviewed.

For the case of Kilosa district, three villages namely Gongoni, Nyali and Ihombwe were purposively selected for this study due to their endowment with *S. birrea* trees. By using snowballing sampling method, 30 respondents were drawn from each village as supported by Bailey (1994) who argues that it is the minimum sample size sufficient for statistical analysis.

3.4 Data Sources

Primary data were collected through household survey, focus group discussions, participant's observations and key informant interviews. The secondary data to support study findings were extracted from reports and other unpublished documents that were gathered from SUA National Library (SNAL) and various web resources as

well as relevant institutions such as Agriculture Research Institute (ARI)-Tumbi and respective districts' offices.

3.5 Data Collection Techniques

3.5.1 Household survey and key informant interviews

A semi-structured questionnaire was used to collect *S. birrea* fruits collection, processing and marketing information. A questionnaire was prepared per each value chain participant (Appendices 8A, 8B and 8C). In order to supplement the field data, information was sought and obtained through focus group discussions with collectors and processors and key informants including village leaders, natural resources officers, extension officers and researchers by use of checklists (Appendices 9A and 9B).

3.5.2 Measurements of variables

This part intends to determine the influence of constraints identified by value chain actors on the success of *S. birrea* products commercialization by use of multiple regression models however a number of procedures followed to identify dependent and independent variables before attempting it. The dependent variable used in a multiple regression model is a success in commercialization of *S. birrea* products however (Marshall *et al.,* 2003), Arnold and Ruiz Pérez (1998), Ruiz Pérez and Arnold (1996), Neumann and Hirsch (2000) have clearly informed that there is no single criterion in which the success of NTFPs commercialisation may be defined. In their study, Marshal *et al.* (2003) used criteria indicated in Appendix 6 to measure the success of commercialization of NTFPs in Bolivia and Mexico. This study

strived to capture other success measurement criteria from the field but all fall under the previously documented criteria by the identified literature. Therefore this study adopted the success measurement criteria developed by Marshal *et al.* (2003). A four points Likert scale of one to four was applied, that is; 1 = Total failure, 2 = Moderate failure, 3 = Moderate success, 4 = Total success was used to capture respondents insights on the success of *S. birrea* product commercialization and a total score was generated by using SPSS version 16. The study as well used the 20 constraints presented in Table 8 and 9 as independent variables. Respondents were asked to show their perceptions based on four points Likert scale ranging from 1, 2, 3 and 4; meaning that a factor is not a constraint, a constraint, a strong constraint and a very strong constraint respectively. All these referred to the degree to which a given factor was considered to be constraining success. These constraints were then to be regressed against the total success however before the multiple regression analysis was employed; a total success score was computed. Principal Component Analysis (PCA) was employed to enhance data reduction.

The principal components generated by PCA were then named following the generic structure of the commercialisation process which was as well used by Marshall *et al*. (2003). The generic structure have six distinct processes which are production, collection, processing, storage, transport, marketing (i.e. promotion of product) and sale but production was omitted since it is irrelevant in *S. birrea* value chain. The PCA, that is, the processes scores were then regressed against the total success score.

3.6 Data Analysis

3.6.1 Descriptive analysis

Data collected were summarized, coded and analyzed using Statistical Package for Social Sciences (SPSS) version 16. Distributions and magnitudes of variables were determined. Sub sector mapping analysis was employed to handle the specific objective (i) while descriptive analysis was done to determine frequencies, and percentages for specific objective (ii), (iii) and (iv). Microsoft Excel Spread Sheet 2007 in combination with an Enterprise Budget Approach were used to compute and present the profitability of *S. birrea* value chain and the distribution of the total profit among the value chain participants. Multiple regression models were used to determine the influence of constraints facing value chain actors on the success of *S. birrea* products commercialization. Variables included in the empirical model were first reduced by using Principal Component Analysis. Reliability test of variables was also performed to test the stability and internal consistency of the variables. Also, data collected through focus group discussions and key informant interviews particularly from objective (i), (iii) and (iv) were analyzed qualitatively.

3.6.2 Sub-Sector mapping analysis

Sub-sector mapping analysis method was used to map *S. birrea* value chain linkages between actors, activities, products, markets, and services in the value chain**.** The aim was to visualize networks in order to get a better understanding of the connections between actors and processes in a value chain, demonstrate the interdependency between actors and processes in the value chain and create awareness of stakeholders to look beyond their own involvement in the value chain (Onuoha *et al.,* 2014).

The analysis was extended by mapping the specific positions and roles of actors in value chains and identifying their specific constraints and opportunities.

3.6.3 Enterprise budget approach

The net income margin is one of the many useful indicators derived from financial analysis (UNIDO, 2011). According to Rushton *et al.* (2004), Enterprise Budget Approach, Commercialization Margins and the proportional of final price measures are methods normally used to analyze the economic profitability in NTFPs value chains. However, the authors' add that for the case of the latter two methods, the calculation of the margin and proportion is made difficult for products that are processed or transformed when passing through the supply chain and also for products which do not have a standard unit of measure throughout the supply chain. Also, these two methods do not take into account fixed costs incurred by chain participants.

Since *S. birrea* fruits are processed to produce wine and jam while variable, labour and fixed costs being incurred by chain participants, the study therefore adopted Enterprise Budget Approach to present findings for objective three which sought to quantify the profitability of *S. birrea* products trade and describe how profit is distributed along the value chain. The method has been previously used in other researchers for instance Rushton *et al.* (2004) who used it to analyse the economic profitability of three NTFPs value chains namely mushrooms (fresh, dried and matsutake mushrooms), Palma Soyate and pita in Mexico and two Bolivian NTFPs which were cocoa and rubber.

As per requirements of Enterprise Budget Method, variable costs, labour costs and fixed costs for each value chain actors were taken into account. For collectors, the collected information include the amount of fruits, purchasing and selling prices, costs for entrance permits, time spent for collecting and sorting fruits and transporting fruits to the selling points which in this study are termed as labour costs. Other information collected were transport and equipments costs which helped to compute variable and fixed costs respectively. On processors side, the information collected were fruits purchasing price, variable costs that are related to raw materials, labour costs associated with time spent for sorting, processing and packaging, types and quantity products, selling price at local market and trade fairs and fixed costs resulting from equipments depreciations.

The enterprise budget formula is;

$$\text{Enterprise Bugdet Profit} = \text{Output} - \text{Variable Costs} - \text{Fixed Costs} \quad \ldots\ldots\ldots\ldots\ldots\ldots(1)$$

In order to capture the fixed costs of each value chain participant, total depreciation values were computed by use of Straight line method.

The formula for Straight line method is;

$$\text{Depreciation} = \frac{\text{Purchasing Cost} - \text{Salvage Value}}{\text{Esimated Life of Asset (years)}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Or

$$D = \frac{P - S}{N}$$

Where D = Depreciation

P = Purchasing Cost

S = Salvage Value

N = Estimated Useful Life

There are number of reasons which influenced the use the Straight line method instead of other methods. According to Marshall *et al.* (2006) there are three common methods of calculating depreciation which are Straight line method, the Diminishing Balances and Sum-of-the-digits methods. However, the latter two are relatively complicated in comparison to the straight line method. These complicated methods are also more applicable where there is a need to calculate depreciation for an item with a large degree of obsolescence e.g. a car, a computer or a processing machine where technologies change rapidly the value of such an asset will decline rapidly in the first year of life due to the purchased item being quickly replaced by newer versions with different technologies. Authors further note that for capital items such as basic tools, machetes, spades, etc., or buildings, the straight line method is preferred and it is generally more appropriate with many of the basic technologies used in the collection of NTFPs and household or village level processing.

3.6.4 Principal component analysis

After documenting the constraints hindering commercialization of *S. birrea*, the study further sought to assess the influence of identified constraints on commercialization of *S. birrea* products; which necessity adoption of multiple regression model. A multiple regression model developed was used to study the relationship between total success score against the generic commercialization processes which are collection, transport, storage, processing, marketing and sale

with their items as depicted by a pattern matrix (Table 11). Prior to multiple regression analysis, constraints that were perceived to constrain the success of *S. birrea* products commercialization were first subjected to principal component analysis for data reductions. The interrelationship among variables was assessed. Prior to performing PCA, the suitability of data for PCA was assessed. The 20 items that were perceived to be the constraints for successful commercialization of *S. birrea* products were subjected to factor analysis using Principal Component analysis with Oblimin rotation. The strength of the relationship among the variable (factors) was also assessed. The number of factors retained was guided by Kaiser-Mayer-Olkin (KMO), Bartlett's test of sphericity and eigen values requirements. The Kaiser-Meyer-Olkin (KMO) indicator was calculated to assess sample size adequacy. According to Chopra *et al.* (2014), the minimum KMO acceptable level is 0.5. The significant Batletts test at $p < 0.01$ suggests existence of correlations between test variables which support suitability of data for factor analysis (Field, 2009).

3.7 Reliability Test

Reliability is concerned with questions of stability and consistency. Stability is the instruments' capacity to yield the same results whereas consistency is the instruments' capacity to produce accurate answers (Singleton and Traits, 2005 cited by Sife, 2010). In this study the reliability was tested for the internal consistency using Cronbach alpha coefficients. The coefficient normally ranges between 0 and 1, meaning that the closer Cronbach alpha coefficient is to 1, the greater the internal consistency of items in the scale (Pallant, 2011). The minimum recommended Cronbach's alpha value is 0.7 (Pallant and Bailey, 2005).

Multiple regression analysis was done to ascertain the independent variables (constraints) which statistically significant influence the success of *S. birrea* products commercialization. Both Principal Component Analysis and multiple linear regressions were selected because they are relevant to this study and have been used by others including Marshall *et al.* (2003) to assess factors influencing success of NTFPs commercialization in Bolivia and Mexico. Principal component analysis (PCA) was used to enhance data reductions while the adoption of multiple linear regressions was to identify independent variables generated by PCA which statistically influence the success of *S. birrea* commercialization in Uyui district.

The Multiple regression models were developed by using independent variables which are defined below. By using multiple regression coefficients (β), the equation was developed.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \mu \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3)$$

Where,

Y = Success in commercialization of *S. birrea* products

β_0 = Constant term

β_1 to β_6 = Coefficients of independent variables

μ = Error term

X_1 = Collection

X_2 = Sale

X_3 = Transport

X_4 = Processing

X_5 = Marketing

X_6 = Storage

Gujarati (2004) reported that regression equations generated by ordinary least squares are associated with several problems depending on the type, nature and form of the regression model employed in the analysis. The most common problems encountered in the regression analyses include multicollinearity, heteroscedasticity and autocorellation. However, the relevant tests were performed to ascertain that the basic assumptions governing linear regression procedure were not violated.

3.8 Multicollinearity Diagnosis

Multicollinearity is the problem which occurs when two or more predictors in the model are correlated and provide redundant information about the response. Variance Inflation Factor (VIF) and level of Tolerance were used to test for the presence of multicollinearity problem.

As a rule of thumb, if VIF value exceeds 10 and Tolerance level <0.1, then the variable is said to be highly collinear (Gujarati, 2004). Since all independent variables have VIF of less than 5 and tolerance of greater than 0.1 (Table 1), a multicollinearity problem was not encountered in the model. In regression, the coefficient of determination (R^2) is the percentage of the total sum of the square mean; the regression sum of the squares divided by the total sum of the squares. Where as Adjusted R^2 is an attempt to correct the weakness of R^2 by adjusting both the numerator and denominator by their respective degree of freedom (Bollerslev, 1986).

Table 1: Multicollinearity diagnosis

Variables	Collinearity Statistics	
	Tolerance	**VIF**
Collection	0.567	1.764
Sale	0.552	1.812
Transport	0.300	3.335
Processing	0.515	1.943
Marketing	0.347	2.886
Storage	0.663	1.509

Source: Field Data, 2014

The R^2 statistics measure the extent to which the total variation of the independent variable is explained by the regression model.

CHAPTER FOUR

4.0 RESULTS AND DISCUSION

4.1 Demographic Characteristics of Respondents

The key demographic characteristics which were taken into account in the study were gender, age, education level and marital status. These characteristics were important to understand the general status of respondents and how the status might have influenced their decision to engage in *S. birrea* fruits collection and trade.

Table 2 shows that in Uyui district (Kigwa and Mbola villages) majority were women with few men, indicating that the *S. birrea* products value chain was dominated by females. Such statistics are due to fact many social groups including indigenous fruits processing industries in most rural areas are always composed of women. The findings are partly similar to that of Elah's (2000) study which found that women were more involved in the collection and transformation of bush mango in both East and South West Regions followed by girls and boys respectively while men were least involved.

In Kilosa district however most of respondents interviewed were men, a situation which is linked to absence of *S. birrea* processing. Such statistics are a result of many household heads being male headed and most of African traditions do allow only household males to talk to visitors. These findings are similar to that of Elah (2000) and Woiso (2011) which found that most of the respondents encountered during survey were males.

The study further revealed that among the respondents interviewed at least 67% aged between 26-50, which could be classified as the active and productive age (Enwerem and Ohajianya, 2013). These findings are almost similar to that of Woiso (2011) that most of respondents in study areas had at least an average age of above 30 years. In terms of marital status, most (more than 73%) of the respondents interviewed were married while the remaining were single, separated and widowed. The high incidence of marriage status is consistent with Tajoacha (2008) and Maroyi (2013) who found that 77% and 65.6% of respondents were married and hence more stable and (Enwerem and Ohajianya, 2013) indicating how responsible the farmers were to their households.

On the level of education, more than 66% of respondents interviewed in all villages had primary level of education. The status of majority to have attained this level can be interpreted that most of them would have no formal employment and thus any initiative to promote commercialization of *S. birrea* products would create informal employment with impacts on communities' livelihoods. In addition, it can be said that since majority had primary education and some few have secondary and post secondary education, they can be trained and can read various sources of information so as they can acquire more knowledge on value addition activities as well as sustainable management of *S. birrea* to enhance its conservation and improve the rural livelihoods. The study findings are in line with Woiso (2011) and Maroyi's (2013) studies which reported that majority of the respondents interviewed were educated up to primary education level.

Table 2: Demographic characteristics of respondents in Uyui and Kilosa Districts, Tanzania

Demographic characteristics	Uyui District				Kilosa District					
	Kigwa village (34)		Mbola village (34)		Gongoni village (30)		Nyali village (30)		Ihombwe village (30)	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Age										
18-25	2	5.9	1	2.9	1	3.3	2	6.7	2	6.7
26-50	23	67.6	23	67.6	21	70.0	20	66.7	21	70.0
>50	9	26.5	10	29.4	8	26.7	8	26.7	7	23.3
Sex										
Male	12	35.3	5	14.7	18	60.0	15	50.0	18	60.0
Female	22	64.7	29	85.3	12	40.0	15	50.0	12	40.0
Marital status										
Single	3	8.8	3	8.8	2	6.7	3	10.0	4	13.3
Married	27	79.4	26	76.5	23	76.7	23	76.7	22	73.3
Widow	2	5.9	3	8.8	4	13.3	1	3.3	2	6.7
Separated	2	5.9	2	5.9	1	3.3	3	10.0	2	6.7
Education level										
Informal	3	8.8	4	11.8	4	13.3	7	23.3	3	8.8
Primary School	28	82.4	30	88.2	26	86.7	21	70.0	20	66.7
Secondary School	2	5.9	0	.0	0	.0	1	3.3	4	14.5
Post-secondary	1	2.9	0	.0	0	.0	1	3.3	3	10.0

Source: Field Data, 2014

4.2 Economic Activities of Respondents

The findings from Table 3 show that crop farming is a major economic activity (assigned more than 40%) in all studied villages. Also, indigenous fruits processing was a second economic activity which was assigned high scores (at least 21% in Uyui district) with none in Kilosa district. Other economic activities that were identified to be undertaken by respondents were livestock keeping, kiosks, seasonal small businesses, beekeeping, restaurant and formal employment, charcoal making, brewing of local alcohol, boda boda, and lumbering. In addition, carpentry, restaurant, mason and radio repairing were also the other economic activities which some of the respondents relied to make their livings.

