#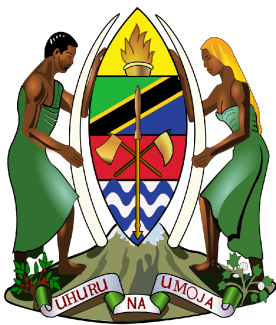 MARKET SYSTEM ANALYSIS OF BAMBOO PRODUCTS IN RUVUMA REGION, TANZANIA -MASTER THESIS FOR SOKOINE UNIVERSITY OF AGRICULTURE

LILIAN MAGAFU

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The United Republic of Tanzania
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MARKET SYSTEM ANALYSIS OF BAMBOO PRODUCTS IN RUVUMA REGION, TANZANIA

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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

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ABSTRACT

Globally bamboo is considered pro poor and contribute significantly to communities along the value chain. The aim of this study was to conduct market system analysis of bamboo products in Ruvuma region in Tanzania. Seventy producers, two processors and twenty five traders were interviewed in Mbinga and Songea districts. Questionnaire survey, key informant interview and direct observation were the key methods for qualitative and quantitative data collection. Descriptive analysis was performed for quantitative data while content analysis was conducted for qualitative data analysis. Results showed that key actors were producers, processors, traders and input suppliers. Main products manufactured were winnowing trays with an average price of TZS 3400, baskets with an average price of TZS 3900, *jamanda* with an average price of TZS 6000 and barbeque sticks with an average wholesale price of TZS 550 per packet. Markets for these products were; within the village and Songea, Mbinga and Nyasa towns. Only barbeque sticks accessed markets in Dar es Salaam. Producers who work individually had the following gross margins; baskets 22%, winnowers 44%, *tenga* 47% and *jamanda* 32%. Those working in informal groups had a gross margin of 78% implying that working in groups reduced costs and increased efficiency and productivity. Processors and traders had a gross margin ratio of 53% and 40% respectively. Inadequate policy and strategy attention to bamboo limited value chain development. INBAR, SUA and TFS roles were observed in improving bamboo management through supplying support services. However, there were little efforts on skills improvement and value addition. The study suggests that producers should organise themselves in groups to increase access to market information and support for profit maximization.

DECLARATION

I, Lilian Magafu, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work, done within the period of registration, and that it has neither been submitted nor being concurrently submitted for a higher degree award in any other institution.

_____   _____

Lilian Magafu   Date
(MSc. Candidate)

The above declaration is confirmed by;

_____   _____

Prof. J. M. Abdallah   Date
(Supervisor)

_____   _____

Prof. R. C. Ishengoma   Date
(Supervisor)

COPY RIGHT

ACKNOWLEDGEMENTS

DEDICATION

This work is dedicated to my beloved mother Prof. Anna Sikira who laid the foundation of my education.

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LIST OF ACRONYMS AND ABBREVIATIONS

BCR   Benefit Cost Ratio

CFWT   College of Forestry, Wildlife and Tourism

DFC   District Forest Conservator

DFO   District Forest Officer

DVD   Digital Versatile Disc

EFTA   Equity for Tanzania Limited

FAO   Food and Agriculture Organisation of United Nations

FORVAC   Forestry and Value Chains Development programme

FSC   Forest Stewardship Council

GCC   Global Commodity Chains

GM   Gross Margin

INBAR   International Network for Bamboo and Rattan

IRR   Internal Rate of Return

MM   Marketing Margin

MNRT   Ministry of Natural Resources and Tourism

MP   Member of Parliament

NTFP   Non Timber Forest Product

PASS   Private Agricultural Sector Support Trust

R&D   Research and Development

RFO   Regional Forest Officer

ROI   Return on Investment

SIDO   Small Industries Development Organisation

SNAL   Sokoine National Agriculture Library

SPSS   Statistical Package for Social Sciences

SUA   Sokoine University of Agriculture

TAFORI   Tanzania Forestry Research Institute

TBC   Tanzania Broadcasting Corporation

TBS   Tanzania Bureau of Standards

TFS   Tanzania Forest Services Agency

TRA   Tanzania Revenue Authority

TZS   Tanzania Shillings

URT   United Republic of Tanzania

USAID   United States Agency for International Development

USD   United States Dollar

VCA   Value Chain Analysis

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Bamboo is one of non-timber forest products (NTFPs) that play important economic and cultural roles in Asian, American and African countries (Selvan, 2018). Bamboo is popular in producing clothes, paper, charcoal and in construction for making laminated boards and panels. Bamboo shoots are widely used as vegetable, with Asian cuisine spreading quickly around the globe (Lobovikov *et al.,* 2005). Bamboo based agroforestry systems are also growing in sub–Saharan countries and contribute to reduced poverty in rural communities in the area (Akoto *et al.,* 2018). Global bamboo market is estimated to be USD 3.6 billion with China being the largest market contributor accounting up to 65% of global bamboo exports (Future Market Insights, 2017 cited by Scheba *et al.* (2017). According to INBAR (2019), bamboo flooring, handicrafts, furniture and bamboo shoots are the most internationally traded products.

Many governments and the private sector in Africa are taking steps towards bamboo commercialization due to its potential. Several countries including Benin, Burundi, Cameroon, Eritrea, Ethiopia, Ghana, Liberia, Kenya, Malawi, Madagascar, Mozambique, Nigeria, Rwanda, Senegal, Sierra Leone, Togo, Uganda and Tanzania joined the International Network of Bamboo and Rattan (INBAR), which assists in information sharing , technology transfer, capacity building and policy formulation to all matters related to bamboo (Musau, 2016). In Tanzania bamboo occurs in different land use types and covers about 1 025 033 hectares. Four major bamboo species occur naturally; *Yushania alpina, Oreobambos buchewaldii, Hickelia Africana* and *Oxytenanthera abyssinica* while introduced species are *Dendrocalamus strictus, Dendrocalamus nutans,*

Bambusa vulgaris, Bambusa multiplex, Bambusa nutans, Bambusa bambos and *Bambusa spp* (Lyimo *et al.*, 2019).

Bamboo in Tanzania is drawing attention due to its potential to create employment through sales of its products. However, the sector is facing challenges including limited information and poor knowledge and technology (Lyimo *et al.,* 2019). The underdeveloped value chain of bamboo products contributes to underutilization of these resources. Therefore, a holistic market system analysis of bamboo is necessary to provide insights on the potential of bamboo for investment purposes.

1.2 Problem Statement and Justification

1.2.1 Problem statement

Non-timber forest products (NTFPs) represent a significant component of the household livelihood and income options (Kimaro and Lulandala, 2013). In the past, these resources were viewed as minor forest products but are currently receiving high attention due to their potential (Lin *et al.*, 2019). Bamboo products, such as carvings, fodder and wine have significant impact on people's livelihoods (FAO, 1999; Chettleborough *et al*., 2000).

Gauli *et al.* (2018) reported that bamboo is one of the most important NTFPs that have gained recognition in Ethiopia, Kenya and Tanzania. According to FAO (2018), bamboo is mostly found around homesteads and is mainly utilized by men and women in making various products for income diversification.

The fifth Phase Government is focusing on industrialization for sustainable growth and development. Bamboo stands a better chance of being part of this focus if its value chains, actors, rules/business environment and supporting functions are analysed and gaps

identified. Despite bamboo having a better chance of increasing sustainable growth and development, its growth in many countries is hindered by lack of information on current marketing channels, prices, demand and supply and product development needs (Pande *et al.,* 2016). Tanzanian communities and planners are not excluded from this challenge.

Market system analysis of bamboo sector can be an important step to creating a better environment for bamboo commercialization. According to Campbell (2014) a market system incorporates all activities from production, distribution to consumption of goods and services. These activities include the contribution of direct market players, supporting functions and the rules/business environment in which they operate.

Lin *et al.* (2019) and Mekonnen *et al.* (2014) reported that Bamboo provides numerous subsistence benefits to communities in Ethiopia. Gauli *et al.* (2018) in a market assessment revealed that farmers failed to sell bamboo products due to lack of market in Kenya. In Tanzania, FAO (2018) conducted a study on bamboo with a focus on its potential on land restoration. Chihongo *et al.* (2000) analysed production to consumption systems of bamboo by analysing the entire chain of activities to which bamboo products are subjected. However, a number of years have passed since this study was done. In addition, these studies have not analysed bamboo based on market system. There is a shortfall of information that could be used to understand what is causing bamboo markets to under-perform and why they are not more inclusive. The empirical information lacking includes supporting functions, rules/business environment and value chains (actors, flows, value addition) which exist. Therefore, the current study was conducted to uncover these facts with regard to bamboo commercialization.

1.2.2 Justification

This study was in line with sustainable development goals number 1 and 12, which focus on poverty reduction and sustainable consumption and production patterns respectively. Information obtained from this study may enhance value chain development of bamboo products and assist in decision-making on whether to commercialize bamboo or not. In addition, the study has provided information for further research on bamboo in Tanzania and other areas where applicable.

1.3 Objectives

1.3.1 Overall objective

The overall objective of this study was to analyse the market system for bamboo products in Ruvuma region.

1.3.2 Specific objectives

The specific objectives of the study were to:

    (i)   Identify existing bamboo products and their potential;

    (ii)   Map actors in the bamboo value chain and study their roles;

    (iii)   Assess the business environment of bamboo trade; and

    (iv)   Assess supporting functions and service provision regarding bamboo trade.

1.4 Research questions

The study aimed to answer the following questions:

(i)   Which potential bamboo products exist in the study area?

(ii)   Who are the key actors along the chain and how do they function?

(iii)   How are profits distributed along the chain?

(iv)   What is the export and import scenario of bamboo in Tanzania?

(v)   What are the policies, rules, guidelines, norms, and customs that influence the consumption of bamboo products?

(vi)   What are the roles of enablers in bamboo value chain development?

1.5 Organization of the report

This report is organized into five chapters. The first chapter is introduction that covers background information, problem statement, objectives, and research questions. The second chapter is literature review, which covers important literature relevant to the study. Chapter three is research methodology which covers description of the study area, research design and data analysis. The fourth chapter presents results of the findings and discussion. Chapter five covers the conclusion and recommendations based on the study findings.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview of bamboo consumption

Globally, bamboo forests cover about 36 million ha with a large part (24 million hectares) located in sixteen Asian countries. Ten American countries accounts for over 10 million hectares and the remaining 2.8 million hectares are found in five African countries (Scheba *et al.,* 2017). Bamboo products are among the important traded natural commodities globally. Data compiled from the UN's Comtrade Database show that average trade value (both import and export) for year 2014, 2015 and 2016 was about USD 3 billion with China being the major exporter of the products, accounting for 72.6% of total exports in the world, whereas its imports are less than one percent. Among the importing countries, the EU is the largest importer (27.8%) followed by the USA (20.4%). There are 12 commonly traded bamboo products; among them, preserved bamboo shoots are the most exported item (20.4 %), followed by bamboo flooring (19.4 %), bamboo basketry (14.2 %) and bamboo and rattan furniture (10.3 %). In all the cases, the EU and the USA are the major importers, accounting for 28% and 21% of imports, respectively (Gauli *et al.,* 2018). These could be one of the important markets for bamboo products from Tanzania if its market system is understood.

2.1.1 Bamboo production in Africa

According to INBAR (2015), Africa's population is expected to increase to 2.4 billion by 2050 hence a need to create new kinds of goods, services and energy sources. It has favourable conditions for cultivating bamboo hence both natural and cultivated bamboo can prove valuable resources for sustainable rural development. The World Bamboo Resources Assessment Report (Lobovikov *et al.,* 2005) reported that Africa has a total of

over 2.7 million hectares of Bamboo distributed in Nigeria, Ethiopia, Kenya, Uganda, Tanzania and Zimbabwe. Two main indigenous species dominant in East Africa are *Yushania alpina* (highland bamboo) and *Oxytenanthera abyssinica* (lowland bamboo). These countries have plenty of skilled craftsmen only that little is done to improve the processing of bamboo products due to poor technology hence failure to compete in the global market (Simpson, 2011).

2.1.2 Bamboo production in Tanzania

According to Lyimo *et al.* (2019) bamboo forests in Tanzania cover about 1 025 033 hectares in both lowland and highland areas receiving good rainfall. Natural species include *Yushania alpina, Oreobambos buchewaldii, Hickelia Africana* and *Oxytenanthera abyssinica* while introduced species are *Dendrocalamus strictus, Dendrocalamus nutans, Bambusa vulgaris, Bambusa multiplex, Bambusa nutans, Bambusa bambos* and *Bambusa* species. The highest proportion of occurrence is in woodland (66%) followed by cultivated land (12%) and forest (10%). Bamboo has been used for various purposes including house construction, handicrafts, ornaments and aesthetics, furniture, fuel and food (Pande *et al.,* 2016). However, its potential is still unrealized in many parts of Tanzania thus little or no commercialization observed.

2.2 Constraints to bamboo development

Bamboo is a fast growing species with multiple uses however; it is facing constraints which hinder the uptake in utilization in many areas. For example, in Ethiopia less value addition has led to low price of bamboo products resulting into weaker value chains. In response to the low return and unstable demand and supply features, the bamboo trade is conducted in combination with other businesses and is often used as a stepping-stone to move to other sectors (Endalamaw *et al.,* 2013). In addition, Mekonnen *et al.* (2014)

observed an unfair relationship between bamboo producers and traders. It was also realized that the final products were not of the desired specification and standards hence are only fit for the local market. Moreover, Mekonnen *et al.* (2014) reported that producers fail to capture market information although this can be explained by the fact that bamboo activities are considered as part-time activities only to generate additional income. Low technology and skills among producers also hinder value addition. For example, few entrepreneurs from Kenya participated in a training held in China but implementation failed because the technology used in China is very advanced and was not available in Kenya (Gauli *et al.,* 2018). Lack of information on the ability of various bamboo species to resist decay is lacking in India leading to a slow process in the upscale of bamboo (Kaur *et al.,* 2016).

2.3 Theoretical framework

2.3.1 Overview of global value chain and global commodity chain

The value chain concept became important to economic researchers in 1990s. It entails a combination of activities in the process of creating and adding value to a product or service. It mainly focused on business activities with little emphasis on the corporate power and institutional context and this led to the emergence of a new concept called the Global Commodity Chains (GCC). The GCC is a collection of networks clustered around one product or service, linking households, enterprises, and states to one another within the world economy (Kano *et al.,* 2020). According to Gereffi *et al.* (2005), the chain discusses governance issues which encompass four patterns:

a) **Hierarchical** chains covering all internal operations of vertically integrated firms.

b) **Quasi-hierarchical** chains which cover a series of low level suppliers, who require high level of support and are the subject of well-developed supply chain management from lead firms, they are often called the chain governor.

c) **Relational** and **modular** chain governance exhibit strong relations between firms and their suppliers and customers in the chain. A low level of chain governance is observed because the main suppliers in the chain are competent and can operate independently of the lead firm.

d) **Market** chains represent the classic arm's length relationships found in commodity markets.

GCC is also described in two aspects which are producer driven commodity chains and buyer driven commodity chains. Buyer driven commodity chains are chains in which buyers practice decentralized production of goods organized through networks among several countries. They are characterized with low technology hence the products made are of low quality (Raikes *et al.,* 2000). In contrast, Producer driven GCC involves production of high quality goods where large enterprises directly control the manufacturing process. It is featured by high technology due to intensive capital invested in the business (Raikes *et al.,* 2000). Therefore, the current study adopted the buyer driven commodity chain approach since bamboo value chain is influenced by buyers in terms of size and quantity to be produced. Moreover, GCC theory considers governance structures and promotes the roles of chain actors which are critical to this study (Fig 1).
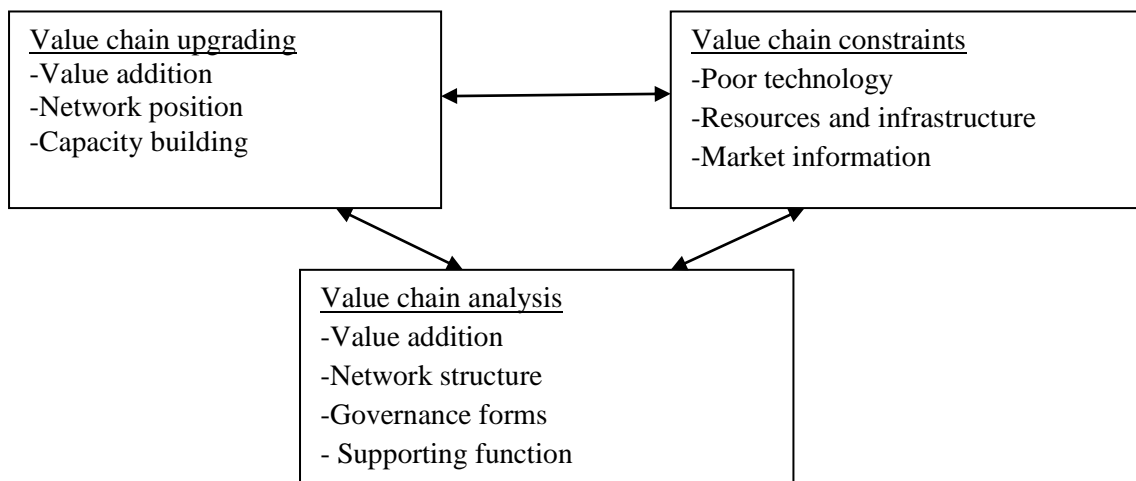
Figure 1: Theoretical framework of the study

2.4 Market system and value chain analysis

2.4.1   Market system analysis

It is evident that natural resource managers in developing countries cannot separate sustainable resource management with enterprise development since natural resources are the doorway to poverty reduction. In a methodological study by FAO (2018) it was reported that market system links various aspects including social, technological, legal and economic features in order to prevent business failure. According to TechnoServe (2019) a market system is a network of buyers, sellers and other actors that come together to trade in a given product or service. It can be product specific or a cross-cutting sector for example finance, labour and business development services. The participants in a market system include: Direct market players such as producers, buyers, and consumers who drive economic activity in the market; Suppliers of supporting goods and services including extension services that provide support to the chain and the enabling environment which includes critical factors that create the operating conditions within which the value chain operates.

Coordination of these participants involved in market system is important because each one has a way of influencing the market environment. It is from the process of examining the interaction among these players that the concept of value chain analysis (VCA) came into place.

2.4.2 Value chain analysis

The concept of "value chain" was introduced by Porter in 1985 to describe the full range of activities, which are required to bring a product or service from conception, through different phases of production, distribution to consumers, and final disposal. VCA requires the "mapping of the market" to track and analyse the contribution of different

chain actors and the relationships among themselves. An understanding of the interactions within a value chain helps to identify various factors that influence how the chain works (Zamora, 2016).

The VCA typically involves identifying and mapping the relationships of four types of features: (a) the activities performed during each stage of processing; (b) the value of inputs, processing time, outputs and value added; (c) the spatial relationships, such as distance and logistics, of the activities; and, (d) the structure of economic agents, such as suppliers and the wholesalers (Subramanian, 2007).

2.4.3 Value chain actors

Value chain actors are those who are involved directly in production and processing to transporting and trading until the product meets the final consumer. They usually own the product for some time as it travels along the chain (Hellin and Meijir, 2006). The value chain actors include producers, traders, processors, transporters, wholesalers, retailers and final consumers (Subramanian, 2007).

2.4.4 Value chain supporters

Value Chain supporters are people and companies who provide services to the value chain actors such as improving capacities of producers and small agro-businesses, ensuring access to information, knowledge and skills, and linking numerous but small producers with markets. These services are provided by actors who never directly deal with the product, but whose services add value to the product. This includes providers of market information, financial services, transport services, research and development (R&D) facilities, and accreditation and appraisal services for financing and securing of equipment (Hellin and Meijir, 2006).

2.4.5 Enabling environment

These are regulatory framework, policies and infrastructures at the local, national and international level that affect value chain (Hellin and Meijir, 2006). The enabling environment deals with governance and institutional factors such as the level of trust, transparency and accountability, the eradication of misconducts and corruption, the presence of well-established policies and laws as well as a defined land tenure system.

2.5 Gross margin analysis

According to Corporate Finance Institute (2020), Profitability ratios are important to investors since they measure and evaluate the ability of a firm to generate profit relative to revenue, assets, operating costs and shareholders' equity during a specific period of time. They show how well a company utilizes its assets to produce profit and value to shareholders. There are various financial metrics used to measure profitability of enterprises including Gross Margin (GM), Return on Investment (ROI), Benefit-Cost Ratio (BCR or B/C), Internal Rate of Return (IRR), and Marketing Margin (MM) (Turuka, 2000 as cited by Mkani, 2013).

Gross margin is a crucial measure for small and medium enterprises planning. It is the ratio of gross profit to revenue where gross profit is the difference between revenue and cost of goods sold. Since gross margin is not affected by the size and type of the enterprise, it is mostly suitable for comparison of operations (Semerci *et al.,* 2014). The use of gross margins evolved widely in the UK from about 1960 among farm managers for analysis and planning purpose. For merchandising decisions in companies with large assortment of goods gross profit expressed in money terms needs to be used when measuring financial results. This allows easy interpretation of financial results

without digging into details. Gross margin on the other hand is expressed in percentage and is more useful when a more detailed analysis is required (Jagelavičius, 2013).

The concept of gross margin relies on the understanding of variable and fixed costs. Variable costs are those costs that increase or decrease as output changes, while fixed costs are those costs that do not change as output is changed (Cramer e*t al.,* 2001 cited by Mashimba 2007). The use of gross margin in this study was employed to analyse profitability of different segments along bamboo value chain in Ruvuma region. Principally, Gross Margin model takes the following form:

$$GM = TR - TC \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(1)$$

Where,

GM = Average Gross Margin

TR = Average total revenue

TC = Average total variable cost

When expressed as ratio/percentages it is given by:

$$Ratio = \frac{Average\ total\ revenue\ (TR) - Average\ total\ cost(TC)}{Average\ total\ revenue\ (TR)} \dots\dots\dots\dots\dots\dots(2)$$

2.6 The conceptual framework

In a broader perspective, value chain analysis deals with not only the production to consumption structures but also with institutional and governance arrangements related to a specific product (Gereffi *et al.,* 2005). The conceptual framework of the present study (Fig.2) is based on the assumption that bamboo value chain connects various nodes from the production towards processing and consumption of the product. In each stage, it is expected that the respective actors (producer, processor, trader and input suppliers) will

have a specific role to play. These roles played by actors have a significant contribution to improving livelihood due to the employment potential they reveal. Moreover, the existing enabling environment greatly influences the performance of bamboo business entailing the need for stable regulatory framework, culture and infrastructure. In addition, there are people and organizations that contribute in capacity building to bamboo actors at various stages of the chain. The aspects covered by these supporting functions include training, financing, R&D, gathering of market information and provision of technology.
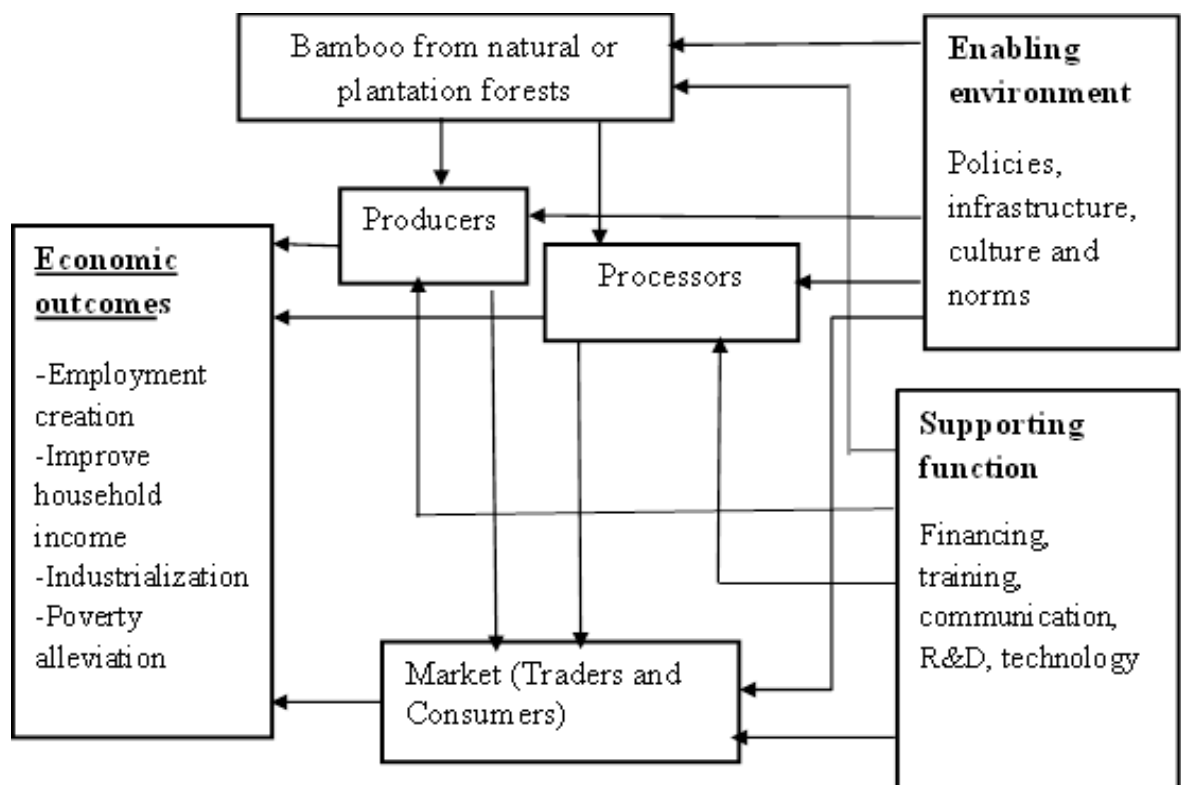
Figure 2: Conceptual framework of the study

Source: Adopted and modified from Teshale *et al.* (2017)

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Description of the study area

3.1.1 Geographical location

Songea and Mbinga districts (Fig. 3) are among the five districts of Ruvuma region others being Namtumbo, Tunduru and Nyasa. Songea is situated in southern highlands part of Tanzania and located between the latitude 10° 41` south and the longitude 35° 65` east. The district shares borders with the Republic of Mozambique in Southern west, Mbinga district in the West, Namtumbo district in the East and Ulanga (Morogoro region) and Njombe region in the North (URT, 2011).