Respondents' dependence on farming as major economic activity implies that occurrence of crop failure due to disasters like floods will severely impact their livelihoods. With these, it can be argued that more commercialization of *S. birrea* accompanied with some domestication initiatives will act as safety net to rescues communities during poor weather conditions and economic hardships as well as to play role as gap filler during off-farm activities. Also, though seasonal, high engagement in indigenous fruits products processing including *S. birrea* products indicates that people recognize the importance of indigenous fruits including marula fruits in their livelihoods hence an opportunity for its domestication. The study findings on respondents' higher reliance on farming as a main economic activity conform to Ugwuja *et al.* (2011) and Woiso (2011) study findings that a greater proportion of respondents were farmers.

Table 3: Economic activities of respondents in Uyui and Kilosa Districts, Tanzania

Economic Activities	Uyui District				Kilosa District					
	Kigwa village (34)		Mbola village (34)		Gongoni village (30)		Nyali village (30)		Ihombwe village (30)	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Crop farming	34	46.6	34	42.5	30	56.6	30	65.2	30	52.6
Livestock keeping	5	6.8	4	5.0	4	7.5	2	4.3	5	8.8
Employee	2	2.7	0	.0	0	.0	0	.0	0	.0
Brewing local beer	0	.0	0	.0	1	1.9	2	4.3	2	3.5
Bee keeping	4	5.5	2	2.5	3	5.7	0	.0	3	5.3
Kiosk	6	8.2	3	3.8	3	5.7	0	.0	3	5.3
Restaurant	2	2.7	4	5.0	2	3.8	0	.0	1	1.8
Processing IFS	16	21.9	30	37.5	0	.0	0	.0	0	.0
Carpenter	0	.0	0	.0	1	1.9	1	2.2	1	1.8
Charcoal making	0	.0	0	.0	3	5.7	1	2.2	2	3.5
Lumbering	0	.0	0	.0	1	1.9	2	4.3	4	7.0
Bodaboda	0	.0	0	.0	1	1.9	1	2.2	1	1.8
Mason	0	.0	0	.0	1	1.9	2	4.3	0	.0
Radio technician	0	.0	0	.0	0	.0	1	2.2	0	.0
Seasonal business	4	5.5	3	3.8	3	5.7	4	8.7	5	18.8
Total	**73**	**100.0**	**80**	**100.0**	**53**	**100.0**	**46**	**100.0**	**57**	**100.0**

Source: Field Data, 2014

4.3 Households Assets Owned by Respondents

The findings in Table 4 show that respondents own various household assets. On media related assets, radios (more than 19%) and cell phones (more than 13%) were mostly owned assets by interviewees. Other assets that were owned by the respondents were television, bush knives and axes, motorcycles, bicycle, wheel barrows and push carts. The ownership of assets like radios and cell phones are of interest to *S. birrea* products commercialization and utilization because these assets are important to value chain actors as they will help them to share market information related to demands, prices, credits, value addition options, packaging and storage, availability of modern processing technologies and link with potential buyers outside their vicinities. These assets are also important gateways where experts can train and disseminate information to the actors and community in general on various aspects including the economic importance of *S. birrea* trees, their domestication, value addition strategies and sustainable harvesting to enhance conservation of these trees hence sustainability of the business.

The findings on ownership of these assets are similar with SFTZ (2011) study which reported that when respondents were asked about ownership of durable goods such as mobile phones, radios or bicycles, the most common item owned in all five of the villages was a radio followed by mobile phones which is also consistent with Hassan and Semkwiji (2011) study for the case of latter that, 89% of the respondents in the study areas reported to own mobile phones.

Table 4: Household assets of respondents in Uyui and Kilosa Districts, Tanzania

Household Assets	Uyui District						Kilosa District			
	Kigwa village (34)		Mbola village (34)		Gongoni village (30)		Nyali village (30)		Ihombwe village (30)	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Electricity(solar)	2	2.2	0	.0	2	1.5	0	.0	0	.0
Television	1	1.1	0	.0	1	.8	0	.0	0	.0
Radio	18	19.8	20	20.4	26	19.7	26	19.5	24	16.1
Cell phone	12	13.2	15	15.3	27	20.5	28	21.1	30	20.1
Bicycle	10	11.0	14	14.3	18	13.6	21	15.8	25	16.8
Vehicle	0	.0	0	.0	0	.0	0	.0	0	.0
Wheelbarrow	2	2.2	3	3.1	3	2.3	1	.8	3	2.0
Push cart	1	1.1	2	2.0	1	.8	1	.8	4	2.7
Bush knife	25	27.5	24	24.5	27	20.5	30	22.6	30	20.1
Axe	18	19.8	20	20.4	24	18.2	24	18.	30	20.1
Motorcycle	2	2.2	0	.0	3	2.3	2	1.5	3	2.0
Total	**91**	**100.0**	**98**	**100.0**	**132**	**100.0**	**133**	**100.0**	**149**	**100.0**

Source: Field Data, 2014

Woiso (2011) also pointed out that presence of FM radios and extensive mobile telephone networks are potential advantage towards interventions for successful improved management and trading of *S. birrea* in Tanzania because will aid farmers to exchange and update prices hence avoiding underpayment from middlemen. Dewees *et al.* (2011) further add that the emergence and expansion of new communication technologies can help to improve market access for the poor.

On power issues, the study found that only few respondents (less than 2.3%) in Kigwa and Gongoni villages have electricity generated from solar energy and national grid respectively. Absence of electricity in the study villages implies that processors are not able to adopt modern processing technology and storage facilities in order to advance in *S. birrea* products processing. The study findings on low access to power are similar to Salami *et al.* (2010) who argued that electricity in rural areas is expensive and often not available which has reduced investments in cold storage facilities, irrigation, and processing of farm produces.

4.4 Local Uses of *S. birrea* Products

Table 5 shows that there are various local uses of *S. birrea* products in the study villages but with some variations. In all districts, respondents reported to eat *S. birrea* fruits (17.9%), use barks as medicine (15.0%) and shade (14.2%).

Table 5: Local uses of *S. birrea* products by respondents in Uyui and Kilosa Districts, Tanzania

Local use	Uyui District				Kilosa District					
	Kigwa village (34)		Mbola village (34)		Gongoni village(30)		Nyali village (30)		Ihombwe village (30)	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Spiritual purposes	0	.0	0	.0	27	26.2	28	25.9	29	27.1
Eat fruits	12	14.0	9	6.6	22	21.4	26	24.1	25	23.4
Use fruits to make juice	0	.0	30	21.9	0	.0	0	.0	0	.0
Make wine	16	18.6	30	21.9	0	.0	0	.0	0	.0
Make jam	16	18.6	30	21.9	0	.0	0	.0	0	.0
Wood to make mortar	3	3.5	3	2.2	3	2.9	1	.9	2	1.9
Seeds for playing bao	0	.0	0	.0	4	3.9	4	3.7	3	2.8
Use as firewood	5	5.8	5	3.6	0	.0	0	.0	0	.0
Timber	9	10.5	7	5.1	7	6.8	3	2.8	3	2.8
Bark as medicine	11	12.8	8	5.8	19	18.4	22	20.4	19	17.8
Roots as medicine	1	1.2	4	2.9	4	3.9	4	3.7	4	3.7
Leaves as medicine	0	.0	0	.0	0	.0	0	.0	0	.0
Shade	9	10.5	7	5.1	17	16.5	20	18.5	22	20.6
Sell fruits	4	4.7	4	2.9	0	.0	0	.0	0	.0
Total	**86**	**100.0**	**137**	**100.0**	**103**	**100**	**108**	**100**	**107**	**100**

Source: Field Data, 2014

In Uyui district, the study further found that respondents use fruits to make wine, jams and juices. Other uses which were reported by respondents were use of trees for firewood, timber, use wood to make mortar and use roots for medicinal purpose. In Kilosa district, most of the respondents reported to have used the tree for spiritual purposes and seeds for playing *bao*. In *S. birrea* trees commercialization and conservation perspectives, the study findings on these local uses are of great importance. Apart from use for timber, other uses indicate that local people are already aware of the economic importance of this tree and hence any commercialization and/or domestication initiative will have a strong support and back up from local communities.

Information on the use of trees for timber is also useful because it alerts conservationists about the threat of timber extraction practices on *S. birrea* trees and hence a need of appropriate measures to curb the situation. Also, use of tree for spiritual purpose in Kilosa district implies that any initiative that is, being commercialization accompanied by domestication will be a potential supplement towards conservation of this economically important tree. The study findings on local use concur with McHardy (2002) study which found that *S. birrea* has a number of uses including use of bark for medicine (79.4 % of households) and the fruit for beer (71.4 %), eating fruits (57.1 %) while 60.3 % of households use marula wood for firewood. Likewise, studies by Woiso (2011), Maroyi (2011) and Shackleton *et al.* (2003) found that marula trees are used for timber, medicine, tool making, fruits and shade and fuel among others.

4.5 *S. birrea* Value Chain Map of Uyui District

S. birrea fruits and associated products value chain is simple with few products and comprised by fruits collectors, local processors and consumers. This shows low intensity of value addition and simple interactions among actors and chain service providers in Uyui district. A range of production and marketing functions undertaken in the *S. birrea* products value chain are collection, transportation, processing and consumption (Fig. 1). The actors involved are presented as nodes within the space of the value chain map. Arrows of different colours distinguish the flows of value added products and services (Fig. 1).

4.5.1 Value chain actors

Different actors exist in *S. birrea* products value chain in Uyui district. The actors identified were;

4.5.1.1 Collectors

These are people who engage in the collection of *S. birrea* fruits in the field. In the two villages surveyed in Uyui district collectors have identified protected areas, communal lands and private lands (farmlands) (Fig. 1) to be the main sources where the *S. birrea* fruits collections are taking place. In Kigwa village the collection of fruits is done by men only, while in Mbola village the collection is done by both men and women. Children were reported to assist sorting activities. Interviews with collectors in the two villages revealed that all collectors usually sell fruits to local processors based in their village vicinity season, an average of 16.5 buckets of 20 litres were collected in Kigwa village each sold at TZS 4 000 whereas in Mbola village 13.5 buckets were as well collected and sold at a price of TZS 6 600 each.

4.5.1.2 Local processors

These are people who deal with the processing of *S. birrea* fruits. Through focus group discussions and key informant interviews it was revealed that previously processors used to produce wine, jam and juices from *S. birrea* fruits but currently they only engage with making of wine for the case of MEMBO group and wine and jam for VUMILIA group based at Kigwa village. Wines and jams are the only products produced by VUMILIA group based at Kigwa village while MEMBO group based at Mbola village produce wine only. The *S. birrea* products's business is seasonal and poorly developed.

The market for *S. birrea* products is of event in nature that is there are no specific outlets where *S. birrea* products are retailed but processors used to sell their products during certain events such as trade fairs like Nane Nane, Saba Saba and SIDO shows and guests visitation for the case of MEMBO group in Mbola village. The wine is usually packed in 350ml and 700ml bottles.

The previous season selling prices for these products were; for the case of MEMBO Group, 350ml bottles of wine was sold TZS 1 500 at local market and TZS 3 500 at trade fairs respectively whereby the 700ml bottle of wine is usually sold TZS 7 000 at regional, zonal or national trade fairs. For the case of VUMILIA group, the group used to produce 30 bottles of 350ml only per annum each being sold for about TZS 2 000 and TZS 5 000 at local markets and trade fairs respectively. Jam is usually marketed at trade fairs and sold for about TZS 5 000.

4.5.1.3 Service providers

Apart from trading, there are non-trading service providers that support the value chain actors. These involve providers of commercial and public services. These engage in supply of equipment, financial and technical services, researches, training and extension services. The study revealed that ICRAF (currently known as World Agroforestry Centre) in collaboration with Ministry of Agriculture and Food Security through the project titled *"Introduction of Indigenous Fruits Processing Technology to Rural Communities in Tabora, Uyui and Sikonge Districts"* pioneered the indigenous fruits processing industry in Tabora region in 2004.

Farm Africa has in past provided equipments supports as well as financial support in terms of revolving fund to both processing groups in Mbola and Kigwa village while Millenium Village Project and Miombo Woodland Project are currently providing financial, materials and technical supports to MEMBO group in Mbola village. In terms of Research and Development (R & D), training and extension services; ARI-Tumbi, ICRAF, SIDO and TAWLAE were identified to be the actors who previously have engaged in this area either through directly providing training or by providing financial support to facilitate trainings.

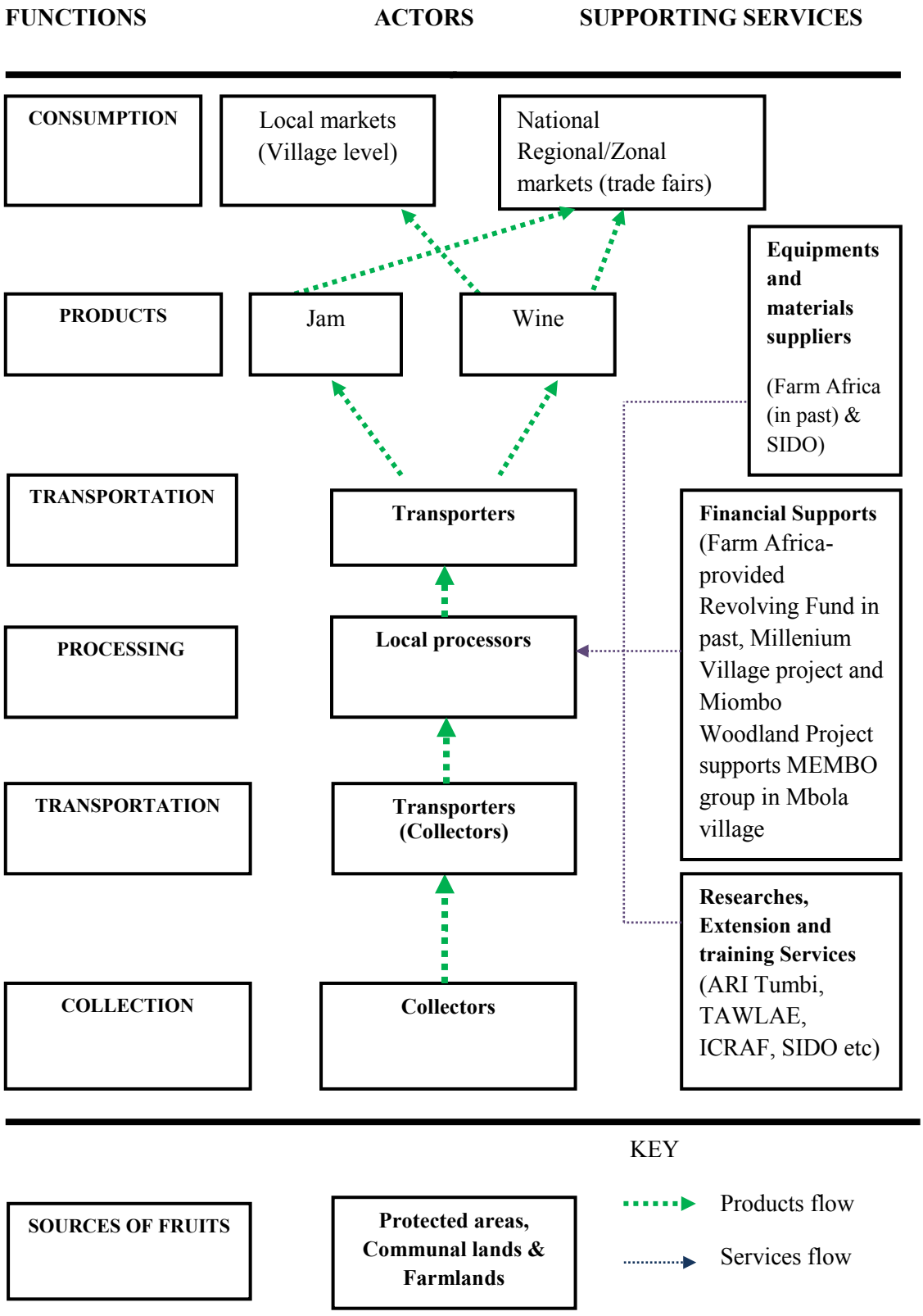


Figure 1: Generalized map of *S. birrea* products value chain in Uyui District, Tabora region, Tanzania

4.5.2 Value addition activities

In any value chain it is usually common to have value addition activities. In *S. birrea's* products value chain as well there are numbers of value addition activities which are pursued by collectors and processors. During focus group discussion with collectors, sorting of fruits either in the field or at home and storage were reported to be the only value addition activities did by these value chain actors. On other hand, the study revealed that processors undertake most of value addition activities before the products can reach consumers. The value addition activities which were reported to be borne by processors were sorting and washing of fruits, peeling and blending/grinding of fruit pulps, sieving, mixing of ingredients, bucketing, packaging, sealing and labelling of final products ready for sale.