Mbinga district is located between the latitude 10° 78` south and the longitude 34° 95` east. It is bordered to the North by Njombe region, to the East by Songea Rural District and Songea Urban district, to the south by Mozambique and to the west by Lake Nyasa.

3.1.2 Population and area

According to the 2012 census, Songea district has a population of 377 130 people (URT, 2013). The district occupies a total area of 16 727 km^2, accounting for 25% of Ruvuma Region's total land area.

Moreover the population of Mbinga district by 2012 was 353 683 (URT,2013). The district covers an area of 4840 km^2 with a density of 73.08 per km^2.

3.1.3 Climate

3.1.3.1 Temperature and humidity

Songea district has moderately mild temperatures averaging between 20°C and 25°C during day time while temperatures range between 15°C and 17°C during night especially in months of June, July and August. The district experiences high humidity in the months of September, October and November.

Mbinga climate is cool throughout the year with temperature highest ranges between 29 ^{0}C and 31 ^{0}C while the lowest ranges between 19 ^{0}C and 23 ^{0}C during cold season of June to August.

3.1.3.2 Rainfall

The rate of rainfall, which Songea receives annually, is between 800 mm and 1200 mm. Songea district has only one rainy season (long rains) which is between November and May. In Mbinga rainfall starts in December every year and stops in April/May. The area receives annual rainfall of above 1200 mm in mountain areas and between 600-800 mm in semi-arid areas which falls between six or seven months.

3.1.4 Economic activities

Agriculture is the main economic activity in Songea district. Shifting cultivation is practiced and crops grown include maize, sunflower, sesame, soya beans, cashew nuts, paddy, tobacco and coffee. Improvement of livestock for different animal types is done by introducing dairy cattle breeds, dairy goat breeds and other small stocks that has now increased the number of livestock in Songea. Other activities include the selling of forest products such as honey and bamboo products. Other sectors like mining are not well developed due to lack of in-depth research on the type of minerals found in the district.

However, there are areas where individuals involve in gemstones mining such as Muhukuru and Litisha ward.

In Mbinga district, economic activities include agriculture, animal husbandry and small scale mining of blue sapphire to some parts of the district. Cash crops are coffee, tobacco and cashew nut. Food crops include maize, beans, wheat, cassava, rice, banana, beans, and other cereals in small quantity. In addition, some people engage in agro-forestry especially those from high hills where climate favour tree plantations like pines and eucalyptus.
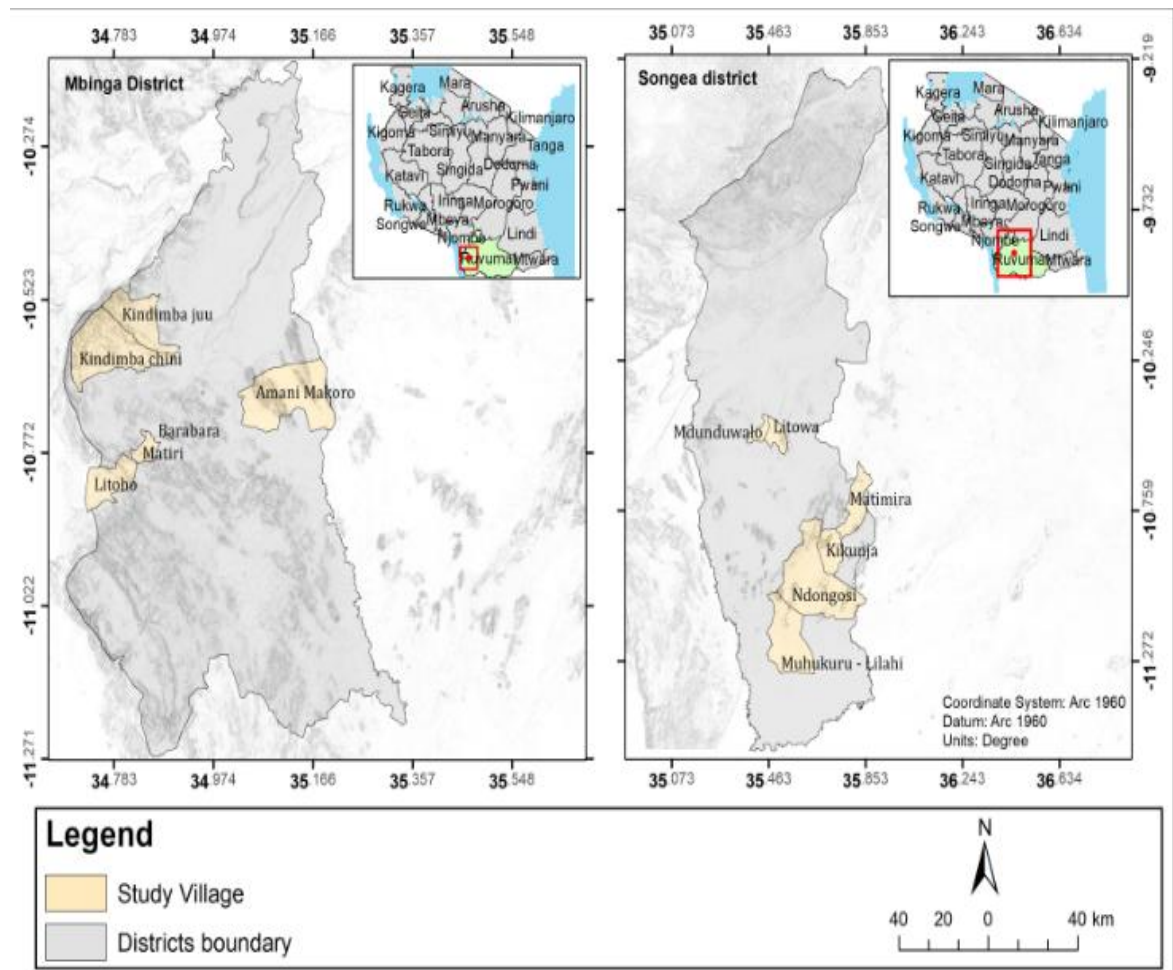
Figure 3: Map of Songea and Mbinga districts showing villages involved in the study

3.2 Research design

A cross-sectional study design was used whereby data was collected once (Bryman and Bell, 2011). The design is suitable because it allows the collection of data from a sample at a low cost and in a short duration of time (Chris and Diane, 2012).

3.3 Sampling procedures and sample size

3.3.1 Selection of the study area

The study was conducted in Songea and Mbinga districts in Ruvuma region. Six villages namely; Mdundualo, Matimila A, Kikunja, Ndongosi, Muhukulu-lilai and Litowa were selected in Songea district. In Mbinga five villages; Kindimbachini, Kindimbajuu, Barabara, Amani-makolo and Litoho were selected. The selected sites are among the most bamboo producing areas in the region. In addition, this study was financed by Forestry and Value Chains Development programme (FORVAC), therefore the villages were in FORVAC programme - Ruvuma cluster. The program aims to support management and commercialization of forest products by working closely with local communities and enterprises. It operates in four regions in Tanzania; Dodoma, Ruvuma, Lindi and Tanga.

The sampling unit for this study was the key actors along bamboo value chain in Ruvuma region. Total enumeration technique was used where all available producers, traders and processors were interviewed in the study. It is recommended in social science studies that at least a sample with 30 units is enough for population representation (Bailey, 1994) therefore all producers that were available in a village were included in the sample because there was no village with more than 30 producers. The case was the same for processors and traders in the market place.

There were two markets which were visited; Mbinga central market and Manzese market in Songea where all available traders (25) were included in the sample. Discussions with key informants (Regional Forest Officer - RFO, District Forest Officer - DFO and FORVAC Cluster Coordinator) revealed the presence of one processing group and two individual processors who were interviewed during the study.

Key informants that were interviewed included; Ruvuma RFO, DFOs and District Forest Conservators (DFCs) from Songea and Mbinga districts, Tanzania Forest Services Agency (TFS) - Ruvu plantation manager, INBAR country coordinator, FORVAC Ruvuma cluster coordinator and SUA - Bamboo project coordinator.

3.4 Data collection

Primary and secondary data were collected. Primary data were collected using various methods including, questionnaires (Appendices 1 and 2) which was supplemented by personal observation of activities done in the field and key informant interviews (Appendices 3 and 4). The study involved bamboo producers, processors, traders and other development support entities in the value chain. A pre-testing was done prior to the main survey in order to test the validity of the data collection tools and to determine the approximate time required in completing an interview.

Secondary data entails available data relevant to the study. This type of data was obtained through document review from various sources including publications, books, reports, office records, internet and Sokoine National Agriculture Library (SNAL).

3.5 Data analysis

Quantitative data were coded and analysed using Statistical Package for Social Sciences (SPSS) and Microsoft excel programme and then presented using descriptive statistical tables, percentages, charts and graphs. Qualitative data obtained from interviews and observations were analysed using content analysis method. Ideas and responses were summarized, synthesized and reviewed against literature for making inference.

3.5.1 Value chain analysis

Value chain analysis was used to map bamboo value chain linkages between actors; producers, processors, traders and input suppliers. The aim was to show inter-relationships between actors and assist in the identification of constraints and opportunities including market access, governance issues, technology, input supply and finance. Moreover, positions and roles of each actor and their characteristics were studied in order to understand how they influence the performance of the value chain (Lusby and Panlibuton, 2004).

3.5.2 Gross margin analysis

Gross margin analysis was used to determine profitability of bamboo products sold for all actors at different levels of the value chain. This was done in addressing the second specific objective of the study. The Gross Margin model is as follows;

$$GM = TR - TC \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(3)$$

Where,

GM = Average Gross Margin

TR = Average total revenue

TC = Average total variable cost

When expressed as ratio/percentages it is given by:

$$Ratio = \frac{Average\ total\ revenue\ (TR) - Average\ total\ cost(TC)}{Average\ total\ revenue\ (TR)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4)$$

3.5.3 Analysis of factors influencing income

Multiple regression analysis was used to test to what extent the income is statistically dependent on the variable of interest. This was done to test which variables and at what extent they contribute to actors' income in bamboo business. Mashimba (2007) explains that regression model is the common theoretical proposition in economics which states; change in one variable can be explained by reference to changes in several variables. The MR equation was specified as follows:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + e \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.(5)$$

Where;

Y = Income per producer

X_1 = Number of products weaved

X_2 = Hiring cost

X_3 = Household size

X_4 = Weaving period

X_5 = Weaving experience

α = Constant term

e = Error term

β_1, β_2, β_3, β_4, and β_5, are the coefficients for independent variables X_1, X_2, X_3, X_4, and X_5 respectively. These coefficients indicate the degree to which number of products weaved;

hiring cost, household size, weaving period and weaving experience affect producer's income.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Identification of existing bamboo products and their potentials

Bamboo has the potential to perform a number of functions ranging from handicrafts to construction uses. Based on the survey conducted in Songea and Mbinga districts, bamboo products identified were winnowers, baskets, local cases commonly known as *jamanda*, tomato carrying baskets commonly known as *matenga,* dustbins, tables, chairs and bamboo sticks (Table 1).

Table 1: List of bamboo products in Songea and Mbinga districts

Actors/Item	District	Producers (n=70)	%	Traders (n=25)	%	Processor (n=3)	%
Winnowers	Songea	36	51	15	60	0	0
	Mbinga	21	30	8	32		
Baskets	Songea	34	49	3	12	0	0
	Mbinga	18	26	3	12		
Jamanda	Songea	2	3	7	28	0	0
	Mbinga	9	13	1	4		
Tenga	Songea	4	6	1	4	0	0
	Mbinga	2	3	1	4		
Sets (table and chair)	Songea	0	-	0	0	1	50
Dustbins	Songea	0	-	0	0	1	50
Sticks (Matogoro stick industry)	Songea	0	-	0	0	1	100

Winnowers

Winnowing fans were found to be a valuable bamboo product in the study area due to its usage especially in the dry season. It was used mainly for winnowing cereals, which were maize, beans and rice. According to the results in Table 1 majority of the respondents (producers 81%, traders 92%) were dealing with this product and mentioned women as the main customers. This is because women are responsible in preparing and preserving

food for the family thus to them a winnower is a necessary appliance. On the traders'
node, two types of winnowers were observed. The first was the one produced in Ruvuma
region and the other, which was made in Mbeya region (Plate 1). The latter was more
preferred by customers due to its appearance and portability. It was moderate in size, light
in weight and had colour patterns which were a different case from those sourced in
Ruvuma. However, respondents revealed that the winnowers made in Ruvuma were the
best in terms of durability and resistance to insect and fungal attack due to the natural
colour that is coated after weaving. This colour was made from the barks of *Garcinia
volkensii* tree which were grinded and then boiled. Also, the slices used and the weaving
process were better than Mbeya winnowers.

Plate 1: Mbeya winnower (left) and Ruvuma winnower (right)

Baskets

Basket made of bamboo materials was another common product used in the study area (Plate 2). Its use prevailed in the dry season when farmers had to carry harvests from the farm to the market or homes. However, these baskets were becoming unpopular due to existing alternatives for carrying and storing crops. Farmers in the study area were shifting from bamboo baskets to sacks (fertilizer bags) and plastic baskets. This was explained by about 24% of bamboo traders. Moreover, the product faced competition from other baskets made of plastic ropes which were mostly preferred by customers.

Plate 2: Bamboo baskets observed in the study area

Traditional cases (*Jamanda*)

This was a round basket with a lid with several uses including decoration and for storing medicine by traditional healers (Plate 3). It had a high price compared to baskets and winnowers due to the complexity and creativity in the making process. In the past it was used for keeping special presents when visiting relatives and when attending ceremonies. Its market was declining due to emerging alternatives for keeping presents and the perception that it is associated with superstitious beliefs.

Plate 3: Traditional cases *'Jamanda'* manufactured in the study area

Basket for Tomato -*'tenga'*

These were larger baskets (Plate 4) made of thicker bamboo slices and had spaces in between. They were used for carrying various groceries like fruits, tomatoes and onions. In this study, they were named 'tomato carrying baskets' because they were found more useful in the period of tomato scarcity.

Plate 4: Basket for tomato sold in Manzese market in Songea

Furniture

Dining chairs and tables were found to be other products made from bamboo. One processor in Songea district reported to manufacture these sets using planted bamboo unlike all other products which used naturally occurring bamboo. The furniture made out of planted bamboo can last for two to three years.

Dustbin

Baskets in the shape of a dustbin (Plate 5) were found to be processed by another processor in Songea town. The raw materials for the products were obtained from Mbeya region and transported to Songea where they were processed into finished products. The dustbins were sold at a higher price compared to the normal baskets and tomato carrying baskets due to their attractive appearance and size.

Plate 5: Dustbins made in Songea district

Bamboo sticks

Bamboo is one of the mostly used material in manufacturing barbeque sticks in Tanzania. Matogoro stick industry was a youth group which processed these sticks (Plate 6) and sold them in Songea and Dar es Salaam. They also produced sticks for making local ice-cream. However the group was facing financial constraints leading to failure in meeting market demand.

Plate 6: Barbeque sticks manufactured by Matogoro stick industry

4.2 Mapping along bamboo value chain and roles

4.2.1 Value chain actors

Value chain actors were those directly involved in value chain activities. They became owners of raw, semi-processed or finished product at one stage of the value chain. In bamboo activities in Ruvuma there were seven products (winnowers, baskets, *jamanda, matenga*, furniture, dustbin and bamboo sticks) and three value chain actors which were producers, traders and processors (Fig.4).

Business enabling Environment

Rules and regulation (Forest policy and regulation

Gender roles

Transportation (on foot, bicycle, motorcycle, public transport (bus))

Grading

Culture and norms

Market Chain

Resource base

Naturally grown bamboo on general land or on private farms

Collect

Producer

Trader

Buy

Processor

Trader

Consumer;
- Within the village
- Nyasa district
- Mbinga district
- Songea district
- Dar es Salaam

Supporting Functions

Technology
-INBAR

Financing – Songea's MP, Songea Municipal Council

Communication – Exhibitions (*Sabasaba&Nanenane*), Bamboo documentary and sports league (TFS)

Training- INBAR & SUA

Research and development -SUA, INBAR

Seedling production INBAR, SUA, TFS

Figure 4: Bamboo value chain map in Ruvuma region

4.2.2 Social-economic characteristics of actors

This section examines the socio-economic characteristics of the actors in the study area. Variables include age, gender, level of education and marital status and their distribution are presented in percentages and frequency. Furthermore, the section explains the association of these socio-economic characteristics with bamboo value chain in Ruvuma region.

Results in Table 2 shows that, 51.4% of the producers interviewed were in the old age category and the remaining 48.6% ranged from 19-60 which is the economic active population. Out of the 48.6%, 30% ranged from 46-60, 17.2% ranged from 31-45 and only 1% ranged between 18-30 years of age. These findings were different from Mekonnen *et al*. (2014) who found that youth (20-30 years) dominated in bamboo activities in Ethiopia. The young generation in the study area saw bamboo weaving as an inferior business thus they left it to the elders who adopted it from their fore fathers. Most youth participated in activities that provide quick and high returns like petty trade, farming and fishing unlike bamboo which was time consuming with very little profit.

In addition, the results show that all sampled bamboo producers (100%) were males. This implies that most production activities were gender sensitive and this can be explained by the nature of the activity, which involved going to fetch raw materials in the forest where there were risks involved such as attacks by wild beasts and long distance travels. The preparation for raw bamboo to be weaved was another risky and tedious process which women did not want to encounter. Women in the study area were mostly engaged in taking care of their families and assisting in farming activities, however they were the main customers of the products made by the producers. These observations were in agreement with Awadh (2010) who reported that bamboo artisans in Kenya worked

under no shelter by the roadside which was not a conducive environment for women thus only 20% of the respondents were women.

Regarding marital status of the producers, the results show that 88.6% of the respondents were married, 8.6% were widowers and 2.9% were divorced (Table 2). This suggests that bamboo production activities were mainly done by elders aiming to improve their livelihoods. Also, about 90% of the respondents had primary level of education and the remaining had no formal education. This implies that bamboo production was performed by individuals who did not have enough chance to advance themselves in education.

Results in Table 2 show that, all processors interviewed were in the middle age category (46-60). Like the producers, bamboo activities were mostly done by the elders while youths participated in other activities which consume less time, more profitable and those which according to them bring respect within the society.

Processors' gender composition was male dominated. This indicates that the activity was laborious in nature and required strength thus inconvenient for women because they had other family engagements. Concerning the marital status of the respondents, 100% of the processors were married. This indicates that married couples have to ensure the availability of daily basic needs for their families and therefore more likely to participate in income generating activities including bamboo production.

Regarding education of the respondents, all processors had primary level of education which implies that bamboo processing was performed by individuals who were not able to advance themselves in education and the activity has been regarded as an income

generating activity for anyone who is ready to practice self-employment. However, in Nairobi (Awadh, 2010) it was realized that level of education has an impact in bamboo income as average income per month increased as the level of education increased. Average income for a processor with primary school education was Ksh. 7000 (equivalent to TZS 150 000), high school Ksh. 11 000 (equivalent to TZS 236 000) and those with college education received Ksh. 19 700 (equivalent to TZS 423 000). This means that entrepreneurship skills improved as the level of education increased in Kenya.

The results in Table 2 shows a slight variation in age classification among the traders in the study area where 36% aged between 18 and 30 years, another 36% aged between 31 and 45 years while 28% aged between 46 and 60 years. This means that bamboo trade was dominated by youth and middle aged people who were more active and flexible in participating in various income generating activities.

The gender composition of traders was quite different from that of producers and processors. Results presented in Table 2 shows that 56% were male and 44% were female traders. This indicates that bamboo trade attracts both men and women and do not involve any gender-specific activities unlike those performed by processors and producers. Furthermore, 88% of the respondents were married and the remaining 12% were single. This trend can be attributed by the argument that married people have to participate in income generating activities that will help them attain their subsistence. In the case of education, 92% of the traders attained primary education, 4% secondary education and the remaining 4% have attained to the college level. This finding indicates that bamboo trade can be done with people of all levels of education.

Table 2: Distribution of respondents according to socio-economic characteristics

Actors/Item	Producers (n=70)	%	Processors (n=2)	%	Traders (n=25)	%
Age						
18-30	1	1.4	0	0	9	36
31-45	12	17.2	0	0	9	36
46-60	21	30	2	100	7	28
>60	36	51.4	0	0		
Gender						
Male	70	100	2	100	14	56
Female	0	0	0	0	11	44
Marital status						
Married	62	88.6	2	100	22	88
Widower	6	8.6	0	0	0	0
Divorced	2	2.9	0	0	0	0
Single	0	0	0	0	3	12
Education level						
No formal education	6	8.6	0	0	0	0
Primary school	64	91.4	2	100	23	92
Secondary school	0	0	0	0	1	4
College	0	0	0	0	1	4

4.3 Roles of value chain actors

4.3.1 Bamboo producers

These were the main key actors within the production section of bamboo value chain. They considered bamboo production as the second activity after farming and they provided labour for bamboo production. The findings show that producers worked on their own and sold their products individually. These findings contradict Akwada and Akinlabi (2018) who found out that bamboo producers employed people in performing bamboo activities in South Africa. This implies that bamboo sector in South Africa is more advanced compared to what is observed in Tanzania. Furthermore, results presented in Fig. 5 shows that 81% of the producers harvested bamboo from general land where bamboo grows naturally along the river banks while other producers (11%) harvested in

private land where there were remnants of natural bamboo clumps or planted bamboo. Only 7% got raw bamboo from both private and general land. These findings were different from Teshale *et al*. (2017) in which most bamboo was produced from smallholders' bamboo plots planted on farmlands in Hula, Ethiopia. This suggests that farmers in Ethiopia have realized the potential of bamboo therefore put much effort in increasing the resource base.
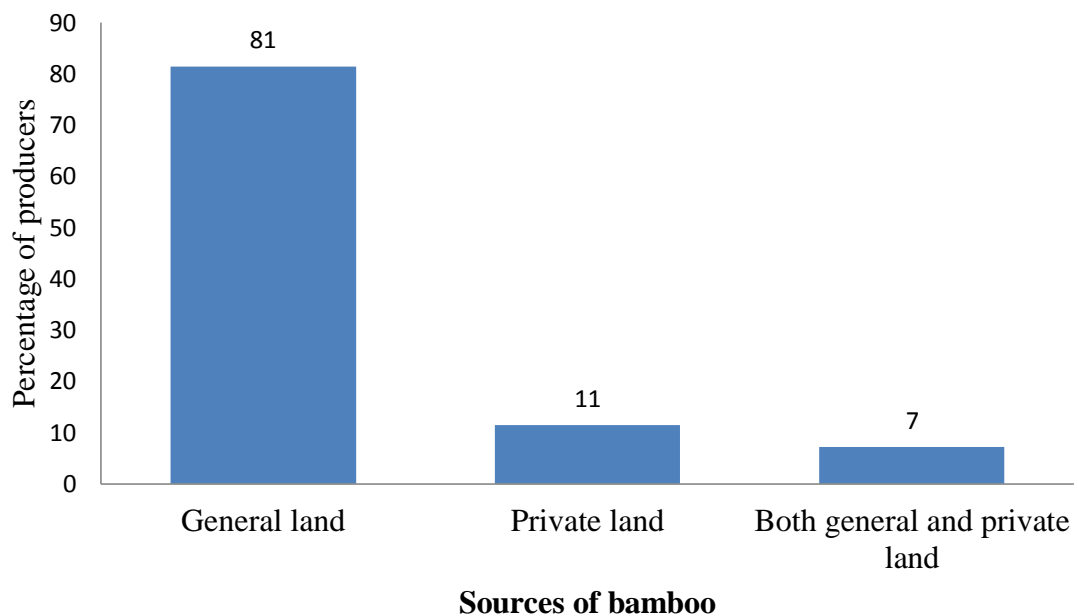
Figure 5: Main sources of bamboo

The study also revealed that bamboo crafting was mainly done during the dry season in which 86% of the respondents engaged at this time of the year while only 14% of the respondents could weave at any time of the year. The production is high from May to November which is the harvest season in the study area. This observation was in agreement with Greijmans *et al.* (2007) in which traditional handicrafts in Houaphanh province were put up for sale in the dry season. It is at this season when bamboo products especially winnowers and baskets are needed for carrying harvested products.