4.6 Economic Profitability and Profit Distribution along the Value Chain

The economic analysis results in Table 6 and 7 implies that processors get 96% of the gross profit while collectors accrued only 4% of the total profit. The result show the value generated from *S. birrea* value chain is small and it is supported by Shanley *et al*. (2002) who argue that many NTFPs markets are small in scope and value. Shackleton *et al.* (2007) further elaborate that generally average financial returns from the local trade in NTFPs tend to be modest; one of the reasons why it is thought to have little potential for poverty reduction and rejected as an area for potential investment and support. These findings concur with UNEP (2012) which noted that in indigenous non timber products trade in Namibia many natural products harvesters earn a very small share (2-3%) of the retail value of the products they supply. Neumann and Hirsch (2000) further inform that Brazil nut collectors were receiving

USD 0.03 to USD 0.04 per pound of nuts which were being exported at USD 1.00 to USD 1.20 per pound.

Table 6: Pooled enterprise budget of collectors in Uyui District, Tanzania

Sales, Costs & Profits	Total value (in TZS)/year			
	Kigwa village	**Mbola village**	**Total**	**Pooled Total Average**
Revenue	66 000	89 100	155 100	19 388
Total variable Costs	20 000	39 000	59 000	7 375
Total Labour Costs	26 006	37 406	63 413	7 927
Total Fixed costs (Depreciation)	444	533	978	122
Total Costs	46 451	76 940	123 390	15 424
Net profit (TZs)	**19 549**	**12 160**	**31 710**	**3 964**

Source: Field Data, 2014

However, Alexendies and Shanley (2004) argue that in spite of their low turnover, the cumulative value of hundreds of these small-scale forest commodities is considerable, forming the monetary base for millions of harvesters, processors and traders.

In the studied villages as well, collectors and processors does not only engage with *S. birrea* products collection and processing but also collect and process other NTFPs such as *Ntalali* (*Vitex mombassae), Mantonga* (*Strychnos cocculoides), Mbuyu* (*Adansonia digitata), Mzambarau* (*Syzium guineense)* and *Furu* (*Vitex doniana)* fruits to make jam, wine and juices. The findings on unequal distribution of profits are supported by Neumann and Hirsch (2000) who state that profits from NTFPs

extraction and marketing tend to be unequally distributed along the chain from forest to market, with the smallest proportion generally being accrued by collectors.

Table 7: Pooled average enterprise budget of processing groups in Uyui District, Tanzania

Sales, Costs & profits	Total value (in TZS)/ year			
	Kigwa village	Mbola village	Pooled Total	Pooled Total Average
Revenue	540 000	660 000	1 200 000	600 000
Total variable Costs	191 800	254 700	446 500	223 250
Total Labour Costs	212 325	342 000	554 325	277 163
Total Fixed costs (Depreciation)	802	2 007	2 809	1 404
Total Costs	404 927	598 707	1 003 634	501 817
Net profit	**135 073**	**61 293**	**196 366**	**98 183**

Source: Field Data, 2014

4.7 Constraints and Opportunities Existing along the *S. birrea* Products Value Chain

4.7.1 Constraints faced by fruits collectors

During focus group discussions with collectors it was reported that there are three sources where *S. birrea* fruits are collected namely private lands (farmlands), communal lands and protected areas (forest reserves) with major collection being undertaken in communal lands and protected areas. It was further reported that due to nature of collection sites, collectors usually face a number of challenges in their work. In Table 8, long distance and scattered trees were the main constraints pointed out each scoring more than 23% in all villages. These findings imply that these

factors affect the sustainability and efficiency of *S. birrea* processing work due to insufficient supply of raw materials; hence any domestication initiative will be of great importance. Similarly, Gyan and Shackleton (2005) and Elah (2000), Marshall *et al.* (2006) also notify that NTFPs collection can be difficult and dangerous because of its location and long distance among other factors. Other challenges that were found to face collectors were rough terrain, poor roads and risks and threats from being attacked by dangerous snakes and animals such as elephants. Marshall *et al.* (2006), Magar (2008) and Elah (2000) also reported on these.

Table 8: Constraints faced by fruits collectors in Uyui District, Tanzania

Constraints	Kigwa village (4)		Mbola village (4)	
	Frequency	%	Frequency	%
Risks from animals	2	16.7	3	23.1
Long distance	4	33.3	3	23.1
Scattered trees	3	25.0	4	30.8
Rough terrain	1	8.3	2	15.4
Poor roads	2	16.7	1	7.7
Total	**12**	**100.0**	**13**	**100.0**

Source: Field Data, 2014

4.7.2 Constraints facing fruits processors

Similar to collectors, Table 9 indicates that processors have not being able to advance in their processing activities due to various challenges which constrain them. The findings (Table 4) show lack of capital and credits were the mostly mentioned challenges having been raised by a least 8% of processors interviewed. The study findings are in line with Ahenkan and Boon (2011), Ham and Akinnifesi (2006), UNEP (2012) and MATF (2005) which reported lack of financial services as

the key constraint facing NTFPs processing industry. Furthermore, absence of electricity (at least 8% of the respondents), lack of market information and linkage, lack of TBS and TFDA certifications and barcodes as well as absences of processing centre in Kigwa village were also identified to be the immediate constraints facing processors each with a score of at least 7%.

Table 9: Constraints facing *S. birrea* fruits processing groups in Uyui District, Tanzania

Constraints	Kigwa village (4)		Mbola village (4)	
	Frequency	%	Frequency	%
Lack of capital	30	8.5	30	8.5
Unreliable availability of packaging materials	19	5.4	23	6.6
Packaging materials are expensive	24	6.8	16	4.6
Absence of modern technology	22	6.2	25	7.1
Seasonal availability of fruits	23	6.5	27	7.7
Unreliable markets	27	7.7	28	8.0
No electricity	30	8.5	30	8.5
Lack of processing centre	29	8.2	0	0.0
Lack of cold storage facilities	18	5.1	24	6.8
Absence of credits	29	8.2	30	8.5
Absence of trainings	16	4.5	15	4.3
Absence of TBS and TFDA certifications	26	7.4	29	8.3
Low quality goods and undifferentiated labels	12	3.4	19	5.4
No barcodes	21	6.0	28	8.0
Lack market information and linkage	26	7.4	27	7.7
Total	**352**	**100.0**	**351**	**100.0**

Source: Field Data, 2014

Presence of these constraints implies that processors could not make a viable investment to produce quality goods and compete in international markets. These findings are supported by FAO (2009), UNEP (2012), Ahenkan and Boon, 2011 and Dewees *et al*. (2011).

Other constraints that were revealed by this study were unreliable markets, scarcity and seasonal availability of fruits, unreliable availability of packaging materials, expensive packaging materials, low quality products and labels, absence of trainings and lack of storage facilities. The study findings converge with Technical Centre for Agricultural and Rural Cooperation's (2000) study which reported that among other things, lack of training as a problem facing small-scale food processing sub sector in Tanzania. Hawassi (2006) as well reported that lack of market, working capital, credits, packaging materials, appropriate processing technology, TBS and TFDA certifications, unattractive image of packaging materials and seasonality of fresh raw materials to be among of the problems affecting performance of fruits and vegetables processing firms in Dar es salaam, Tanga, Iringa and Dodoma regions.

4.7.3 Constraints and their influence in success of *S. birrea* products commercialization

Principal Component Analysis results are presented in Table 11. The study's Kaiser-Meyer-Olkin (KMO) is 0.61 and Bartlett's test of sphericity is $p<0.00$ which are acceptable. In summary, the adequacy and reliability of the selected components are suitable for further study.

Table 10: Kaiser-Meyer-Olkin measures of sampling adequacy and Bartlet's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.606
Bartlett's Test of Sphericity	Approx. Chi-Square	287.1
	df	153
	Sig.	.000

Source: Field Data, 2014

The internal consistency was also tested and was 0.71 which comply with the recommended minimum level of 0.7. Total variance explained revealed the presence of six components with eigenvalues exceeding 1, with total cumulative variance of 62.8% explaining 19.2%, 11.8%, 9.6%, 8.2%, 8.0% and 6.0% of the variance respectively. An inspection of the scree plot also supported a six factors solution. Following Oblimin rotation, the pattern and structure matrix (Table 11 and 12 respectively) shown presence of simple structure with both components showing a number of strong loadings. The double loadings recorded in Table 10 confirm existence of correlations among factors.

Table 11: Pattern matrix for principal component analysis after oblimin rotation

	Component					
	Collection	**Sale**	**Transport**	**Processing**	**Marketing**	**Storage**
Poor roads	.799					
Processing centre	.704					
Scattered trees	.624			.479		
Dangerous animals	.450		.311		-.352	
Unreliable market		.796				
Unreliable materials		-.667				
Labels		-.491	-.490			
Storage facilities			-.761			
Lack Market information		-.342	.418		-.391	
Electricity	.304		-.381			
Seasonality				-.814		
Obsolete technology				-.670		
Expensive P/ materials					-.856	
Training					-.672	
Barcodes		.306			-.533	
Long distance			-.352	-.406	-.410	.365
Credits						.778
Capital						.767

Extraction Method: Principal Component Analysis

Source: Field Data, 2014

Table 12: Structure matrix for principal component analysis after oblimin rotation

	Component					
	Collection	**Sale**	**Transport**	**Processing**	**Marketing**	**Storage**
Poor roads	.816					
Processing centre	.759				-.356	
Scattered trees	.604		-.319	.348		
Dangerous animals	.446			-.376	-.441	
Unreliable market		.785				
Unreliable p/materials		-.670				
Labels			-.762			
Storage facilities	.348	-.496	-.521			
Lack Market information	.405		-.432			
Electricity		-.318	.424		-.419	
Seasonality				-.811		
Obsolete technology				-.673		
Expensive P/ materials					-.805	
Training	.415				-.680	
Barcodes		.337			-.608	
Long distance			-.312	-.466	-.501	.421
Credits						.797
Capital						.774

Extraction Method: Principal Component Analysis

Source: Field Data, 2014

The results of this analysis supported the use of components generated as independent variables in a multiple regression model to test if they have influence on success of *S. birrea* products commercialization. In order to test the influence of perceived constraints as the limiting factors on the successful commercialization of *S. birrea* products, the overall total success score and the PCA scores per each component were generated with the aid of SPSS version 16. The success total score was then regressed against the PCA scores. The dependent variable was a total success score of the criteria that were perceived to be the measurement of success while independent variables were collection, sale, transport, processing, marketing and storage which were extracted by use of PCA as explained in the Chapter three.

Results in Table 13 show that coefficient of determination (Adjusted R^2) was 0.302; meaning that 30.2% of success in commercialization of *S. birrea* products was due to the independent variables included in the regression model, whereas the other 69.8% was due to variables that are not included in the equation and possible sampling and measurement errors. Toole (2007) points out that an adjusted R squared above 0.25 is considered typically meaningful in social science research whereas Gaur and Gaur (2009) as cited by Mtebe and Raisamo (2014) further note that as much as lower value R square 0.10-0.20 is acceptable in social science research. When total success score was regressed against PCA scores, multiple regression results (Table 13) indicated that processing (comprised of seasonal availability of fruits, absence of modern processing technology, long distance and scattered trees) is statistically significant ($\beta = -0.464$, $t = -3.264$, $p<0.01$) influence the success of *S. birrea* products commercialization.

Table 13: Results from multiple regression model on factors influencing success of *S. birrea* products commercialization in Uyui District, Tanzania

	Unstandardized Coefficients		Standardized Coefficients		
	B	**Std Error**	**Beta**	**t**	**Sig.**
(Constant)	30.374	1.532		19.826	0.000
Collection	-0.123	0.126	-0.132	-0.972	0.335ns
Sale	-0.209	0.168	-0.171	-1.245	0.218ns
Transport	0.024	0.184	0.025	0.133	0.895ns
Processing	-0.638	0.196	-0.464	-3.264	0.002**
Marketing	0.009	0.140	0.012	0.067	0.947ns
Storage	0.023	0.148	0.020	0.156	0.876ns

Adjusted $R^2 = 0.302$

** = Significant at 0.05, ns = Not Significant at 0.01 and 0.05

Source: Field Data, 2014

The negative sign justifies a failure in commercialization of *S. birrea* products in the study area due to limiting factors that constitute processing as depicted in Pattern Matrix (Table 11). Processors usually outsource fruits from collectors who used to collect them mostly from communal lands and protected areas. Fruits are then processed to make wine, jam and juices. With regard to this, the influence of processing (seasonal availability of fruits, absence of modern processing technology, long distance and scattered trees) on commercialization of *S. birrea* products is attributed by; seasonality of fruits prevent processors to allocate potential capital to invest in processing due lack of sustainability of the business. Outdated technology as well constrains processors to produce products of high quality so as to be more competitive in the market. In addition, a widely dispersed trees and long distance also have impact on processing as they hinder continuous supply of fruits from collectors to enhance sustainability of processing activities.

4.8 Opportunities for Commercialization of *S. birrea* Products in Tanzania

After exploring constraints that exist in the *S. birrea* products value chain, a further analysis was carried to examine the kind of opportunities that are perceived by processors to be potential for the growth of *S. birrea* products processing industry in study areas and Tanzania in general. The study findings depicted in Fig. 2 shows that availability of trees and fruits (more than 22%), was identified to be the most potential opportunities that offer a room for more commercialization and utilization of *S. birrea* trees and their products in the study areas and elsewhere in Tanzania. Subedi *et al.* (1999) presented similar findings that abundance of high value resources such as allo, lokta, argeli and several others were identified as a major opportunity. Also, the possibility of *S. birrea* trees to be domesticated in farmlands was mentioned as an immediate opportunity for more commercialization and utilization of these trees with duo impacts in its conservation and improvement of communities' livelihoods. Elah's (2010) study also found that relatively easy domestication of bush mango (*Irvingia sp*.) and integration into agro forestry crops was perceived to be an opportunity for its commercialization.