In the months of December to April producers tend to engage in farming activities and the demand for bamboo products is low during this time.

4.3.1.1 Main sources of income

Producers had three main sources of income as displayed in Fig.6. The main activities were farming, bamboo weaving and pastoralism. Bamboo was done in small scale unlike in Houaphanh province in LAO PDR where bamboo was regarded as a national income source due to exports made especially in times of economic depression (Greijmans *et al.,* 2009).
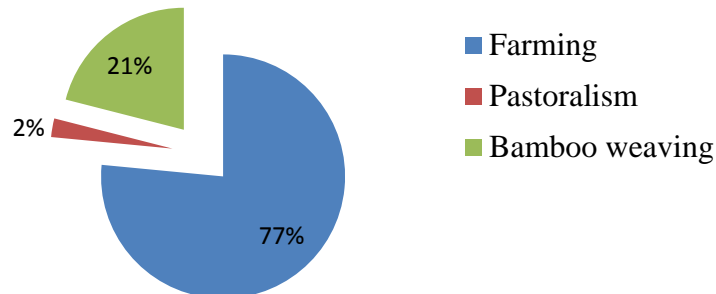
Figure 6: Main sources of producers' income in Songea and Mbinga districts

4.3.2 Bamboo processors

Three processors of different bamboo products were identified in the study area. They were differentiated from the producers by product type, location and capital invested in the business. Two were individuals who worked on their own while one was a youth group of three members. The situation was different from what was reported by Awadh (2010) where bamboo processors had employed an average of five to ten people.

The first processor dealt with making furniture sets comprising of tables and chairs. He bought raw bamboo from farmers and processed his products from the same site where the raw bamboo was bought and transported finished sets direct to the consumer as ordered. The second processor made dustbins from large bamboo strips. He fetched raw bamboo from Mbeya and transported them to Songea town where he processed and sold them to various areas in the district. He explained that there was plenty of good quality bamboo (*Arundinaria alpina*) in Igoma-Mbeya than what can be fetched in Songea.

4.3.2.1 Matogoro stick industry

One youth group known as Matogoro stick industry which manufactured barbeque sticks and sticks for local ice-cream was identified in Songea district. The group begun in late 2018 under the guidance of Community Development Officer from Songea Municipal Council. Again, all members of this group were men unlike previous observations by INBAR, (2015) who reported that women at Adal PLC in Ethiopia were the main producers of bamboo sticks. The group produced an average of 100 packets per month. The price of their product depended on the price of sticks imported from China. However, they failed to meet market demand due to shortage of manpower and lack of machines which could enable them to produce in large quantities.

4.3.3 Bamboo traders

All the traders in the sample districts bought bamboo products from the producers and sold directly to the consumers in the market place. The products that were mainly sold were winnowers, baskets, *matenga* and local cases (*jamanda*). These traders did not only sell bamboo products but had other kitchenware and were all located in the central market in Mbinga and Manzese market in Songea where consumers could get several needs at once. It was revealed that winnowers were obtained from two sources which are Mbinga

district and others from Mbeya region. Women were reported to be the main customers and preferred portable and colourful winnowers than those from Mbinga which were heavy and uncoloured.

4.4 Value addition in bamboo value chain

Value addition activities were common in the area whereby producers and processors undertook most of the value addition activities before the product reach the market. The activities included slicing of raw bamboos into strips which could be used to create different products. In the study area, products created at the producer node included winnowing trays, baskets, local cases (*jamanda*) and tomato carrying baskets (*matenga*). Producers weaved at their best skills because the quality of these crafts was usually judged by appearance. First, the sliced strips should not be extremely light a case which most producers did not adhere to. Crafts made from too light strips do not last long. Secondly, they made sure not to leave space between the strips and lastly is the finishing which required proper threading to hold the craft. To prevent the crafts from pests, a natural colour extracted from the barks of *Garcinia volkensii* was smeared to the product. This was the reason why winnowers from Ruvuma were more durable than winnowers from Mbeya.

Processors went further as far as bamboo value addition is concerned. Products including tables, chairs, barbeque sticks and dustbins were created from bamboo. The dustbins were processed from larger strips and made more attractive by using artificial colours. The sticks were sharply pointed, properly packed and labelled to ease traceability and marketing. A few of these value added products were similar to those mentioned by Teshale *et al.* (2017) who reported quite a number of products that were made in Ethiopia

which are beds, tables, chairs, shelves, cupboards, traditional mats, baskets for flowers, lamb holders, trays and cultural house. Few products were observed in the study area and this can be attributed to lack of awareness on the potential products that can be made out of bamboo as well as policy grounds needed for the upscale of bamboo in Tanzania.

4.5 Bamboo distribution channels

The study identified four principle bamboo distribution channels in Ruvuma region as presented in Fig. 7.

Channel 1:

This was the leading major channel in which producers (87%) sold their products directly to consumers. This feature was similar to that reported by Endalamaw *et al.* (2013) where a predominance of producer to consumer transactions was observed in the bamboo chain in Ethiopia. Products under this channel included baskets, winnowers and *jamanda*. In this channel about 47% of the producers were selling after receiving orders from consumers and 30% transported the goods to the market place.

Channel 2:

This channel was observed from few respondents (13%) who sold their products to traders who then sold direct to the market. In this channel, the producer followed the traders who were located in market centres in Nyasa, Mbinga and Songea districts. Products within this channel were baskets, winnowers, *matenga* and *jamanda*. This channel was observed in small quantity (13%) because of lack of financial capital and market information among the producers. Also, the design of the products did not attract customers unlike the winnowers processed from Mbeya which revealed a good market performance.

Channel 3:

This channel was observed from Matogoro bamboo processing group where bamboo was bought from producers (farmers) and then processed into barbeque sticks which were sold to a trader in Dar es Salaam and then to consumers. However, the respondents claimed that the trader earned more profit than them because of the price at which they sold the products.

Channel 4:

This channel was observed from processors who bought raw bamboo from producers (farmers) then manufactured and sold their products direct to consumers. The products in this channel included tables, chairs, dustbins and barbeque sticks. This channel was slightly observed because bamboo activities were regarded as inferior activities hence given less attention.
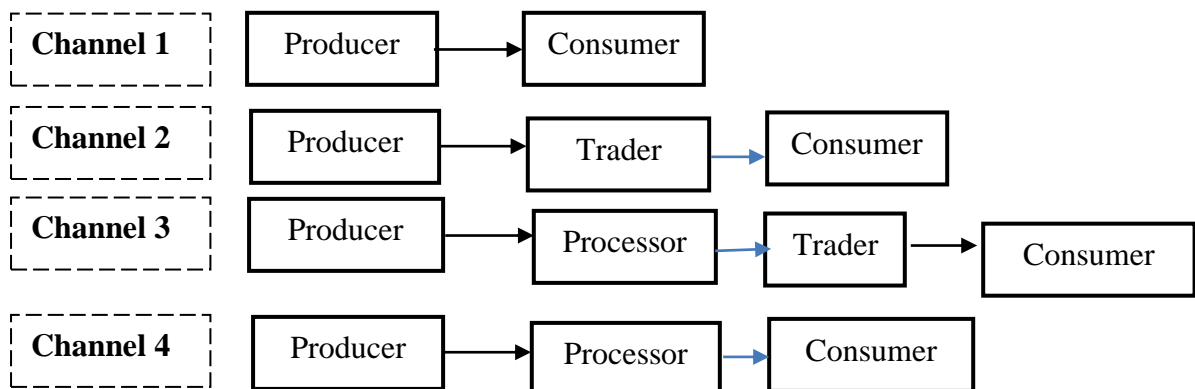
Figure 7: Market channels in bamboo value chain in Ruvuma Region

4.6 Profitability analysis

Profitability analysis was done in order to see whether there was equitable distribution of the profits between the value chain actors or not. This was important hence, it aids in providing recommendations to development practitioner to promote value chain with equal distribution of profits between value chain actors. The results from the gross margin analysis showed the distribution of benefits for different actors in bamboo value chain in Ruvuma region. The analysis showed that there was unequal distribution of profits between all actors in the chain.

Gross margins differed by products among actors. On the producer node, tomato carrying baskets '*matenga*' had a gross margin of 47%, winnowers 44%, local cases 32% and baskets had a gross margin of 22%. However, the above data excludes 13% of the producers which were from Litoho village located in Mbinga district. A separate analysis was made for this village because of its different features in conducting activities. A gross margin of 78% was revealed from producers in this village.

Profitability analysis for processors was conducted separately due to the differences in the nature of activities conducted by each. One had a gross margin of 56% while the other 54%. Matogoro stick industry had a gross margin of 50%. Regarding the traders; the scenario was different from the producers. Baskets had a gross margin of 47%, local cases 45%, tomato carrying baskets 44%, winnowers from Mbeya 38% and lastly winnowers from Mbinga with a gross margin of 28%. The following section shows in detail the profitability analysis of different actors in bamboo market in the study area.

4.6.1 Producers

Producer profitability analysis was done in two sections. The first involved 10 villages which covered 87% of the respondents and the second involved one village (13% of the respondents). This was done due to differences observed in the production patterns between the groups. The majority (87%) had few products processed in a year and did not invest much capital in the business compared to the smaller group. Producers in the latter had transport and hiring costs which was not revealed in the first group. To avoid misinterpretation, a separate analysis was necessary.

Profitability analysis for the first group was done with the following assumptions: Firstly, the producers did not incur costs for raw bamboo because they collected freely from natural forests. Secondly, the producers purchased their working tools only once a year though most of these tools were also used in other activities. These tools included knife, machete and sewing needle. Thirdly, they incurred preparation and processing costs of which they did not really incur instead the researcher had to ask them how much it would cost if they had the ability to do so and included it in the analysis. Fourthly, they did not incur cost of transporting the products to the market because they used family labour to transport the products to the market or customers followed them at their homesteads to buy the products. An average production per producer was estimated per each product and gross margin calculated (Table 3). Baskets had the lowest gross margin (22%), followed by local cases (32%), winnowers (44%) and tomato carrying baskets (47%). However, among the four, only two of these products were mostly processed in the study area. Baskets were processed by 67% of the respondents and winnowers 69%. Based on the gross margins calculated, it can be seen that producers made economic loss in the production process and this would be a reason why there was no significant improvement in livelihood at the producer level. For example, if the cost of raw bamboo and

transportation costs were considered, producers would have an additional cost and the profit obtained would reduce at a greater amount. Another reason could be the absence of producer groups or associations which could reduce costs and maximize production.

Table 3: Producers' gross margin for bamboo value chain in 2019

S/N	Item	Basket (67%)	Winnower (69%)	Tenga (9%)	Jamanda (4%)
A	Working tools	7 500	7 500	7 500	7 500
B	Preparation and processing	26 400	13 200	90 000	9 600
C	Total cost= A+B	33 900	20 700	97 500	17 100
D	Average production per year	11	11	25	4
E	Price per product	3 947	3 365	7 333	6 333
F	Revenue per year=D*E	43 417	37 015	183 325	25 332
G	Gross profit =F-C	9 517	16 315	85 825	8 232
H	Gross margin=G/F*100(%)	22	44	47	32

Profitability analysis for the second group (13%) of producers was done for all producers in Litoho village in Mbinga district. It was from this village that traders reported to source their products. Three products; baskets, winnowers and *jamanda* were involved in this analysis and all the producers engaged themselves in the processing of these products simultaneously. Respondents mentioned three types of costs; one was transport cost for fetching raw bamboo and ropes from the forest in which motorcycles were the means of transport. The second was hiring cost in which producers made rotations of working from one producer to another. The most tedious and time consuming activity of slicing was done in a short time due to the extra manpower at hand. This was the reason to why they produced in large quantities compared to the producers in the previous group. The person in charge of the rotation could prepare a meal for the other producers who joined to perform the task or sometimes paid the members an average rate of TZS 1000 – 2000.

The third is the cost of transporting the product to the markets in which the farthest point (Songea) was considered. The transport means was motorcycle and by bus (public transport). This was not in line with Endalamaw *et al.* (2013) who reported trucks to be the means of transport of bamboo products in Ethiopia. A gross margin of 78% was observed at the producer node with winnowers making the highest (46%) contribution of the profit followed by local cases *'jamanda'* (33%) and lastly baskets 20% as presented in Table 4.