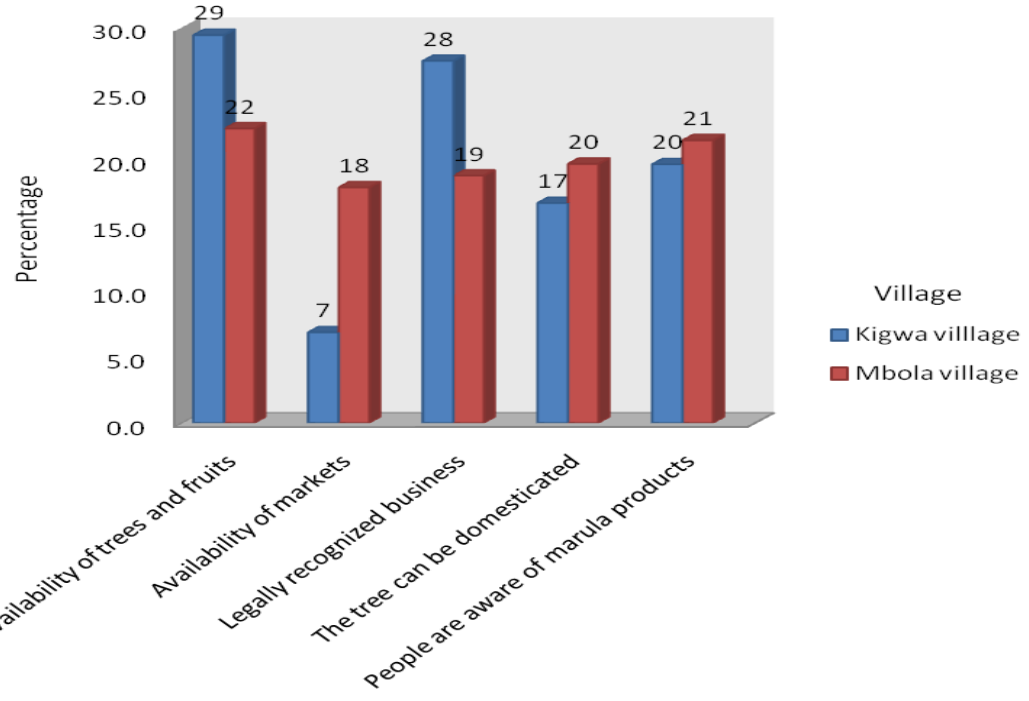


Figure 2: Perceived opportunities by respondents from Uyui District, Tanzania

In Kilosa district (Fig. 3), availability of trees was frequently mentioned by (at least 68%) of the respondents as a potential opportunity for more commercialization of marula trees. Also, the possibility of *S. birrea* trees to be domesticated was pointed out to be another opportunity for commercialization of marula fruits. These findings are supported by Elah (2010) and Subedi *et al.* (1999). Respondents' awareness on the possibility of the marula tree to be domesticated is attributed by the presence of Marula Project in their villages that is investigating on the possibility of integrating marula trees into farmlands. Respondents in Kilosa district have came up with only few parameters which they perceived as opportunities because in this district so far there is no marula products commercialization initiative hence people know nothing about other kind of opportunities that were reported in Uyui district.

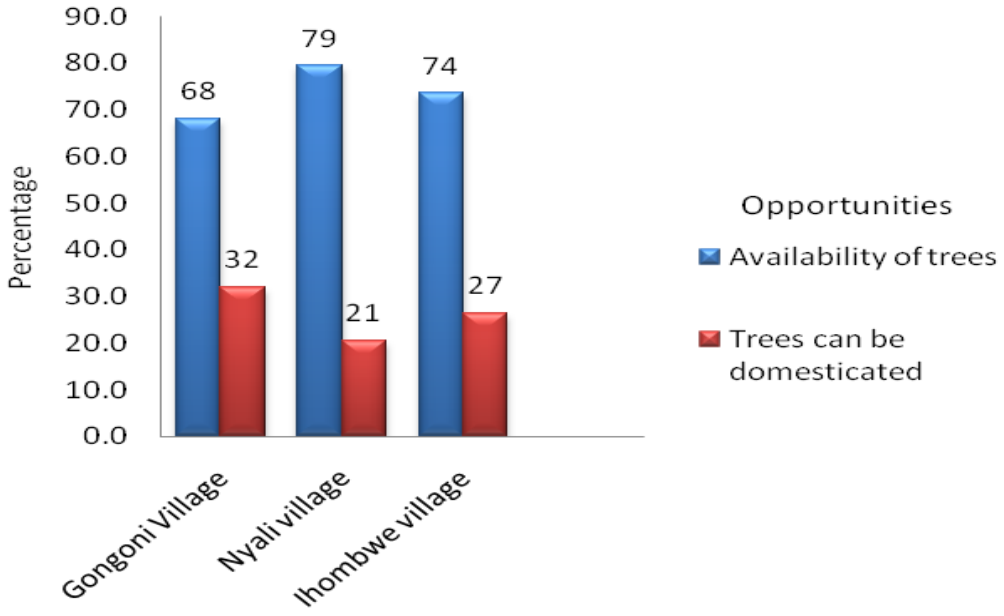


Figure 3: Perceived opportunities by respondents from Kilosa District, Tanzania

4.9 Reasons for Underutilization of *S. birrea* Trees Resources in Kilosa District, Tanzania

In Kilosa district (Table 14), it can be observed that lack of awareness raising campaigns and knowledge on economic importance of *S. birrea* fruits as a result of absence of government and NGO initiatives towards commercialization process were the most prominent factors identified by at least 19% of respondents encountered to be the key reasons for underutilization. Respondents' insights reflect what have influenced utilization and commercialization of marula trees and other NTFPs elsewhere in the world. During focus group discussions and key informant interviews in Uyui district it was revealed that the commercialization of *S. birrea* trees and other economically important trees in Uyui district among other districts in Tabora came in place as a result of ICRAF (currently World Agroforestry Centre)

initiative in 2004. IUCN's (2008) report further informs that the commercialization of NTFPs in various countries have spearheaded by both NGOs and government initiatives for example a project on the sustainable use of NTFPs in Viet Nam was formulated through cooperation between the IUCN, the Government of Viet Nam and two local non-government organizations (ECO-ECO and CRES); in Lao PDR, FAO in partnership with SNV assisted the Forest Research Centre (FRC) in the implementation of a project entitled Marketing System Development for NWFPs in Nepal as well, CARE Nepal Churia portfolio programme initiated the commercialization of NTFPs the initiatives which as well engaged in awareness-raising regarding the role of NTFPs in conservation, bio-diversification and livelihood improvements for communities.

Table 14: Respondents responses on reasons for under utilization and commercialization of *S. birrea* in Kilosa District, Tanzania

Reasons	Gongoni village (30)		Nyali village (30)		Ihombwe village (30)	
	Frequency	%	Frequency	%	Frequency	%
No awareness raising campaign	29	20.9	26	19.1	25	20.5
Lack of awareness on economic value	30	21.6	30	22.1	27	22.1
No government initiative	27	19.4	27	19.9	29	23.8
No NGO initiative	25	18.0	24	17.6	22	18.0
Lack of market information	28	20.1	29	21.3	19	15.6
Total	**139**	**100**	**136**	**100**	**122**	**100**

In South Africa, Marula Project of the National Mine Workers Development Agency (MDA), a DFID-funded employment creation initiative was in front line to enhance the commercialization of Marula products. In Namibia, the commercialization of

marula products changed in 1999 when CRIAA SA-DC, a Namibian non-governmental organization (NGO), had the idea of producing marula oil of a higher quality and in larger volumes so that it could be sold as an export product for the cosmetic industry (WIPO, 2010).

4.10 Tenure Systems, Regulations and Policies Governing *S. birrea* Resources Use and Access in Uyui and Kilosa Districts, Tanzania

The findings in Fig. 4: show that collectors mostly collect *S. birrea* fruits from communal lands, protected areas (forest reserves) and private lands (farmlands) respectively though there some variation among the villages. Collectors' preference of collecting fruits from community lands and protected areas is due to free access of resources in these areas. The findings from this study are supported by McHardy (2002) study findings in Ophande district in South Africa which found that most (84.1 %) households collect marula in the communal areas while 33.3% used to collect *S. birrea* fruits from their own yards. The study's findings also concur with Subedi *et al.* (1999) and FAO (2009) who reported that the collection of NTFPs including *Asparagus* roots in Nepal is common in cultivated farms, community forests and national forests. The study also has found that the way in which communities used to access and collect/harvest *S. birrea* resources vary between the two districts and within the district.

In Kilosa district, during focus group discussions and key informant interviews it was reported that it is usually free to access and collect/harvest marula products even in the neighbors' farmlands without asking for a permission from the owner of that

land. This free access was linked to absence of commercial value assigned to fruits and other products from this tree.

In Uyui district however, the way collectors used to access fruits do vary between the two villages. In Kigwa village, collectors notified that previously they used to collect fruits from someone's farm for free but after seeking permission from the owner of that land but nowadays things are changing and farmlands owners have began to demand collectors to pay some amount of money before they can access and collect fruits. This change was linked to increased people's awareness on financial returns that collectors are accruing from selling of *S. birrea* fruits and other indigenous fruits. This can be interpreted that more commercialization of this tree fruits with the absence of domestication could lead to exclusion of some community members in the value chain and possibly result into resources use conflicts hence any *S. birrea* domestication initiative will be of great importance.

In Mbola village there is no free access and collection of fruits in private lands, collectors can only access fruits in private lands after paying the owner the farm. Collectors in Mbola reported that they usually use to pay TZS 3 000 per bucket. However, due to high availability of fruits and in order to accrue more benefits collectors in study sites reported to mostly prefer to illegally collect fruits from communal lands and protected areas. The land and resource tenures governing access of marula products in the study areas conform to Shackleton *et al.* (2003) study in Namibia and South Africa which found that in Namibia, land and resource tenures

were most defined and individuals must seek permission before harvesting fruit from individually owned or communal land.

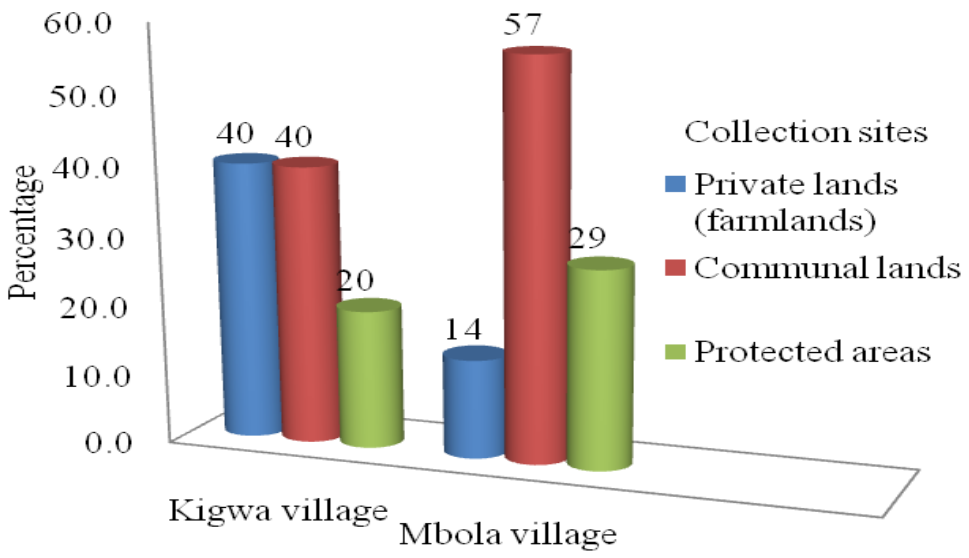


Figure 4: Sources of *S. birrea* fruits in Uyui District, Tanzania

S. birrea has high potential for domestication (Muok *et al*., 2011) however, (Woiso, 2011) in Tanzania the land belongs to the president as a trustee and is given to people through lease and (Kusiluka *et al.,* 2011) land in the rural area is owned under customary laws and village land act.

Woiso (2011) interprets this as, if land is required for public purposes then the president through relevant departments acquire the land in most cases by compensating the owners; the situation which makes investment in tree management on hired lands less likely because trees take long time to be harvested while there is no guarantee for tenants to retain the land for such long periods.

Place (2009) further add that land tenure and security issues are important keys to investment and development decisions for agricultural growth for poverty and hunger alleviation in rural Africa. German *et al. (*2009) further note that farmers are more likely to retain or plant trees on land which they have a security of ownership. This implies that the existing land tenure and security system in Tanzania is a stumbling block towards intensive investment in domestication of *S. birrea* for commercial purposes.

Furthermore, Shackleton *et al.* (2003), argue that as is the case for all non-timber forest products, a range of laws and policies impact the management, use and commercialization of marula. These include laws and policies that directly relate to the resource base such as natural resource, agriculture, forestry, and environment laws relating to land tenure and resource rights; and a variety of economic and financial measures such as trade and taxation. This study however revealed that there no government rules and regulations that specifically govern the collection and harvesting of *S. birrea* products in study areas. This finding is in line with Shackleton *et al.* (2003) study which found that across all sites visited in South Africa there was a lack of clarity as to the rules governing access to marula fruits within conservation areas, private, state and municipal lands from communities, traditional authorities and government officials alike.

The rules protecting *S. birrea* trees in the study areas are similar to McHardy (2002) study findings in Maputaland in South Africa which found that in relation to rules governing marula use, interviewees were only familiar with government rules that

were advocating that no cutting of trees is allowed. The results from this study further found that currently there is no policy set specifically for NTFPs including *S. birrea* products. In the current National forestry policy all NTFPs including *S. birrea* products which the policy document term them as NWFPs are categorized as "minor forest products" implying that they are of less economic importance compared to timber.

On customary laws, it was revealed that in Uyui District particularly on the study villages there is neither customary laws nor traditional rules that enhance respect and hence protection of *S. birrea* trees. In Kilosa District however, through focus group discussions and key informant interviews it was found that the *S. birrea* trees are traditionally respected due to their local uses for spiritual purposes termed as *tambiko* whereby communities used to go to these trees to pray for rainfall, recovery if someone is sick, bad dreams about the deceased ones and sometimes if someone is hardly faced with economic hardships. The informants reported that these practices were commonly done by Wasagara, Wavidunda, Wangindo, Wakaguru, Hehe and Wagogo tribes.

The study findings are in line with Ngorima (2006) study that in which found that about 35% of people sampled in Zvishavane district believed that the spirits of their ancestors rest under *S. birrea* trees and hence many traditional beer rituals of praying for crop protection against wild animals are carried out under *S. birrea* trees. Ngorima further adds that use of green marula wood is forbidden in local traditional culture.

However, the respondents reported that westernization (introduction of religions and education) and the immigrations of other tribes have weakened the respect of traditional beliefs and the trees as well leading to decline in the number of trees in the study areas which was attributed by several factors. Wynberg *et al.* (2002) also reported that in the north-central regions of Namibia, traditional laws are maintained and upheld strongly, but in the study sites in South Africa, democracy and the changing political and social context have exacerbated resource management problems and have led to an erosion of the role of traditional authorities. Maroyi (2013) also found that 6% of respondents felt that the populations of *S. birrea* were declining due to ignoring traditional rules and taboos that govern plant resources in in South-Central Zimbabwe. Apart from reduced respect of traditional rules and taboos, other factors were identified to contribute declining of *S. birrea* in Uyui and Kilosa districts. In Uyui district, following order of significance, lumbering activities, agriculture activities, charcoal making and use of wood to make mortar were identified to be the main drivers for declining of *S. birrea* trees in the study area (Fig. 5). These findings are supported by Treydte *et al.* (2010) who inform that in African savannahs, however, tree abundance and habitat structure are changing due to a variety of human land-use and management activities including wood-harvesting primarily for firewood and charcoal.

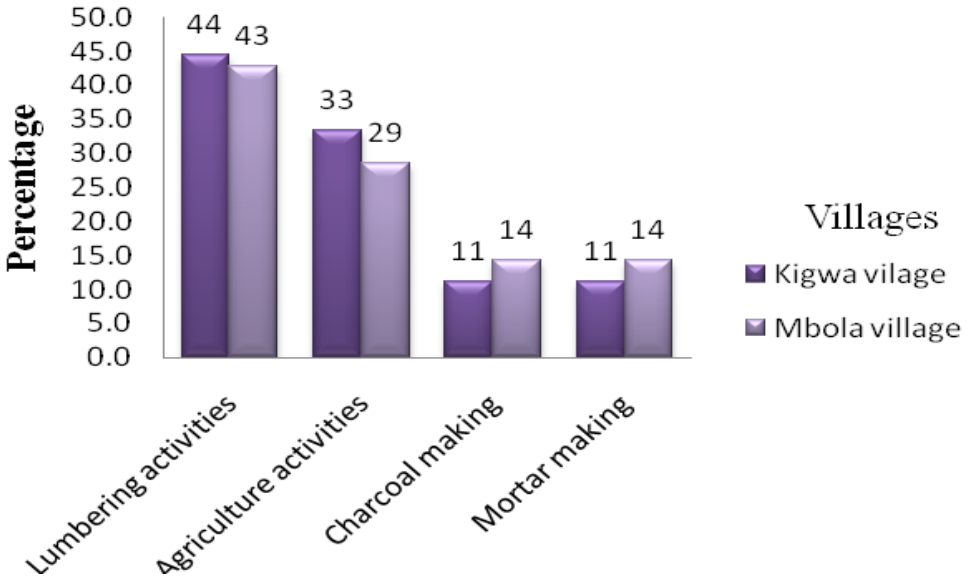


Figure 5: Reasons for declining of *S. birrea* trees in Uyui District, Tanzania

In Kilosa district (Fig. 6), it was slightly different, agriculture activities was identified to be the main driver of marula trees cutting in study area followed by lumbering activities charcoal making and use of wood to make mortar. The study findings correlates with Maroyi's (2013) study in South- Central Zimbabwe which found the factors responsible for decline of *S. birrea* in that region were land clearing for settlement and cultivation (20.7%) and carving (19%). Wynberg *et al.* (2002) further add that natural recruitment of *S. birrea* in study sites under "Winners and Lossers Project" in Southern Africa was low, largely due to lower densities of male trees through deforestation and selective removal and use of male trees for fuel woods. Similarly as it was reported by Gouwakinnou *et al.* (2011), agricultural factors contributing towards the decline included the destruction of natural habitat for conversion into cultivated land and by burning, ring-barking and removing *S. birrea* seedlings and saplings during farming activities. Higher contribution of agriculture

on decline of *S. birrea* resources in Kilosa district can be associated with increased land demand due to high influx of immigrants.

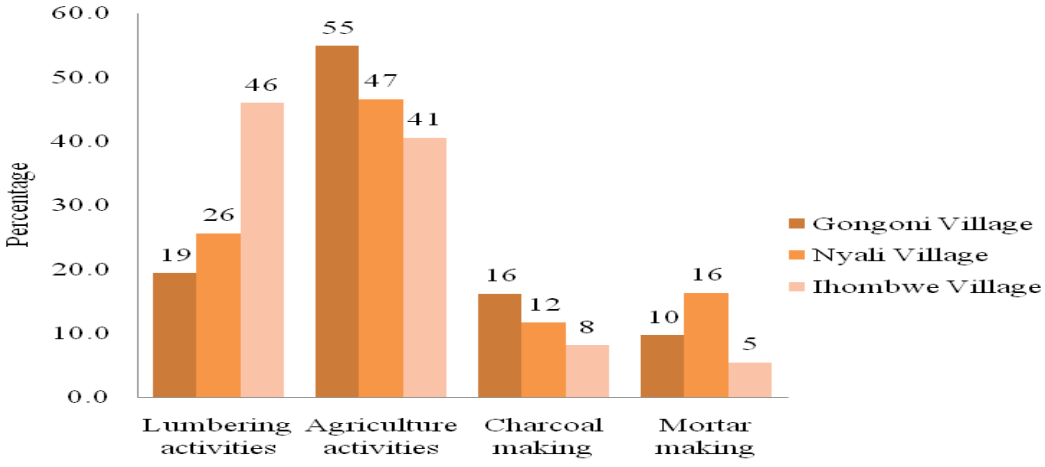


Figure 6: Reasons for declining of *S. birrea* trees in Kilosa District, Tanzania

Shackleton *et al.* (2003) as well found that in Bushbuckridge province in South Africa, the cutting of marula and other trees is common, largely as a result of increases in the population and land clearance, a breakdown of respect for traditional authorities, the use of wood as firewood and changes in governance. Gouwakinnou *et al.* (2011)'s study in Pendjari National Park in Benin, also reported that almost all (98%) informants stated that the population of *S. birrea* has declined in recent times both in abundance and in distribution. The factors purportedly responsible for this decline include the anthropogenic ones, that is, agriculture, felling of trees for carving and grazing.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

The study aimed to analyse *S. birrea* products value chain so as to identify potential area for intervention in order to enhance the commercialization and utilization and conservation of this tree in study areas and all over the country. Specifically, the study mapped *S. birrea* products value chains; quantified the profitability and its distribution along the value chain, examined the constraints and opportunities that face fruits collectors and processors as well as reasons for poor commercialization and the perceived opportunities; and finally, analysed the tenure systems, regulations and policies that govern harvesting and trade of *S. birrea* products. Since the *S. birrea* products value chain is poorly developed, the targeted populations dealt by this study were collectors and processors in Uyui district and the sampled households in selected villages in Kilosa district.

5.1 Conclusions

The *S. birrea* products value chain is simple and poorly developed comprised of collectors, processors and consumers. *S. birrea* fruits which are then processed into wine and jams are the only products which are sold at regional, zonal and national trade fairs and rarely at local markets. Currently there is no export of marula products.

The profit accrued along the value chain is small and unevenly shared. Processors take a big share of total profit (96%) while collectors only accrue 4% of the total profit.

Several constraints face collectors and processors however, processing (comprised of seasonal availability of fruits, absence of modern processing technology, long distance and scattered trees) is a key constraint and statistically significant (β = -0.464, t = -3.264, $p<0.01$) influence the success of *S. birrea* products commercialization. Availability of *S. birrea* trees, markets and the possibility of tree to be domesticated are potential opportunities for the growth of *S. birrea* products processing industry in Tanzania.

S. birrea fruits are collected from private lands (farmlands), communal lands and protected areas through payments, permissions and free access. Tanzania lacks NTFPs policy and so far there are neither customary/traditional nor government rules which govern harvesting of *S. birrea* products.

5.2 Recommendations

In view of the discussion and conclusions, the study recommends as follows;

i. Government and NGOs should conduct a sensitization and awareness raising campaign to inform communities about economic importance of *S. birrea* trees as well as help in establishment of processing centers where are not yet in place, access to power, cold storage facilities and financial services as well as identification of potential market niches for marula products.

ii. The government and NGOs should also facilitate processing groups through training, financial services, easier access of quality packaging and labeling materials, TBS, TFDA certifications and barcodes and provision of market

information and link them to foreign markets where South Africa, Namibia and Zimbawe sell their marula products.

iii. The government and NGOs should allocate more funds to research on the product development and a baseline survey to document on the potential markets for marula products in the national and global markets.

iv. The government and NGOs should initiate the *S. birrea* trees domestication projects in Tanzania to ensure sufficient supply of fruits to processing centers as well as to reduce labours costs and pressure on the demand for fruits and other products from trees found in communal lands and protected areas.

v. The government should formulate guidelines to govern harvesting of *S. birrea* products to enhance sustainability.

vi. The successful commercialization of *S. birrea* fruits and others associated products will depend on their availability and abundance hence further study should be done to document on this before intervention.

REFERENCES

Ahenkan, A. and Boon, E. (2011). *Improving the Supply Chain of Non-Timber Forest Products in Ghana, Supply Chain Management - New Perspectives*, Intech, Ghana. 17pp.

Akinnifesi, F. K., Ajayi, O. C., Sileshi, G., Kadzere, I. and Akinnifesi, A. I. (2007). Domesticating and commercializing indigenous fruit and nut tree crops for food security and income generation in Sub-Saharan Africa. *Paper presented at the New Crops International Symposium,* 3-4 September, 2007, Southampton, United Kingdom. 42pp.

Akinnifesi, F. K., Kwesiga, J., Mhango, T., Chilanga, A., Mkonda C. A. C., Kadu, I., Kadzere D., Mithofer, J. D. K., Saka, G., Sileshi, T. R. and Dhliwayo, P. (2006). Towards the development of miombo fruit trees as commercial tree crops in Southern Africa. *Forests, Trees and Livelihoods* 16: 103 – 121.

Alexiades, M. N. and Shanley, P. (Eds.) (2004). *Productos Forestales, Medios De Subsistencia Y Conservación. Estudios De Caso Solore Sisternas De Manejo De Productos Forestales No Maderables.* Center for International Forestry Research, Bogor, Indonesia. 22pp.

Andel van, T. (2008). *Non-Timber Forest Products.* The value of wild plants. Agromisa Foundation and Technical Centre for Agricultural and Rural Cooperation. Wageningen. 69pp.

Andersen, U. S., CO´rdova, J. P. P., Nielsen, U. B., Olsen, C. S., SØrensen, C. N. M. and Kollmann, J. (2007). Conservation through utilization: a case study of the Vulnerable Abies guatemalensis in Guatemala. *Fauna and Flora International Oryx* 42(2): 206 – 213.

Arnold, J. E. M. and Ruiz-Pérez, M. (2001). Can non-timber forest products match tropical forest conservation and development objectives? *Ecological Economics* 39: 437 – 447.

Barry, I. N. (2007). *A Value-Chain Analysis for the Sri Lankan Rambutan Subsector.* Research Report No. 2. The International Centre for Underutilised Crops, Kolombo, Sri Lanka. 55pp.

Bailey, K. D. (1994). *Methods for Social Research*. The Free Press, New York. 345pp.

Belcher, B. and Schreckenberg, K. (2006). Commercialisation of Non-timber Forest Products. A Reality Check. *Journal of Development Policy Review* 25 (3): 2 - 23.

Brown, K. (2003). Three challenges for a real people-centred conservation. Ecological sounding. *Global Ecology and Biogeography* 12: 89 – 92.

Brown, K. (2002). Innovations fokr conservation and Development. *The Geographical Journal* 168: 6 – 17.

Bollerslev, T. (1986). Generalised autoregressive Conditional Heteroscedasticity. *Journal of Econometrics* 13: 307 – 327.

Chopra, A., Sachdeva, A. and Bhardwaj, A. (2014). Importance of Training and Data management Issues in implementing Reliability Centered Maintenance. *International Journal of Engineering and Technical Research* (2): 175 - 180.

Dietz, M; Matee, S; Ssali, W; Fellows, P; Redecker, M; Kinabo, J; Nduguru, M; Sabano, R. *and* Lubowa, M. (2000). *Assessment of the Small-Scale Food Processing Subsector in Tanzania And Uganda*. Study Report. No.1020. Technical Centre for Agricultural and Rural Cooperation (ACP-EU), Wageningen. 72pp.

Da Silva, C. A. and De Souza Filho, H. M. (2008). *Guidelines for Rapid Appraisal of Agrifood Chain Performance in Developing Countries.* Occasional Paper No. 20 Agricultural Management, Marketing and Finance, Rome, Italy. 100pp.

Dewees, P., Campbell, B., Katerere, Y., Sitoe, A., Cunningham, A. B., Angelsen, A. and Wunder, S. (2011). *Managing the Miombo Woodlands of Southern Africa: Policies, Incentives, and Options for the Rural Poor.* Program on Forests, Washington DC. 77pp.

Elah, E. M. (2010). Markets and market chain analysis for bush mango (*irvingia sp*.) in the south west and east regions of Cameroon. Dissertation for Award of MSc Degree at University of Buea, Cameroon. 128pp.

Enwerem, V. A. and Ohajianya, D. O. (2013). Farm size and technical efficiency of rice farmers in Imo State, Nigeria. *Greener Journal of Agricultural Sciences* 3(2): 128 – 136.

FAO (2009). *Challenges and Opportunities for Nepal's Small and Medium Forest Enterprises.* Asia Network for Sustainable Agriculture and Bioresources, Kathmandu, Nepal. 89pp.

FAO (2001). Resource assessment of non-wood forest products: *Experience and Biometric Principles* (Edited by Jennifer, L. G., Kirsti, T. and Nell, B.) Food and Agriculture Organization, Rome, Italy. 109pp.

Field, A. (2009). *Discovering statistics using SPSS.* (3rd Ed), SAGE Publication Ltd, London. 857pp.

German, G., Akinnifesi, F., Edriss, A., Sileshi, G., Massangano, C. and Ajayi O. (2009). Influence of property rights on farmers' willingness to plant indigenous fruit trees in Malawi and Zambia. *African Journal of Agricultural Research* 4(5): 427 – 437.

Gouwakinnou1, G. N., Lykke, A. M., Achille E Assogbadjo, A. E. and Sinsin, B. (2011). Local knowledge, pattern and diversity of use of *S.birrea. Journal of Ethnobiology and Ethnomedicine* 7: 1 - 9.

Gujarati, D. (2004). *Basics of Econometrics.* (Fourth Ed.), McGraw hill company, Inc. United States Millitary Academy, West Point. 234pp.

Gyan, C. A and Shackleton, C. M. (2005). *Abundance and Commercialization of Phoenix reclinata in The King Williamstown Area.* South Africa. *Journal of Tropical Forest Science* 17 (3): 334-345.

Hall, J. B., O'Brien, E. M. and Sinclair, F. L. (2002). *S. birrea: A Monograph. School of Agricultural and Forest Sciences*. Publication Number No. 19. University of Wales, Bangor. 157pp.

Ham, C. and Akinnifesi, F. (2006). *Priority Fruit Species and Products for Tree Domestication and Commercialization.* The University of Stellenbosch and World Agroforestry Centre, South Africa. 54pp.

Hassan, A. K. and Semkwiji, D. (2011). *The Role of Mobile Phones on Sustainable Livelihood.* Discussion Paper No. 33. The Economic and Social Research Foundation, Dar es Salaam. 24pp.

Hawassi, F. G. H. (2006). Analysis of processing, marketing and demand for processed fruits and vegetables in Tanzania. Thesis for Award of PhD Degree at Sokoine University of Agriculture, Morogoro, Tanzania, 270pp.