Table 4: Producers' (Litoho) gross margin for bamboo value chain in 2019

S/N	Item	Amount
A	Working tools	7 500
B	Transport to fetch raw materials	9 700
C	Hiring cost	27 500
D	Transport to the market-songea	24 375
E	Total cost=A+B+C+D	69 075
F	Average basket production per year	33
G	Selling Price of Basket	1 938
H	Basket Income per year=F*G	63 954
I	Average winnower production per year	64
J	Price per Winnower	2 313
K	Winnower income per year=I*J	148 032
L	Average jamanda production per year	23
M	Price per jamanda	4 625
N	Jamanda Income per year=L*M	106 375
O	Total income per year=H+K+N	318 361
P	Gross profit=O-E	249 286
Q	Gross margin=P/O*100(%)	78

4.6.2 Processors

Profitability analysis was done for two individual processors and one group in Songea district. The analysis was done separately for each processor because they process different products which could not be measured by similar units. The first (Table 5) had a gross margin of 56%, the second had a gross margin of 54 % (Table 6) and the group had

a gross margin of 50 % (Table 7). This performance was due to the type of product they process which was different from what producers made. The first processor made large baskets which were used as dustbins or for other storage purposes as per user's interest. The baskets were very attractive (Plate 5) due to the weaving style and pattern of colours displayed. However, this processor did not fetch raw materials from Ruvuma instead he transported them from Mbeya and processed and sold them in Ruvuma. This respondent explained that bamboo that grows in Mbeya were of good quality than those from Ruvuma. Another reason was that he thought searching for raw materials from Ruvuma would be a waste of time since he originates from Mbeya and knows most of the sites where he can fetch raw bamboo. Therefore, Ruvuma was only a market area for him and not a source of raw materials.

The other processor with a gross margin of 54% (Table 6) made furniture out of bamboo. He created tables and chairs which can last up to three years. This processor used planted bamboo unlike other respondents who mostly reported to use naturally occurring bamboo. The respondent purchased 1 bamboo piece at an average price of TZS 500 - 1000 and he manufactured his products from the site where he bought raw materials so he transported finished products straight to the customer.

Table 5: Processor's (Dustbin) gross margin for bamboo value chain in 2019

S/N	Item	Amount
A	Carrying raw bamboo from forest to Mbeya town	28 000
B	Transport from Mbeya to Songea	200 000
C	Total Transport cost= A+B	228 000
D	Price for plastic bag used to carry sliced bamboo	8 000
E	For 2 plastic bags (salphet)	16 000
F	Knife	2 000
G	Machete	3 500
H	Needle	2 000
I	4 bunches of rope	152 000
J	Dye (colour)	100 000
K	Nails 1 box	8 000
L	Glue	8 000
M	Fees paid in the village	20 000
N	Living costs (rent+food)	100 000
O	Total cost=C+E+F+G+H+I+J+K+L+M+N	639 500
P	Average dustbin production per year	80
Q	Selling Price of Basket	18 000
R	**Dustbin Income per year=O*P**	1 440 000
S	Gross profit=R-O	800 500
T	Gross margin=S/R*100(%)	56

Table 6: Processor's (Furniture) gross margin for bamboo value chain in 2019

S/N	Item	Amount
A	Buying raw bamboo per piece	1 000
B	Bamboo needed per 1 set	15
C	Cost for 1 set = A*B	15 000
D	For 4 sets per year = C*4	60 000
E	Varnish 1 litre	8 000
F	Varnish 2 litres=E*2	16 000
G	Transport cost per trip	7 000
H	4 trips =G*4	28 000
I	Tools (Knife,*Panga*,Needle,wire)	11 500
J	Glue	8 000
K	Tax paid at checkpoint	150 000
L	Total cost=D+F+H+I+J	273 500
M	Average set production per year	4
N	Selling Price per set	150 000
O	Income per year=L*M	600 000
P	Gross profit=N-K	326 500
Q	Gross margin=O/N*100(%)	54

According to Table 7 profitability analysis for Matogoro stick industry revealed a monthly gross margin of 50%. Costs incurred by this processing group per month included electricity charges, maintenance cost, price of purchasing raw bamboo and cost for raw bamboo transportation.

Table 7: Gross margin per month for Matogoro Stick Industry

S/N	Item	Amount
A	Transport per month	15 000
B	Electricity charges per month	10 000
C	Maintenance cost	2 000
D	Packets needed per month	150
E	Price of 1 PKT of packaging material	50
F	Total cost of packets = D*E	7 500
G	Price of 1 Bamboo stem	500
H	Bamboo stems needed for 150 pkts	13
I	Cost of bamboo stems = G*H	6 500
J	**Total cost=A+B+C+F+I**	**41 000**
K	Average stick production per month in pkts	150
L	Selling Price per pkt	550
M	**Income per month = K*L**	**82 500**
N	Gross profit = M-J	43 500
O	Gross margin = N/M*100(%)	50

4.6.3 Traders

Profitability analysis was done for traders in Ruvuma region and for one trader who dealt with selling sticks produced by Matogoro stick industry. Table 8 presents the gross margin of traders in the bamboo value chain in Ruvuma region. The assumptions underlying this analysis was that apart from the cost of purchasing the products from the producer, there were no any other costs associated with the business since they sold more than one product and bamboo products were not their main products. All four products were analysed with baskets having the largest gross margin (47%) and winnowers from Mbinga the lowest (28%). However, it was observed that traders preferred winnowers from Mbeya since 72% of the respondents sold the product and claimed to be the most

preferred by customers (Table 8). This explains the underdeveloped bamboo value chain in Ruvuma region due to existing competition from products from other regions.

Table 8: Traders' gross margin for bamboo value chain in 2019

S/N	Item	Baskets (24%)	Winnowers-Mbinga (68%)	Winnowers – Mbeya (72%)	Jamanda (32%)	Tenga (8%)
A	Purchases per year	14	55	117	21	90
B	Buying price	3 217	2 112	1 261	6 250	5 000
C	Total cost=A*B	45 038	116 160	147 537	131 250	450 000
D	Sales per year	14	52	113	20	90
E	Selling price	6 083	3 106	2 111	12 000	9 000
F	Revenue per year=D*E	85 162	161 512	238 543	240 000	810 000
G	Gross profit=F-C	40 124	45 352	91 006	108 750	360 000
H	Gross margin=G/F*100(%)	47	28	38	45	44

Profitability analysis for one trader who sold barbeque sticks in Dar es Salaam was done and a gross margin of 31% was observed (Table 9). The trader only incurred buying and transportation costs in the process. He further explained that the sticks made by Matogoro industry were heavy and could withstand heat for a long time than the sticks imported from China. Also, buyers were motivated to buy products that are made in Tanzania as part of supporting the movement of industrialization so there were no market challenges for him. Conversely, the processors were letting him down because what they produced did not satisfy market demand. According to him the demand is 2000 stick packets per month but he only supplied 150 stick packets.

Table 9: Trader's gross margin per month (Barbeque sticks)

S/N	Item	Amount
A	Stick(pkts) purchases per month	150
B	Buying price per sticks (pkts)	550
C	Total buying price = A*B	82 500
D	Transport to DSM	10 000
E	**Total cost=C+D**	**92 500**
F	Sales per month	150
G	Selling price	900
H	**Income per month = F*G**	**135 000**
I	Gross profit = H-E	42 500
J	Gross margin=I/H*100(%)	31

4.7 Factors influencing bamboo income in the study area

Multiple regression analysis was done to find variables that contributed to bamboo income in the study area. Variables included in the analysis were number of products created by a producer, hiring cost, household size, experience in weaving and weaving period as shown in Table 10.

Table 10: Factors influencing bamboo income among producers in the study area

Variable	Unstandardized Coefficients		Standardized Coefficients	T-value	Sig.
	B	**Std. Error**	**Beta**		
(Constant)	20111.0799	36058.5057		0.558	0.579
Number of Products	3340.1877	288.1322	0.9947	11.593	0.000*
Cost of Hiring	-3.24684	1.2088	-0.2328	-2.686	0.009*
Household size	-4122.0730	3618.1673	-0.0778	-1.139	0.259
Weaving period	18470.3303	21701.4590	0.0570	0.851	0.398
Weaving experience	-271.1472	500.5344	-0.0374	-0.542	0.590

$R=0.854$, $R^2=0.730$, Adjusted $R^2=0.709$, F=34.604, * significant at **$p \leq 0.05$**
Dependent Variable: Bamboo income per producer (TZS)

Table 10 indicates the R-square for the regression model is 73% (with an adjusted $R^2 =0.709$). The variation in factors that affect bamboo income was explained by variables fitted in the regression model. The remaining 27% of the variation in factors that affect income was explained by variables that were not fitted in the regression model.

This indicates that the regression model was strong enough to explain the relationship between the dependent and independent variables.

Hiring cost had a negative linear relationship and significant at ($P<0.05$) with producers income in bamboo value chain. This suggests that as hiring cost increase by 1 unit, producer's income decreases by 0.23 units.

A positive coefficient of number of products was observed as shown in Table 10. This implies that in any increase in number of products manufactured by a producer, there is a significant increase in income with a beta coefficient of 0.9. This was noticed from Litoho producers who manufactured and sold a big number of products at a low cost.

Household size, weaving period and weaving experience were not statistically significant at 5 percent level therefore did not influence the income of producers in the study area.

4.8 Export and import scenario of bamboo products in Tanzania

Analysis of data from Tanzania Revenue Authority (TRA) database shows a detailed trend of imports and exports from 2012 to 2020 (Appendices 5 and 6). There were seven commonly traded bamboo products in Tanzania of which building materials (plywood and flooring) were the most traded products accounting for 73% of imports and 53% of exports followed by clothes' hangers which accounted for 18% and 31%of imports and exports respectively (Table 11). Other products were traded in small quantities with bamboo shoots being almost negligible.

Table 11: Import and export total values (in TZS) of bamboo products from 2012 to 2020

Product name	Import (TZS)	%	Export(TZS	%
Bamboo shoots	89 295 276	0	-	-
Houseware	3 041 007 724	5	31 425 689	4
Building materials	48 572 163 284	72	462 543 563	53
Clothes hangers	11 715 028 649	18	270 114 183	31
Basketry	879 551 208	1	100 232 065	11
Pulp and paper	422 931 694	1	-	-
Bamboo furniture	2 202 071 280	3	8 219 136	1
Total (TZS)	**66 922 049 114**	**100**	**872 534 636**	**100**

Results in Fig.8 shows irregularities in the import of bamboo products in Tanzania. The highest import was observed in 2018 (TZS 13 181 005 106) and the lowest in 2020 (TZS 1 557 820 375). This implies that the demand of bamboo products varies from year to year and the sharp fall from 2019 to 2020 could be due to Covid 19 pandemic which led transport restrictions and closing of borders from March to June 2020 in many countries in the world including China which is the largest importer of bamboo products in Tanzania. Furthermore, export (Fig. 9) varied from year to year with a sharp rise observed in 2018 with a huge (79% of total bamboo sales in 2018) sale of building materials. Countries of destinations were Democratic Republic of Congo (27.1%), Zambia (8.3%), Kenya (7.5%), Burundi (7.2%) and Mozambique (6.7%).
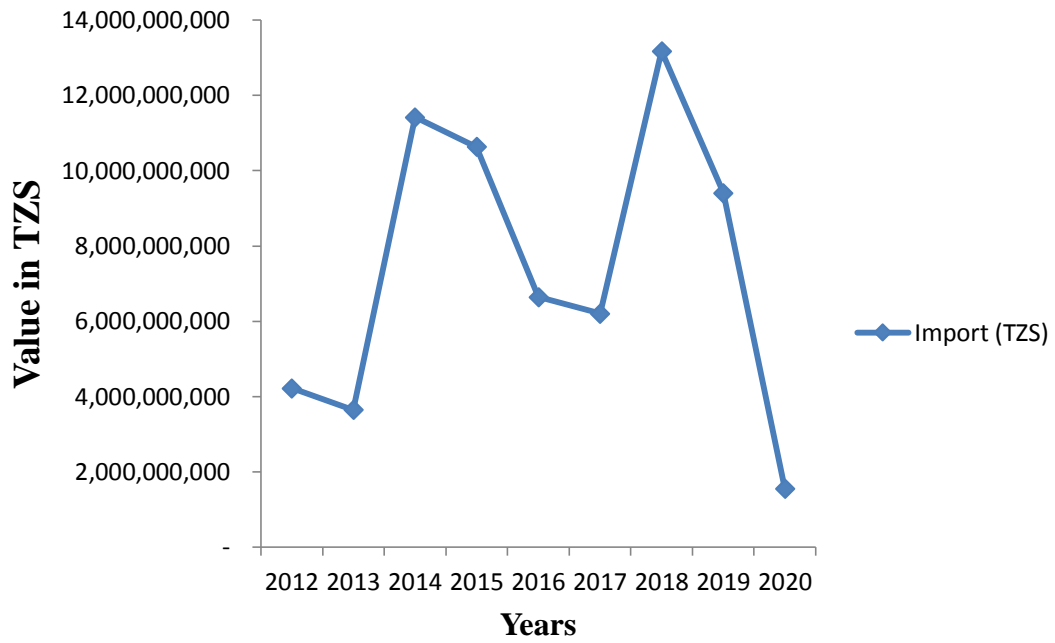
Figure 8: Trend of import of bamboo products in Tanzania (2012 - 2020)
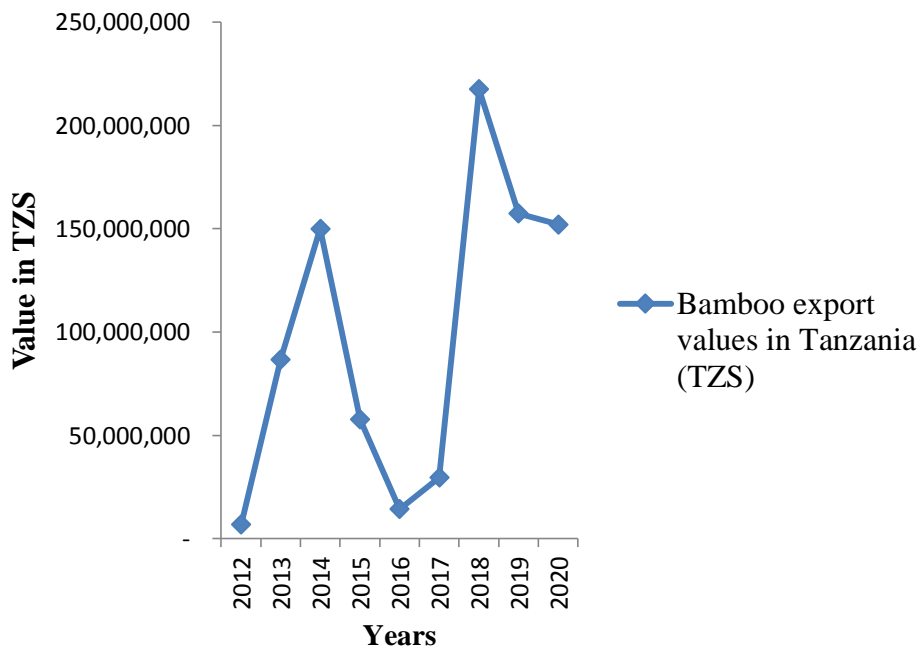
Figure 9: Trend of export of bamboo products from Tanzania (2012 - 2020)