Hellin, H. and Meijer, M. (2006). Guidelines for value chain analysis. FAO, Italy. 24pp. *[*ftp://ftp.fao.org/es/esa/lisfame/guidel_valueChain.pdf]. Site visited on 6/8/2015.

ILO (2007). *An Operational Guide to Local Value Chain Development Combining Local Economic Development With Value Chain Development to Strengthen Competitiveness And Integration of SMEs Into Markets*. International Labour Organisation. Colombo, Sri Lanka. 140 pp.

Ingram, V. and Bongers, G. (2009). *Valuation of Non-Timber Forest Product Chains in the Congo Basin: A Methodology for Valuation.* Centre for International Forest Research. Yaounde, Cameroon. 80pp.

Ingram, V. J. (2010). *Governing Forest Commons in the Congo Basin*. Non-Timber Forest Product Value Chains, Bogor. 31pp.

IUCN (2008). The role of NTFPs in poverty alleviation and biodiversity conservation. *International Conference Proceedings.* Ha Noi, Vietnam. 260pp.

Jama, B. A., Mohamed A. M., Mulatya, J. and Njui, A. N. (2007). Comparing the ‘‘Big Five’’: A framework for the sustainable management of indigenous fruit trees in the drylands of East and Central Africa. [www.worldagroforestry.org/downloads/Publications/PDFS/ja07042. pdf]. Site visited on 7/5/2013.

Jensen, A. (2009). Valuation of non-timber forest products value chains. *Forest Policy and Economics* 11: 34 – 41.

Kilosa District Council (2010). *Kilosa District Profile.* Kilosa District Council, Morogoro Tanzania. 15pp.

Kimaro, J. and Lulandala, L. (2013). Contribution of non-timber forest products to poverty alleviation and forest conservation in Rufiji District - Tanzania. *Journal of Livestock Research for Rural Development.* [http://www.lrrd. org/lrrd25/5/kima25092.htm] site visited on 4/8/2015.

Kothari, C. R. (2004). *Research Methodology. Methods and Techniques*. (2nd Ed.), Age International Ltd., New Delhi, India. 418pp.

Kusiluka, M. M., Kongela, S., Kusiluka, M. A., Karimuribo, E. D. and Kusiluka, L. J. M. (2011). The negative impact of land acquisition on indigenous communities‘ livelihood and environment in Tanzania. *Habitat International* 35(1): 66 – 73.

M4P (2008). *Making Value Chains Work Better for the Poor. A Tool book for Practioners of Value Chain Analysis.* International Development of Agricultural, Phnom Penh, Cambodia. 145pp.

Magar, D. B. T. (2008). *Contribution of Non-Timber Forest Products in the Livelihood of Chepang Community.* A Final Report Submitted to Social Inclusion Research Fund (SIRF) SNV, Nepal. 102 pp.

Mahlati, V. (2011). Establishing viable and sustainable rural economic development programmes in a competitive global economy: Analysis of Marula Commercialisation in South Africa. Thesis for Award of PhD Degree at Stellenbosch University. 284 pp.

Makonda, F. B. S. and Gillah, P. R. (2007). Balancing wood and non-wood products in miombo woodlands. MITMIOMBO – management of indigenous tree species for ecosystem restoration and wood production in semi-arid miombo woodlands in Eastern Africa. *Proceedings of the First MITMIOMBO Project Workshop held in Morogoro, Tanzania,* 6–12 February 2007. 64 – 70 pp.

Maroyi, A. (2013). Local knowledge and use of marula [*S.birrea* (A.Rich) Horchst] in South- Central Zimbabwe. *Indian Journal of Traditional Knowledge* 12(3): 398 – 403.

McHardy, T. (2002). *Use of Marula Products for Domestic and Commercial Purposes by Households in the Ophande District.* Institute of Natural Resources, Maputaland, South Africa. 29pp.

Marshall, E., Schreckenberg, K. and Newton, A. C. (Eds.) (2006). *Commercialization of Non-Timber Forest Products: Factors Influencing Success. Lessons Learned From Mexico and Bolivia and Policy Implications for Decision Makers*. World Conservation Monitoring Centre, Cambridge, UK. 135pp.

Marshall, E., Rushton, J., Schreckenberg, K., Arancibia, E., Edouard, F. and Newton, A. (2006). *Non Timber Forest Products Commercialization Research Methods. Practical Tools for Researching Successful Non Timber Forest Products* Commercialization. 72pp. [rmportal.net/library/frame/PDF/A-METHODS-MANUAL-ENG.../file]. Site visited on 7/1/2013.

Marshall, E., Newton, A. C. and Schreckenberg, K. (2003). Commercialisation of non-timber forest products: First steps in analysing the factors influencing success. *International Forestry Review* 5(2). 128-137.

MATF (2005). *Introduction of Indigenous Fruits Processing Technology to Rural Communities in Tabora, Uyui and Sikonge Districts.* Project summary for the MATF monitoring mission from 4 - 8 July 2005. Tumbi Agricultural Research Institute. 12pp.

Mng'omba, S. A., Sileshi1, G., Jamnadass, R., Akinnifesi, F. K. and Mhango, J. (2012). Scion and stock diameter size effect on growth and fruit production of *S. birrea* (marula) trees. *Journal of Horticulture and Forestry* 4(9): 153 – 160.

Moganedi, K., Sibara, M., Grobler, P. and Goyvaerts, E. (2011). An assessment of genetic diversity among marula populations using the amplified fragment length polymorphism technique. *African Journal of Agricultural Research* 6(4): 790 – 797.

Mollel, M. H. N. and Goyvaerts, E. M. A. (2012). Micropropagation of marula, *S. birrea* subsp. *Caffra (Anarcadiaceae)* by axillary bud proliferation and random amplified polymorphic analysis of plantlets. *African Journal of Biotechnology* 11(93): 16003 – 16012.

Morales-Nieto, J. (2009). Key policy actions to invigorate small and medium business and enterprise development in emerging economies. *Paper Prepared For The Botswana SMME Conference and Fair,* Gaborone, 16 – 18 April 2009. 15pp.

Mtebe, S. J. and Raisamo, R. (2014). Challenges and instructors' intention to adopt and use open educational resources in higher education in Tanzania. *The International Review of Research in Open and Distance Learning*. [www.irrodl.org.] site visited on 6/9/2014.

Muok, B. O., Khumalo, S. G., Tadesse, W. and Alem, S. H. (2011). *S. Birrea, Marula. Conservation and Sustainable Use of Genetic Resources of Priority Food Tree Species in Sub-Saharan Africa*. Bioversity International. Rome, Italy. 11pp.

Nang'ole, E. M., Mithöfer, D. and Franzel, S. (2011). *Review of Guidelines and Manuals for Value Chain Analysis for Agricultural and Forest Products*. Occasional Paper No.17. World Agroforestry Centre, Nairobi, Kenya. 17pp.

Ndabikunze, B. K. N., Bonaventure, N. M. and Bendantunguka, M. T. (2010). Vitamin C and mineral contents, acceptability and shelf life of juice prepared from four indigenous fruits of the Miombo woodlands of Tanzania. *Journal of Food, Agriculture and Environment* 8 (2): 91 – 96.

Neumann, R. P. and Hirsch, E. (2000). *Commercialisation of Non-Timber Forest Products: Review and Analysis of Research.* Center for International Forestry Research, Bogor, Indonesia. 176pp.

Newton, A. C. E., Marshall, K., Schreckenberg, D., Golicher, D. W., te Velde, F. E. and Arancibia, E. (2006). Use of a Bayesian belief network to predict the impacts of commercializing non-timber forest products on livelihoods. *Ecology and Society* 11(2): 1 – 24.

Ngorima, G.T. (2006). Towards sustainable use of Marula (*S. birrea*) in the Savannah woodlands of Zvishavane District, Zimbabwe. Dissertation for Award of MSc Degree at University of the Witwatersrand, Johannesburg, 73pp.

Onuoha, O.N., Eme, P.E. and Ekpo, U.E. (2014). Chemical Evaluation of Unripe Plantain Dishes Commonly Consumed by Type 2 Diabetics attending the University of Uyo Teaching Hospital in Akwa Ibom State, Nigeria. *Pakistan Journal of Nutrition* 13 (6): 331-334.

Owiredu, E. A. (2008). Sustainable Commercialization of Non Timber Forest Products: The case Of Ghana. Dissertation for Award of MSc Degree at Graduate School of Development Studies, Institute of Social Studies, The Hague, 53pp.

Pallant, J. (2011). *Survival Manual. A Step By Step Guide to Data Analysis Using SPSS*. (4th Edition.) Allen and Unwin, Australia. 359pp.

Pallant, P. F. and Bailey, C. M. (2005). Assessment of the structure of the Hospital Anxiety and Depression Scale in musculoskeletal patients. *Health and Quality of Life Outcomes* 3(82): 1 – 4.

Place, F. (2009). Land Tenure and Agricultural Productivity in Africa: A comparative analysis of the economics literature and recent policy strategies and reforms. *World Development* 37(8): 1326 – 1336.

Raufu, M. O., Akinniran, T. N., Olawuyi, S.O. and Akinpelu, M. O. (2012). Economic analysis of rural women income from non-timber forest products in ife south local government area of Osun State, Nigeria. *Global Journal of Science Frontier Research Agriculture and Biology* 12 (1): 23 - 32.

Robinson, E., Lukman, A. and Bello, A. (2012). Review of *S. birrea* seed oil extracted as a bioenergy resource for compression ignition engines. *International Journal of Agriculture and Biological Engineering* 5: 1- 9.

Ruffo, C. K., Birnie, A. and Tengnäs, B. (2002). *Edible wild plants of Tanzania.* Technical Handbook Series No. 27. Regional Land Management Unit, Nairobi, Kenya. 766pp.

Runyoro, D. K. B., Ngassapa, O. D., Matee, M. I. N., Joseph, C. C. and Moshi, M. J. (2006). Medicinal plants used by Tanzanian traditional healers in the management of *Candida* infections. *Journal of Ethnopharmacology* 106: 158 – 165.

Rushton, J., Pérez, L. and Viscarra, C. (2004). *Commercialisation of Non-Timber Forest Products: Factors Influencing Success. Final Report on the Marketing Chains for a range of Non-Timber Forest Products in Bolivia and Mexico*. Overseas Development Institute, United Kingdom. 128pp.

Salami, A., Kamara, A. B. and Brixiova, Z. (2010). *Smallholder Agriculture in East Africa: Trends, Constraints and Opportunities.* Working paper series No. 105. African Development Bank, Angle des trois rues: Avenue du Ghana. 52pp.

Schaafsma, M; Morse-Jones, S; Posen, P; Swetnam, R.D; Balmford, A; Bateman, I.J; Burgess, N.D; Chamshama, S.AO; Fisher, B; Freeman, T; Geofrey, V; Green, R.E; Hepelwa, A.S; Herna´ ndez-Sirvent, A; Hess, S; Kajembe, G.C; Kayharara, G; Kilonzo, M; Kulindwa, K; Lund, J.F; Madoffe, S.S; Mbwambo, L; Meilby, H; Ngag, Y.M; Theilade, I; Treue, T; Van Beukering, P; Vyamana, V.G and Turner, R.K (2014). The importance of local forest benefits: Economic valuation of Non-Timber Forest Products in the Eastern Arc Mountains in Tanzania. *Global Environmental Change* 24: 295 – 305.

Schreckenberg, K., Marshall, E., Newton, A., te Velde, D. W., Rushton, J. and Edouard, F. (2006). *Commercialisation of Non-Timber Forest Products: What Determines Success?* Forest Policy Brief, Overseas Development Institute, London. 6pp.

Schwartzman, S., Moreira, A., Nepstad, D. and Pinheiro, E. (2009). *Rethinking Tropical Forest Conservation: Perils in Parks.* Environmental Defense Fund, Washington DC. 20pp.

SFTZ (2011). *The Whole Village Project. Village Reports for Leguruki, Kingori, Malula Samaria, and Njoro In Arumeru District.* SFTZ, Arusha, Tanzania. 41pp.

Shackleton, S. E. (2005). The significance of the local trade in natural resource products for livelihoods and poverty alleviation in South Africa. Thesis for Award of PhD Degree at Rhodes University, 287pp.

Shackleton, C. and Shackleton, S. (2004). The importance of non-timber forest products in rural livelihood security and as safety nets: A review of evidence from South Africa. *South African Journal of Science* 100: 658 – 664.

Shackleton, S. E., Wynberg, R. P., Sullivan, C. A., Shackleton, C. M., Leakey, R. R. B., Mander, M., McHardy, T., den Adel, S., Botelle, A., du Plessis, P., Lombard, C., Laird, S. A., Cunningham, A. B., Combrinck, A. and O'Regan, D. P. (2003). *Marula Commercialisation For Sustainable And Equitable Livelihoods: Synthesis of A Southern African Case Study.* Rhodes University, Grahamstown. 51pp.

Shackleton, S., Adel, S. D., McHardy, T. and Shackleton, C. (2002). Use of marula products for domestic and commercial purposes: Synthesis of key findings from three sites in southern Africa. Rhodes University, Grahamstown. 51pp.

Shackleton, C. M., Botha, J., Emanuel, P. L. and Ndlovu, S. (2002). *Inventory Marula (S. Birrea Subsp. Caffra) Stocks and Fruit Yields in Communal and Protected Areas of The Bushbuckridge Lowveld.* Rhodes University, Grahamstown. 17pp.

Shanley, P., Pierce, A. R., Laird, S. A. and Guillen, A. (2002). *Tapping the Green Market: Certification and Management of Non-Timber Forest Products.* People and Plants Conservation Series. Earthscan Publications, London, UK. 456pp.

Sife, S. A. (2010). Contribution of mobile telephony, Radio and Television to rural livelihoods and poverty reduction in Morogoro Region, Tanzania. Thesis for Award of PhD Degree at University of Dar es Salaam, 294pp.

Subedi, B. P., Ojha, H. R., Surya, B., Binayee, S. B. and Nicholson, K. (1999). Identification of NTFP Based Micro-Enterprises in Parbat: *Opportunities, Constraints and Strategies for Development. A Workshop Report Kushma and Milanchowk*, Parbat December 4 – 6 December, 1999. 29pp.

Swai, R., Oduol, P., Mbwambo, L. and Mbaruku, D. (Eds.) (2003). Germplasm and tree domestication in Tanzania. International Centre for Research in Agroforestry, Nairobi. [www.docstoc.com/.../Review-and-Appraisal-on-the-Status-of-Indigenous]. Site visited on 23/11/2012.

Tajoacha, A. (2008). Market chain analysis of the main NTFPs in the takamanda/mone forest reserves, south west of cameroon and the cross River State of Nigeria. Dissertation for Award of MSc Degree at University of Dschang, Dschang, Cameroon, 96pp.

Toole, M. T. (2007). A Primer on Social Science Research Methods in Construction. *Paper Accepted for The Proceedings of The 2006 ASCE-CIB Joint Conference on Leadership In Construction,* 4 – 6 May 2007, Bahamas. 8pp.

Treydte, A.C; Riginos, C. and Jeltsch, F. (2010). Enhanced use of beneath-canopy vegetation by grazing ungulates in African savannahs. *Journal of Arid Environments* 3 (2): 1 – 7.

Ugwuja, V. C., Adesope, O. M., Odeyemi, T. J., Matthews-Njoku, E. C., Olatunji, S. O., Ifeanyi, Obi, C. C. and Nwakwasi, R. (2011). Socio-economic characteristics of farmers as correlates of fertilizer demand in Ekiti State, Southwest Nigeria: Implications for Agricultural Extension. *Greener Journal of Agricultural Sciences* 1(1): 48 – 54.