Figure 10 shows a deficit in the trade of bamboo products since imports were high compared to exports. It was observed that import of bamboo products was seventy six times greater than export (Table 11). In short run negative balance of trade does not have significant impacts to the national economy however in the long run it will demoralize local initiatives, export labour and affect markets of locally manufactured bamboo products. Moreover, the negative balance of trade implies that there is market for bamboo products in the country hence a need for the promotion of local initiatives. In other words, Tanzania is not able to meet the demand of bamboo products and therefore other countries are taking this advantage to bring bamboo products. This failure can be due to low level of technology for manufacturing quality bamboo products unlike China which has advanced in producing value added bamboo products that are accepted in the global market (Gauli *et al.,* 2018). Another reason could be lack of awareness on different potential products that could be made out of bamboo. For example in the study area, bamboo business was limited to handicraft which only attracts the local market.
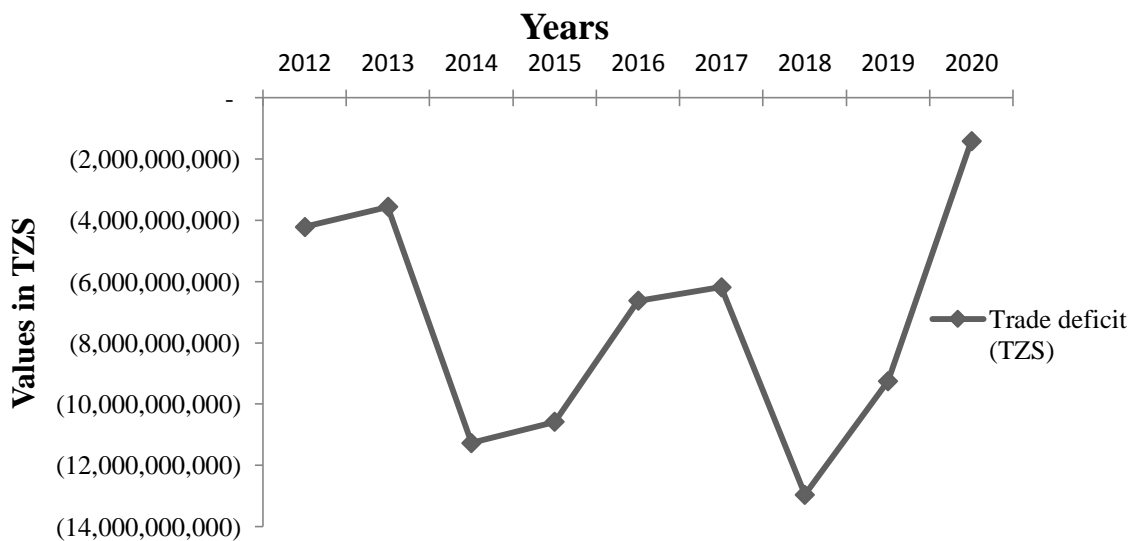
Figure 10: Bamboo trade deficit observed in Tanzania

It was observed from Fig. 11 that Tanzania imported bamboo products from 120 countries in the world. However, only seven countries imported in significant quantities while the contribution of the remaining 113 is almost negligible. China was the leading importer (41.8%) followed by United Arab Emirates (12.6%) and South Africa (7.3%). The performance revealed by China was due to the technology used in the industry and product diversification thus making it the most developed bamboo economy in the world.
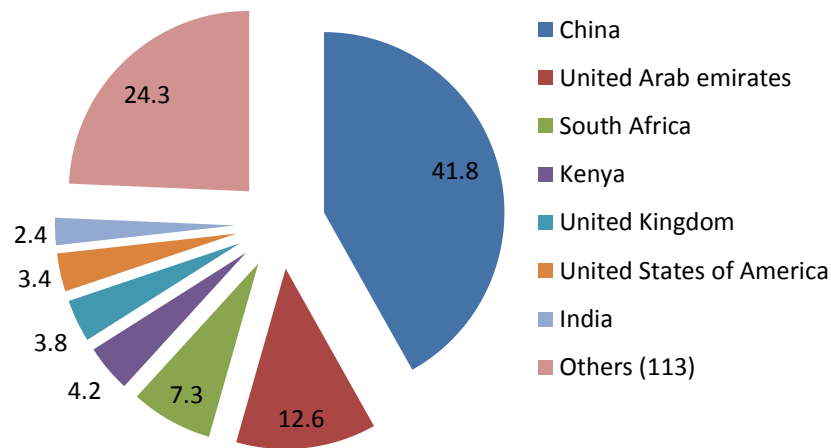
Figure 11: Contribution of Bamboo imports by country of origin

Despite the limited performance observed in bamboo chain in Tanzania, data obtained from TRA database reported that she exported products including building materials (53%) and hangers (31%). The export was limited to her neighbours which are Democratic Republic of Congo (27.1%), Zambia (8.3%), Kenya (7.5%), Burundi (7.2%), Mozambique (6.7%) and Malawi (4.6%). However, a slight amount was observed to cross the continent as displayed in Fig. 12 where 2.9% and 2.3% were exported to United Kingdom and United States respectively implying the presence of market for the product in various parts of the world. A detailed description of bamboo imports and exports by country is displayed in Appendix 7.
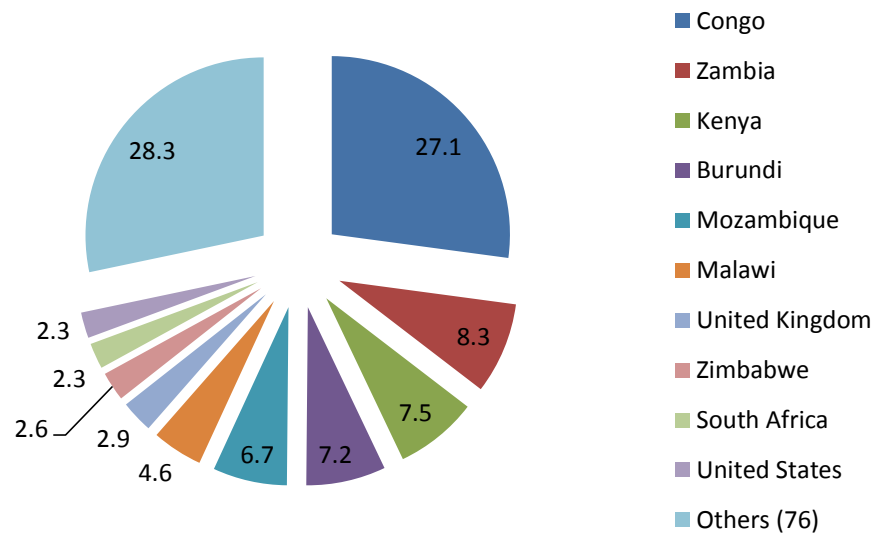
Figure 12: Countries of destination for bamboo exports

4.9 Business Enabling Environment in Bamboo Market

The presence of a well-organized business environment is important for the competitiveness of any value chain. Constraints and gaps in the regulatory and administrative support mechanisms should be eliminated to promote business growth, greater compliance, less unemployment and consequently alleviate poverty.

4.9.1 Rules and regulations

Majority of bamboo value chain actors in Ruvuma region were not aware of any laws with regard to bamboo business. Table 12 shows that 60% of producers were not aware of any bamboo laws while the rest (40%) did have little knowledge on forest management directives. However, only 17% of the producers mentioned to have ever paid tax for bamboo products and this was more than ten years ago.

One of the processors reported to occasionally pay TZS 7500 for each piece of furniture on transit. These payments were made at the checkpoints along the road when transporting the products. Traders reported not to pay any tax in the belief that producers have paid already and they have never received any notification regarding any payment fees.

The processors reported to buy raw bamboo at a price of TZS 1000 per piece but according to forest regulation of 2017, a bamboo pole with a butt diameter above 5 cm is charged TZS 900 while below 5 cm is charged TZS 600 (URT, 2017). If these prices were known by processors, in this case they would gain more revenue because their cost incurred in buying was higher than what was portrayed in the regulation. This implies that bamboo rules were not known or were neglected by all actors in the chain. Rural communities and the government have lost revenue by putting little emphasis in enforcing compliance to regulations.

TFS-Ruvu plantation manufactured bamboo products including tables, chairs bicycles, bookshelves and crafts. These products were used only for exhibitions and not for sale. The reason to why they were not sold is lack of policy ground which allow the manufacture and sell of bamboo products.

Furthermore, the National Forest Policy (1998) had little focus on bamboo development and/or related bamboo products such that there has been no serious government support in bamboo development like financial support and training for skills development. A different case was observed from Dwivedi *et al.* (2019) where the forest act of India was reviewed to allow interstate transportation of bamboo grown on areas other than the forest. The new regulation aimed to upscale bamboo business with the goal of doubling farmers' income by 2022.

Table 12: Perceived laws by producers

Description of the law	Frequency	%
Not aware of any laws	42	60
Pay tax to district council	13	19
Acquire harvesting permit	7	10
Do not harvest bamboo	7	10
Tree planting	1	1

4.9.2 Gender roles

During the survey at the producer and processor node, it was realized that women did not participate in production activities because of the perception that it is a risky and tedious activity. Men performed all the activities from fetching raw bamboo to processing the final product. Youth's participation was almost negligible and this was explained by the notion that bamboo weaving is an inferior job and those doing it are not respected at all. In a focus group discussion with producers at Litoho village one member said 'young men are afraid to participate in weaving because people in the neighbourhood will laugh at them and will not be accepted by ladies once they want to establish marital relationships'. This means that bamboo activities at the producer and processor nodes were not inclusive. A different case was observed on the trader node where women and youth participated in selling bamboo products. This was because there were no activities involved in the selling apart from finding capital to buy the products.

4.9.3 Transportation

Transportation of bamboo products is an important aspect in bamboo business. In Ruvuma region most of the producers walked on foot or used bicycles to bring the product to the market except for few (13%) that transported to market centres. The means of transport used were motorcycles and public transport. There were no specific prices charged for this product its only negotiations between the service provider (conductor or motorcycle driver) and the producer. A transit pass fee (7700 for a 7 ton vehicle or below

and 15 400 for a vehicle above 7 ton) is supposed to be paid to TFS but no producer reported to have done this. This can be due to lack of awareness about the fee, difficulties in follow-up due to the means of transport used, or the nature of the regulation being irrelevant to bamboo products.