UNEP (2012). *Green Economy Sectoral Study: Biotrade. A Catalyst for Transitioning to a Green Economy in Namibia.* United Nations Environment Programme, Namibia. 42pp.

UNIDO (2011). *Industrial Value Chain Diagnostics: An Integrated Tool.* United Nations Industrial Development Organization Vienna, Austria. 144pp.

URT (2012). *Population and Housing Census. Population Distribution by Administrative Areas.* National Bureau of Statistics Ministry of Finance Dar es Salaam Office of Chief Government Statistician President's Office, Finance, Economy and Development Planning, Zanzibar. 244pp.

Velde, D. W., Rushton, J., Schreckenberg, K., Marshall, E., Edouard, F., Newton, A. and Arancibia, E. (2006). Entrepreneurship in value chains of non-timber forest products. *Forest Policy and Economics* 8: 725 – 741.

William, M. K. T. (2002). Non-probability Sampling. [www.Methodologicalinnovations.org.uk/.../6.-Williams] site visited on 01/8/2015.

WIPO (2010). A Tree and Traditional Knowledge: A Recipe for Development. Organization for Economic Co-operation and Development, Paris. 6pp.

Woiso, A. D. (2011). A comparative study of the subspecies of *S. birrea*: Their potential for domestication in Tanzania. Thesis for Award of PhD Degree at Bangor University, Bangor, United Kingdom, 306pp.

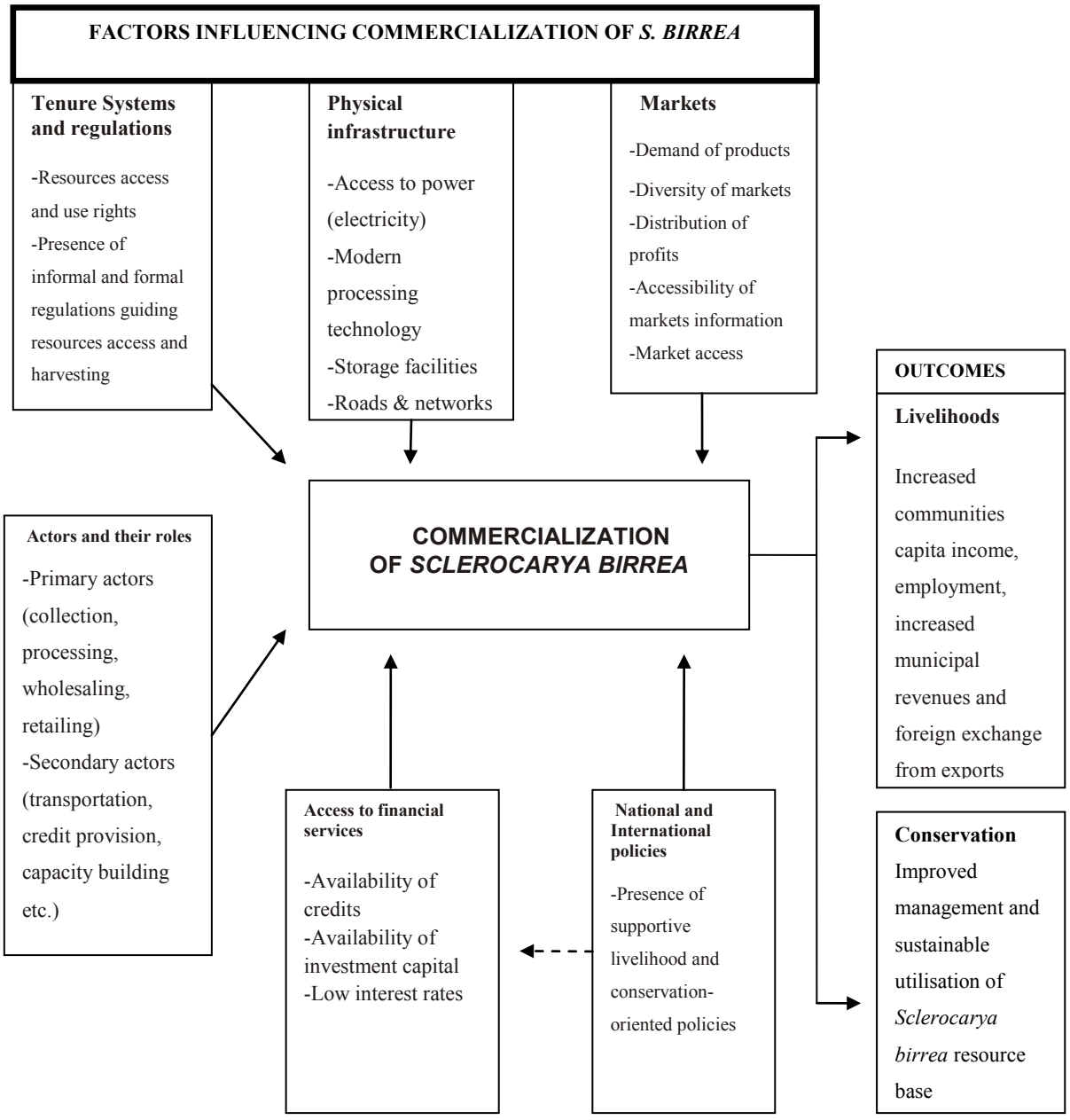
Wynberg, R. P., Cribbins, J., Leakey, R. R. B., Lombard, C., Mander, M., Shackleton, S. E. and Sullivan, C. A. (2002). Knowledge on *S. birrea* subsp. *Caffra* with emphasis on its importance as a non-timber forest product in South and southern Africa: A summary. Part 2: Commercial use, tenure and policy, domestication, intellectual property rights and benefit sharing. *Southern African Forestry Journal* 196: 67 – 77.

Wynberg, R; Laird, S; Botha, J; den Adel, S. and McHardy, T. (2002). The Management, Use and Commercialisation of Marula: Policy Issues. Centre for Ecology and Hydrology, Wallingford, UK. 63pp.

Yanda P. Z. and Shishira, E. K. (1997). *Land Use and Natural Resource Assessment. Report Prepared for Kilosa District Council/Irish Aid.* Institute of Resource Assessment, Dar es Salaam, Tanzania. 25pp.

APPENDICES

Appendix 1: A modified conceptual framework adopted from Shackleton (2005)



Appendix 2: Pooled enterprise budget for the collectors based in Kigwa village, Uyui District, Tanzania

	Unit	Quantity	Price /unit	Depreciation	Total Value (in TZS)/year
Sales or outputs					
Fruits sales	Bucket	16.5	4000		66000
Total sales					**66000**
Variable costs					
Transport	Days	4	3000		12000
Entrance permit	Days	4	2000		8000
Total variable costs					**20000**
Gross margin for the activity					**46000**
Labour costs					
Collection	Hours	29	712.5		20663
Sorting	Hours	4.5	712.5		3206
Transportation to market	Hours	3	712.5		2138
Total labour costs					**26006**
GM less labour costs					**19994**
Fixed costs					
Equipment depreciation	Unit	Number	Price/ unit	Useful life (years)	Depreciation value
Sulphate bags	Unit	4	1000	1.5	**444.4**
Total fixed costs					**444.4**
Total costs					**46451**
GM less Variable costs less Labour costs and Fixed costs					**19549**

Appendix 3: Pooled enterprise budget for the collectors based in Mbola village, Uyui District, Tanzania

	Unit	Quantity	Price/unit	Total Value (in TZS)/year
Sales or outputs				
Fruits sales	Bucket	13.5	6600	89100
Total sales				**89100**
Variable costs				
Transport	Days	6.0	3500	21000
Entrance permit	Days	6.0	3000	18000
Total variable costs				**39000**
Gross margin for the activity				**50100**
Labour costs				
Collecting	Hours	40.5	713	28856.25
Sorting	Hours	6.0	713	4275
Transportation to market	Hours	6.0	713	4275
Total labour costs				**37406**
GM less labour costs				**12694**
Fixed costs				
Equipment depreciation	Number	Price	Useful life (years)	Depreciation value
Sulphate bags	6	800	1.5	**533**
Total fixed costs				**533**
Total costs				**76940**
GM less Variable costs less Labour costs and Fixed costs				**12160**

Appendix 4: Enterprise budget for a processing group based in Kigwa village, Uyui District, Tanzania

Sales or outputs	Unit	Quantity	Price per unit		Depreciation	Total Value/process	Total value (in TZS)/ year
			Local market	Exhibitions			
Wine							
Small bottle (350ml)	Bottle	30	2000	5000		210000	
Jam	Bottle	12		5000		60000	
Total Sales						**270000**	**540000**
Variable Costs							
Materials for Wine							
Fruits (buckets of 20ltr/kg	Bucket	7		3000		21000	
Sugar (kg)	Kilos	3		2000		6000	
Tea leaves (packet)	Number	1		1000		1000	
Yeast/Packet	Number	1		300		300	
Orange	Number	6		200		1200	
Lemon	Number	6		100		600	
Bottles for packaging	Number	30		1000		30000	
labels	Number	30		50		4500	
Seals	Number	30		50		1500	
Stoppers	Number	30		150		4500	
Water (containers of 20ltrs)	Number	2		200		400	
Firewood (bundle)	Number	1		1000		1000	
Materials for Jam							
Sugar	Kilos	5		2000		10000	
Lemon	Number	3		100		300	
Bottles	Number	16		500		8000	
Label	Number	1		3000		3600	
Charcoal	Number	1		2000		2000	

Total variable Costs						**95900**	**191800**
Gross margin less Variable costs						**174100**	**189100**
Labour costs							
Time spent for processing wine	Hours	12	712.5			102600	
Time spent for processing jam	Hours	5	712.5			3563	
Total Labour Costs						**106163**	**212325**
Gross margins less variable and labour costs						**67938**	**82938**
Fixed Costs	Number		Price/unit	Salvage value	Useful life	Depreciation value	
Plastic bucket	Number	2	4500	0	7.3	103	
Pan/metal pot	Number	1	5000	900	19	18	
Plastic Containers	Number	2	4000	0	11	61	
A tumble	Number	2	2000	0	3	111	
A small pipe	Number	1	3500	0	5	58	
A sieve	Number	1	1500	0	3	42	
Wooden spoon	Number	1	200	0	8.9	2	
Spoon	Number	2	500	0	12.8	7	
Total fixed costs						**401**	**802**
Total Costs						**202463**	**404927**
Gross margin less Variable costs, Labour costs and Fixed costs						**67537**	**135073**

Appendix 5: Enterprise budget for a processing group based in Mbola village, Uyui District, Tanzania

Sales or outputs	Unit	Quantity	Price per unit		Depreciation	Total Value/process	Total value (in TZS)/year
			Local market	Trade Fairs			
Wine							
Large bottle (700ml)	Bottle	15		7000		105000	
Small bottle (350ml)	Bottle	45	1500	3500		225000	
Total Sales						**330000**	**660000**
Variable Costs			**Price/unit**				
Fruits (buckets of 20ltr/kg	Bucket	6	6600			39600	
Sugar (kg)	Kilos	5	2500			12500	
Tea leaves (packet)	Number	1	350			350	
Yeast (Packet)	Number	5	100			500	
Orange	Number	5	150			750	
Lemon	Number	3	50			150	
Small bottles	Number	45	700			31500	
Large bottles	Number	15	1400			21000	
labels	Number	60	50			3000	
Seals	Number	60	50			6000	
Stoppers	Number	60	150			9000	
Water (containers of 20litres)	Number	5	200			1000	
Firewood (bundle)	Number	2	1000			2000	
Total variable Costs						**127350**	**254700**
Gross margin less Variable costs						**202650**	**405300**
Labour costs							
Days for processing wine (hrs)	Hours	8	712.5			171000	
Total Labour Costs						**171000**	**342000**
Gross margins less Variable and						**31650**	**63300**

Labour costs

Fixed Costs	**Number**		**Price per unit**	**Total cost**	**Salvage value**	**Useful life**	**Depreciation value**	
Plastic buckets	Number	2	4000	8000	0	7.3	91.3	
Pan/metal pot	Number	5	30000	150000	8850	19	619.1	
Containers (20 Ltr)	Number	2	4000	8000	0	11	60.6	
A tumble	Number	2	2000	4000	0	3	111.1	
A small pipe	Number	1	3000	3000	0	5	50.0	
A sieve	Number	1	1500	1500	0	3	41.7	
Wooden spoon	Number	2	200	400	0	8.9	3.7	
Spoon	Number	8	500	4000	0	12.8	26.0	
Total fixed costs							**10034**	**2007**
Total Costs							**299354**	**598707**
Gross margin less Variable costs, Labour costs and Fixed costs							**30646**	**61293**

Appendix 6: Criteria used to measure the success of commercialization of *S. birrea* products

- Increasing family income within the community
- Improving the economic status of women within communities
- Strengthening local culture
- Improving the conservation of forest resources
- Improving local capacity
- Improving the control and ownership of forest resources within the community
- Improving consumer well being
- Increasing the proportion of community members with paid work
- Strengthening community organization
- Improving well-being – education, health, diet etc, within communities
- Improving the economic status of the poorest members of the community
- Improving social justice – transparency and equitable distribution
- Strengthening markets
- Increased ability to meet consumer preferences
- Increasing value added locally
- Increasing income generated to businesses
- Increasing income generated to governments
- Ability to adhere to international norms

Appendix 7: A generic structure of *S. birrea* commercialization process in Uyui District, Tanzania

Process
i. Collection
Constraints
Poor roads
Don't have processing centre
Trees are very scattered
Risks of being attacked by dangerous animals
No electricity
ii. Sale
Unreliable market
Unreliable availability of packaging materials
Low quality and undifferentiated labels
Lack market information and linkage
No barcodes
iii. Transport
Risks of being attacked by dangerous animals
Low quality and undifferentiated labels
Lack of cold storage facilities
Lack market information and linkage
No electricity
Long distance
iv. Processing
Trees are very scattered
Seasonal availability of fruits
Absence of modern processing technology
Long distance
v. Marketing
Risks of being attacked by dangerous animals
Lack market information and linkage
Packaging materials are expensive
Lack of training
No barcodes
Long distance
vi. Storage
Long distance
Absence of credits
Lack of capital

Appendix 8: A questionnaire for *S. birrea* fruits collectors in Uyui District, Tanzania

Questionnaire No. _____

Name of Respondent_____ Age_____

Village _____Ward _____Division _____

SECTION A: Demographic Information

Circle the most appropriate answer and where necessary fill in the blanks

1. Gender

a. Male

b. Female

2. What is your age in years?

a.18 – 25

b.26 – 50

c.50 and above

3. What is your marital status?

a. Single

b. Married

c. Widowed

d. Other (specify)

4. Education level?

a. No formal education

b. Primary School

c. Secondary School

d. Post Secondary

SECTION B: RESOURCE BASE AND ECONOMIC ACTIVITIES

5. What are themain economic activities that members of your household engage in?

a. Crop farming only

b. Livestock keeping only

c. Crop and Livestock keeping

d. Irrigation farming

e. Salary/wages

f. Trading

6. What is the major source of household cash income?

(a) Crop farming only (b) Livestock keeping only (c) Crop and Livestock keeping (d) Irrigation farming (e) Salary/wages (f) Trading

7. List down three main household cash expenses, starting with the major one

a. Food

b. Clothing

c. Education

8. What is the size of your cropping land?

a.1-2 acres

b.2-3 acres

c.3-4 acres

d. More than 4 acres

9. Name four types of crops that you grow (starting with the one that occupies most of the cropping land

a. ……

b. ……

c. ……

d. ……

10. What building material do you use to construct most of your houses? Circle the most correct answer

(i) Walls (a) mud (b) poles (c) burnt bricks (d) earth ricks

(ii) Roof (a) mud (b) grasses (c) iron sheets (d) others

(iii) Floor (a) mud (b) cement (c) others

11. What is the source of your drinking water? (a) Boreholes (b) Wells (c) Tapes

12. Does your household have any of the following? Tick the correct answer

Asset	**Yes**	**No**
a. Electricity		
b. Television		
c. Radio		
d. Cellphone		
e. Bicycle		
f. Vehicle		
g. Wheelbarrow		
h. Push cart		
Others		

C. LOCAL USE OF *S. BIRREA* PRODUCTS

13. Please indicate if you use the *S. birrea* products as indicated (Tick answer)

Uses	**Yes**	**No**
Fruits		
i. Eat fruits		
ii. Make wine		
iii. Prepare juice		
v. Make jam		
Kernels		
vi. Eat kernels		
vii. Extract cooking oil		
viii. Extract cosmetic oil		
Plant parts		
xii. Make wood carvings		

xiii. Use wood to make utensils		
xiv. Use as firewood		
xv. Use poles as house construction or fencing material xvi. Use for timber		
xvii. Use bark as medicine		
xviii. Use roots as medicine		
xix. Use leaves as medicine		
Other uses		

D. ACTORS AND THEIR RESPONSIBILITIES IN *S. BIRREA* FRUITS ACTIVITIES

14. Please complete the following table, showing the distribution of responsibilities in marula- related activities (Use ranking of 1-4, with 1 being most actively involved and 4, least actively involved)

Activity	**Actor**		
	Men	**Women**	**Children**
Collecting			
Transporting fruit			
Crushing the nut			
Pulp extraction			
Beer or wine brewing			
Others			

E. PROFITABILITY AND ITS DISTRIBUTION ALONG THE *S. BIRREA* VALUE CHAIN

15. List down equipment (s) you commonly use in your collection activities

Equipment	**Buying cost**	**Equipment's life**
1.		
2		

16. Complete the following table on activities, quantities, costs and price associated with *S. birrea* fruits collection and selling.

Activity and labour	**Quantity per day/week**	**Costs/hour**	**Selling price/unit of measurement**
Collection			
Labour (number of individuals)			
Transportation			
Sorting			
Others			
Total			

17. Mention charges/fees you pay in your collection activities.

Charge	**Amount**	**How often?**
1.		
2.		

F. CONSTRAINTS AND OPPORTUNITIES EXISTING IN *S. BIRREA* VALUE CHAIN

17. Where do you sell your products (in Tanzania)?

……

……

18. What value addition activities do you carry?

……

…….....

19. Who determine price?

……

20. What are the main constraints you encounter in your work?

……

…….....

21. What do you think are the opportunities which could enhance full commercialization of *S. birrea* products in your area?

……

…….....

G. TENURE SYSTEMS, REGULATIONS AND POLICIES GOVERNING ACCESS AND USE OF *S. BIRREA* PRODUCTS

26. Where are *S. birrea* trees you access and use mostly found?

(a) Protected areas (b) Communal lands (c) Private land (farms)

27. Do all people in a community have the same right of access to harvest/collect the *S. birrea* products from communal lands?

(a)Yes (b) No

28. List down ways in which people access the *S. birrea* trees for the purpose of collecting fruits?

.....,.....,.....,.....

29. Do you think the number of *S. birrea* trees in your area is

(a) Increasing? (b) Decreasing? (c) Not changing

30. Give reasons for answer to question 29

.....

32. List down non-formal local community regulations that govern use of *S. birrea* trees in your area

.....

33. List down formal local community regulations that govern use of *S. birrea* trees in your area.

.....

34. List down government regulations that govern access and use of *S. birrea* trees in your area.

.....

Appendix 9: Questionnaire for *S. birrea* fruits processors in Uyui District, Tanzania

SECTION A: Demographic Information

Circle the most appropriate answer and where necessary fill in the blanks

1. Gender

(a) Male (b) Female

2. What is your age in years?

(a)18 – 25 (b) 26 – 50 (c) 50 and above

3. What is your marital status?

(a) Single (b) Married (c) Widowed (d) Other (specify)

4. Education level?

(a) No formal education (b) Primary School (c) Secondary School (d) Post Secondary

SECTION B: RESOURCE BASE AND ECONOMIC ACTIVITIES

5. What are the main economic activities that members of your household engage in?

(a) Crop farming only (b) Livestock keeping only (c) Crop and Livestock keeping (d) Irrigation farming (e) Salary/wages (f) Trading

6. What is the size of your cropping land?

(a) 1-2 acres (b) 2-3 acres (c) 3-4 acres (d) More than 4 acres

7. Name four types of crops that you grow (starting with the one that occupies most of the cropping land)

.....

.....

8. Does your household have any of the following? Tick the correct answer

Asset	**Yes**	**No**
i. Electricity		
j. Television		
k. Radio		
l. Cellphone		
m. Bicycle		
n. Vehicle		
o. Wheelbarrow		
p. Push cart		
Others		

C. LOCAL USE OF *S. BIRREA* PRODUCTS

13. Please indicate if you use the *S. birrea* products as indicated (Tick answer)

Uses	**Yes**	**No**
Fruits		
j. Eat fruits		
ii. Make and drink wine or beer		
iii. Prepare juice		
iv. Prepare porridge from fruits		
v. Make jam		
Kernels		
vi. Eat kernels		
vii. Extract cooking oil		
viii. Extract cosmetic oil		
Plant parts		
xii. Make wood carvings		
xiii. Use wood to make utensils		
xiv. Use as firewood		

xv. Use poles as house construction or fencing material xvi. Use for timber		
xvii. Use bark as medicine		
xviii. Use roots as medicine		
xix. Use leaves as medicine		
Other uses		

14. List down equipments you commonly use in your work

Equipment	**Buying cost**	**Equipment's life**
1.		
2		

15. Complete the following table below on procurement, processing and marketing of *S. birrea* fruits and products respectively.

Activity	**Quantity (unit of measurement**	**Costs**	**Types of products produced**	**Quantity produced per hour/ day**	**Selling price per each unit**
Procurement: Purchasing of fruits Transportation Taxes/charges Communication Promotion Interest paid Others ……	……	…… ……			
Processing: Labour -Permanent employees -Casual labours Power Water Maintenances Rent Fuel Others ……		……	i. Juices ii.Wine iii.Jam iv. Beer Others …….	……	…….

Marketing: Transportation Communication Electricity bills Others……		……			
Total					

16. What types of products do you produce?

.....

17. Where do you sell your products (in Tanzania)?

.....

18. Do you export your products?

(a) Yes (b) No

19. If yes, in which countries?

.....……

20. If answer is no, why?

.....

.....

21. What value addition activities do you carry?

……

22. What is the market trend of *S. birrea* products?

(a) Increasing (b) Static (c) Declining

23. Give reasons for your answer in 22 above?

.....

24. Using the following criteria to comment on the success of *S. birrea* products commercialization in your area. Assign; 1 = Total failure, 2 = Moderate failure, 3 = Moderate success and 4 = Total Success.

- Increasing family income within the community ( )
- Improving the economic status of women within communities ( )
- Strengthening local culture ( )
- Improving the conservation of forest resources ( )
- Improving local capacity ( )
- Improving the control and ownership of forest resources within the community ( )
- Improving consumer well being ( )
- Increasing the proportion of community members with paid work ( )
- Strengthening community organization ( )
- Improving wellbeing – education, health, diet etc, within communities( )
- Improving the economic status of the poorest members of the community ( )
- Improving social justice – transparency and equitable distribution ( )
- Strengthening markets ( )
- Increased ability to meet consumer preferences ( )
- Increasing value added locally ( )
- Increasing income generated to businesses ( )
- Increasing income generated to governments ( )
- Ability to adhere to international norms ( )

25. Using the following identified constraints during focus group discussion to comment on their influence in success of *S. birrea* products commercialization in your area. Assign; 1 = Not a constraint, 2 = A constraint, 3 = a strong constraint and 4 = a very strong constraint.

- Risks from animals ( )
- Long distance ( )
- Trees are scattered ( )
- Rough terrain ( )
- Poor roads ( )
- Lack of capital ( )
- Unreliable p/materials ( )
- Expensive p/materials ( )
- Poor technology ( )
- Scarcity of fruits ( )
- Unreliable market ( )
- No barcodes ( )
- No processing centre ( )
- No cold storage facilities ( )
- Absence of credits ( )
- No TBS and TFDA certificate ( )
- Absence of trainings ( )
- Low quality products & labels ( )
- Lack market info & linkage ( )
- No electricity ( )

26. What do you think are the opportunities for growth of *S. birrea* products processing industry in Uyui district and Tabora region in general?

……

…….....

27. Based on your experience, what are the main reasons for poor utilization and commercialization of *S. birrea* fruits in Tanzania compare to other Southern Africa Countries?

…….....

TENURE SYSTEMS, REGULATIONS AND POLICIES GOVERNING ACCESS AND USE OF *S. BIRREA* PRODUCTS

28. Where are *S. birrea* trees you access and use mostly found?

(a) Protected areas (b) Communal lands (c) Private land (farms)

30 List down ways in which people access the *S. birrea* trees for the purpose of collecting fruits?

.....

29. If answer to 32 is No, how can access to the trees be improved?

……

30. Do you think the number of *S. birrea* trees in your area is

(a) Increasing? (b) Decreasing? (c) Not changing

31. Give reasons for answer to question 33

.....

32. Name the major traditional practices associated with the marula season in your area

.....

33. List down non-formal local community regulations that govern access and use of *S. birrea* trees in your area

.....

34. List down formal local community regulations that govern access and use of *S. birrea* trees in your area

.....

35. List down government regulations that govern access and use of *S. birrea* trees.

.....

Appendix 10: A questionnaire for household survey in Kilosa District, Tanzania

Questionnaire No. _____

Name of Respondent_____ Age_____ Village _____

Ward_____Division_____ District

SECTION A: Demographic Information

Circle the most appropriate answer and where necessary fill in the blanks

1. Gender

(a) Male (b) Female

2. What is your age in years?

(a) 18 – 25 (b) 26 – 50 (c) 50 and above

3. What is your marital status?

(a) Single (b) Married (c) Widowed (d) Other (specify)

4. Education level?

(a) No formal education (b) Primary School (c) Secondary School (d) Post Secondary

SECTION B: RESOURCE BASE AND ECONOMIC ACTIVITIES

5. What are the main economic activities that members of your household engage in?

(a) Crop farming only (b) Livestock keeping only (c) Crop and Livestock keeping (d) Irrigation farming (e) Salary/wages (f) Trading

6. What is the size of your cropping land?

(a) 1-2 acres (b) 2-3 acres (c) 3-4 acres (d) More than 4 acres

7. Name four types of crops that you grow (starting with the one that occupies most of the cropping land)

.....

.....

8. Does your household have any of the following? Tick the correct answer

Asset	Yes	No
q. Electricity		
r. Television		
s. Radio		
t. Cellphone		
u. Bicycle		
v. Vehicle		
w. Wheelbarrow		
x. Push cart		
Others		

C. LOCAL USE OF *S. BIRREA* PRODUCTS

13. Please indicate if you use the *S. birrea* products as indicated (Tick answer)

Uses	Yes	No
Fruits		
k. Eat fruits		
ii. Make and drink wine or beer		
iii. Prepare juice		
iv. Prepare porridge from fruits		
v. Make jam		
Kernels		
vi. Eat kernels		
vii. Extract cooking oil		
viii. Extract cosmetic oil		
Plant parts		
xii. Make wood carvings		
xiii. Use wood to make utensils		
xiv. Use as firewood		
xv. Use poles as house construction or fencing material xvi. Use for timber		
xvii. Use bark as medicine		
xviii. Use roots as medicine		
xix. Use leaves as medicine		
Other uses		

D. TENURE SYSTEMS, REGULATIONS AND POLICIES GOVERNING ACCESS AND USE OF *S. BIRREA* PRODUCTS

14. Where are *S. birrea* trees you access and use mostly found?

(a) Protected areas (b) Communal lands (c) Private land (farms)

16. List down ways in which people access the *S. birrea* trees for the purpose of collecting fruits?

.....

17. Do you think the number of *S. birrea* trees in your area is

(a) Increasing? (b) Decreasing? (c) Not changing

18. Give reasons for answer to question 17

.....

22. Name the major traditional practices associated with the marula season in your area

.....

23. List down non-formal local community regulations that govern access and use of *S. birrea* trees in your area

.....

24. List down formal local community regulations that govern access and use of *S. birrea* trees in your area

.....

25. List down government regulations that govern access and use of *S. birrea* trees

.....

Appendix 11: An interview schedule for *S. birrea* value chain stakeholders in Uyui District, Tanzania

PART A: Focus group discussion in Uyui District

1. When was *S. birrea* fruits processing began in Uyui District?
2. Where do *S. birrea* fruits and associated products sold?
3. Mention the actors taking part in *S. birrea* products value chain
4. What are the main roles of actors mentioned in 3 above play in value chain activities?
5. (i) What are the constraints/challenges do you face as collectors?
6. Mention the local use of *S. birrea* tree
7. What are tenure systems, regulations (traditional laws and rules) governing *S. birrea* resource access and harvesting?
8. What are the reasons for underutilization and commercialization of *S. birrea* fruits and associated products in Uyui District?

PART B: District authorities

1. How *S. birrea* resource harvesting is coordinated?
2. What are regulations and policies governing *S. birrea* resource harvesting and trade?
3. What arrangements have you stipulated to ensure *S. birrea* resource base is harvested sustainably?
4. What are the reasons for underutilization and commercialization of *S. birrea* fruits and associated products in Tanzania?
5. What do you think are the opportunities for future growth of *S. birrea* products trade?

PART C: *S. birrea* value chain initiators/developers

1. When was *S. birrea* fruits processing began?
2. What types of products are found in *S. birrea* value chain?
3. Where these products mentioned in 2 above do sold?
4. Who are actors and their roles in the value chain?
5. What are the constraints in *S. birrea* products value chain?
6. What are the reasons for underutilization and commercialization of *S. birrea* fruits and associated products in Tanzania?
7. What do you think are the opportunities for future growth of *S. birrea* products trade in both local and international markets?

Appendix 12: An interview schedule for *S. birrea* stakeholders in Kilosa District, Tanzania

PART A: An interview schedule for focus group discussion in Kilosa District

1. Where do *S. birrea* resource base mostly found?
2. Mention the local use of *S. birrea* tree
3. What are the reasons for underutilization and commercialization of *S. birrea* fruits and associated products in Kilosa district?
4. What are the major threats to *S. birrea* tree?
5. What are tenure systems and regulations (traditional laws and rules) governing *S. birrea* resource access and harvesting?

PART B: An interview schedule for Kilosa District authorities

1. How *S. birrea* resource harvesting is coordinated?
2. What are regulations and policies governing *S. birrea* resource harvesting?
3. What arrangements have you stipulated to ensure *S. birrea* resource base is harvested sustainably?
4. What are the reasons for underutilization and commercialization of *S. birrea* fruits and associated products in Tanzania?
5. What do you think are the opportunities for future growth of *S. birrea* products trade?