4.9.4 Grading

Local grading methods were observed in the study area though they did not influence the price of the products. It was reported that bamboo products were normally judged by appearance. First, the slices should not be very light but this was often violated because the producer wanted to maximize production. For example, one culm of medium height can produce one winnowing tray but one may find a producer making two trays out of one culm. Second is the arrangement of the slices in the weaving process, some tend to leave spaces in between the slices and this affects the durability of the product. Moreover, in the final threading to put the craft on hold, small or no space should be left between the ropes but one may find a tray threaded with very few ropes affecting its durability. It was observed that some producers were more skilled than others hence not all products that enter the market are made to the required standards. Grading of these products may be a good basis for pricing of the product and improve customers' satisfaction. In a study by Scheba *et al.* (2017) in South Africa it was realized that EcoPlanet Bamboo, the owner of the largest commercial bamboo plantations had adopted high grading mechanisms such as FSC certification which enabled them to capture both national and international market for bamboo.

4.9.5 Culture and norms

Bamboo products were reported to be household necessities (winnowers and baskets) with an exception of local cases *'jamanda'* which had extra purposes other than

decoration. In the past when visiting relatives, it was necessary to bring special presents carried in a *jamanda* and those visited would be very happy to receive presents kept in a *jamanda*. However, due to cultural deterioration it was reported that people rarely visit each other currently or if they do so, they use bags and plastic basins. On the other hand traders revealed that most of the customers for *jamanda* are traditional healers who use *jamanda* for carrying their medicines so other customers are quitting from buying this product.

4.10 Supporting function

4.10.1 Bamboo production technology

There was no modern technology observed in the study area. The whole process from harvesting to the final processing of the product used local technology. Harvesting was done by using machetes and the culms were brought to the processing area that was usually around the homestead. At this stage, a knife was used to slice the bamboo culms into the required sizes. The producers reported to experience several finger cuts during the process. The slicing took three to four days depending on the number of baskets or winnowing mats required. The final threading was done by using local ropes obtained from *Annona senegalensis* tree, which were tailored by using a needle.

Matogoro stick industry had small machines for cutting bamboo culms and for cutting packaging materials. These machines were designed by a local technician in Songea town after requesting for assistance from SIDO with no success. More efforts were done in order to get better machines including visiting EFTA but have not yet acquired it due to shortage of fund.

Technological support was reported during key informant interview with INBAR national coordinator to TFS-Ruvu plantation and Isongole bamboo centre which were supplied with bamboo processing and treatment machines.

4.10.2 Financing

During the survey, there were no any financing institutions mentioned to be assisting in bamboo activities in the study area probably because there were no any arrangements of working in groups or association and funding is mostly targeted to groups and not individuals. However, an exception was realized from processors at Matogoro stick industry who reported to receive funds from Dr.Damas Ndumbaro (MP), which enabled them to attend training and procure machines made by a local technician in Songea town. In addition, Songea Municipal council funded a study tour to visit 'Tanzania Paradise Bamboo' which is a group of processors located in Iringa region.

4.10.3 Communication

Communication strategy was slightly observed among actors in Ruvuma. Issues such as promotion and branding seemed to receive little attention. Only Matogoro stick industry packed and labelled their products. They also attended *Nanenane* exhibitions in 2018.

During the researchers visit to TFS-Ruvu plantation, the manager explained that promoting bamboo awareness was their main target. They manufactured some few products which were used during '*Sabasaba*' exhibition. Another strategy used was through conducting sports league where the winner's cup and medals were made of bamboo. TFS-Ruvu also prepared DVDs with a documentary on bamboo issues and was distributed to the community and aired on national television (TBC).

4.10.4 Training

With exception of Matogoro stick industry, no trainings were conducted among actors in Ruvuma region unlike bamboo processors in Ethiopia who attended regular trainings on skills which are conducted by different NGOs in their country (Endalamaw *et al.,* 2013). Matogoro processors attended various trainings including training on entrepreneurship and business management that was prepared by SIDO, PASS and TBS. They also visited Tanzania paradise bamboo in Iringa to learn from their fellow processors. INBAR has contributed in training bamboo groups in Iringa and bamboo officials from TFS Ruvu. Issues trained included silvicultural treatments, quality issues as well as value addition. Some of these trainings take place in China and four people attend each year.

4.10.5 Research and development

INBAR has invested in Research and development where by issues such as the importance of bamboo for soil and water conservation were studied and are yet to be published. SUA through the College of Forestry Wildlife and Tourism (CFWT) has realized the potential of bamboo and have shown efforts in research and development. The distribution of bamboo resources in Tanzania and its contribution to industrialization are among topics already discussed.

4.10.6 Seedling production

Presently, TFS-Ruvu plantation has 196 hectares of various species of bamboo and produces more seedlings to expand the plantation. However, seed availability is a problem because they are obtained from bamboo with 30-100 years of age so most of the seeds are obtained from China with the help from INBAR. Moreover, SUA has a mother block which produce seedlings to be planted and some to be distributed to individuals.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

5.1 Conclusion

Existing bamboo products and their potential

Bamboo products existing in the study area included winnowers, baskets, tomato carrying baskets commonly known as *matenga* which were commonly used in the harvest season and for household purposes; local cases commonly known as *jamanda* which were used for decoration and storage purposes; tables and chairs for furnishing and barbeque sticks commonly used in catering services.

Actors in the bamboo value chain

Bamboo value chain in the study area involved various actors which are producers, processors, traders and service providers. Profit was unequally distributed among actors in the chain. Working in groups among producers was more efficient than on individual basis. A trade deficit was observed implying that Tanzania is not able to meet the demand of bamboo products thus fails to capture both domestic and international market.

The business environment of bamboo trade

The business environment for bamboo products was not organized leading to failure in the development of the chain. Weak policy attention, poor means of transport and lack of appropriate grading mechanisms characterized the chain in the study area. It was also realized that transformation in culture and norms has minimized the consumption of bamboo products in the study area.

Supporting functions and service provision regarding bamboo trade

The use of local technology prevailed among producers while the processors at Matogoro reported to use locally designed machines which have little influence in boosting production. INBAR has supported the business by supplying machines for treatment and processing of bamboo products to TFS- Ruvu plantation and Isongole bamboo centre.

With regard to training in the study area, only members from Matogoro stick industry attended general entrepreneurship training and one training that was specific to bamboo enterprises all under the assistance of Songea Municipal Council. On national basis, INBAR has trained on silvicultural issues as well as value addition to individuals and groups dealing with bamboo activities.

5.2 Recommendations

Bamboo products and their potential

For a broader commercialization of bamboo, more products should be added to the chain to attract both domestic and international market. Producers and processors should be provided with knowledge and skills as well as the appropriate technology to create more value added products to the chain such as bamboo shoots, household utensils and building materials.

TAFORI, INBAR and SUA should conduct research on the suitability of bamboo species since it was not clear on whether species suitable for handicraft can also be used for making furniture. Also the research should include the comparison of bamboo products sourced from different areas to determine customers' preference. For example from this

study it was realized that some respondents believe Mbeya winnowers are durable compared to Ruvuma winnowers and the other way round.

Value chain actors

Producers should adopt the approach observed in Litoho village and organize themselves into cooperatives which will enable them to improve production in quality and also market in large quantities. The groups will make it easy for service providers to intervene in providing support services such as capacity building through training, financial aid and provision of working tools. However, the cooperatives requires a strong and proper management system to overcome challenges such as the presence of under ambitious members, delay of inputs, poor accounting and record keeping and lack of transparency within the group. There should be a strong linkage between stakeholders to communicate on technology, market prices and availability of products.

Business environment

The government is required to create a good environment to promote a competitive bamboo chain. The study recommends promotion of bamboo through prioritizing it in resource allocation to improve production and marketing. It is also important to strengthen policy attention through reviewing it and communicating it to relevant stakeholders. Physical infrastructure such as roads should be improved to enhance access to raw materials and market. Most of the raw materials for bamboo production activities are found in remote areas where roads are not in good condition. Youth should be encouraged to participate in bamboo activities to ensure sustainability of the activity since most of the producers are of old age.

Supporting functions and service provision regarding bamboo trade

In promoting bamboo commercialization, it is necessary to have a strong resource base. This can be made possible through the participation of stakeholders including the government through the establishment of bamboo plantations. Farmers on the other hand should be encouraged to use bamboo for activities such as construction and fencing which will in turn create demand of the resource so more bamboo farms will be established. Another focus is on input supplies including seedling and technology so as to ensure the production of quality bamboo products. Moreover, bamboo actors should be trained on suitability of species to respective end uses and on the skills on how to manufacture different bamboo products.

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APPENDICES

Appendix 1: Questionnaire for bamboo producers in Ruvuma region, Tanzania

MARKET SYSTEM ANALYSIS OF BAMBOO PRODUCTS IN RUVUMA

REGION, TANZANIA

This questionnaire is for MSc study purposes. The information and data that will be obtained from this field survey will be used to draft MSc ENAREC Dissertation for submission to SUA.

Questionnaire for bamboo producers

Questionnaire number…………………………...........................

Date of interview…………………………………………………..

District…………………Village……………………………….

Section A: Personal information of a respondent:

1. Name of the respondent..………………………………………………………….

2. Age in years……………………………………………..

3. Gender: 1 = male [ ], 2 = female [ ]

4. Marital status:1= Married [ ], 2= Single [ ], 3= Divorced [ ], 4= Widowed [ ]

5. Level of education: 1 = No formal education [ ]; 2 = Primary school [ ]; 3 =

Secondary school [ ]; 4 = College [ ], 5 =University [ ], 6 = others [ ]

(specify)………………

6. How many people are in your household (Household size)…………………..

Section B: Information on bamboo production

7. Do you participate in Bamboo production (farming)?

   1= Yes [ ], 2= No [ ]

   If Yes,

8. What is total area in acreages under bamboo

    production………………………...

9. What is the source of labour? 1=family labour [ ], 2=hired [ ], contract [ ].

10. How often do you engage in bamboo activities in a year?

1 = Dry season [ ], 2 = When in need of money [ ], 3 = All the time [ ].

11. What bamboo products do you harvest and where do you sell them? Specify according to the product

S/No	Product(s)	Total harvest (specify unit)	Selling price (TZS)	Market (middlemen wholesalers, retailers, others) list the name
1				
2				
3				
4				

12. Please indicate the costs involved in bamboo production activities:

S/No	Item/Activity	Cost (TZS)

13. Do you receive any extension services? 1= Yes [ ], 2= No [ ].

If yes, what type and source...

14. Have you ever received training on how to improve bamboo production?

1=Yes [ ], 2= No [ ]

15. If Yes, list the training and who trained you

Types of training	When trained	Who trained

16. Do you get market information? 1 = Yes [ ], 2 = No [ ]

17. If yes to question 15 above, how do you obtain such information?

1 = friends [ ], 2 = from media [ ], 3 = direct visit to the markets [ ], 4 = others []

specify…...

18. Who sets the price for the bamboo products when selling?

1=buyer [ ], 2=seller (producer) [ ], 3=others [ ]

(specify)…………………………………………………………………………..

19. What factors are considered in setting up the price of bamboo products?

1 = production costs [ ], 2= transportation costs [ ], 3= quality [ ], 4=others

(specify)…………………………………………………………………

20. Are you satisfied with the current bamboo products prices? 1 = Yes[ ], 2 = No [

]

If no, why?

1 = price is low [ ], 2 = operational costs are very high [ ], 3 = buyers offer price

which are in their favour [ ], 4 = others

specify)…………………………………………………..

21. How do you rate the quality of bamboo products you produce:

Very good [ ], Good [ ], Fair [ ]. Explain your choice …………………………..

22. What   factors   do   you   think   influence/affect   your   business?

………………………………………………………………………………….

23. Any other comments, …………………………………………………………………

24. List value addition activities you perform in bamboo production

(i)……………………………………………………

(ii)…………………………………………………..

(iii)……………………………………………………

25. How do you assess the linkage between you and other actors along the value

chain?

1 = very strong [ ], 2 = strong [ ], 3 = weak [ ], 4 = very weak [ ], 5 = none [ ]

26. Who do you perceive as having greater power in the bamboo value chain?

1 = producers [ ], 2 = traders [ ], 3 =processors [ ] 4 = consumer [ ]

27. How do you assess the current performance of the bamboo value chain?
    1 = best [ ], 2 = good [ ], 3 = worse [ ], 4 = worst [ ]

28. How do you think the performance of the value chain can be improved?
    ....
    ....

29. As producer, do you have any association in your area? 1 = yes [ ], 2 = no [ ]

30. If yes, to question 29 above,

a. What is the name of the association …………………………………

b. What are the benefits of the association/organization?
    ………………………………………………………………………………

31. What are the main challenges facing bamboo production?
    …………………………………………………………………………………..

32. What do you think should be done to make your work easier
    ....

33. Which laws affect your production activities and how do they affect the
    process? Please suggest ways to eliminate the effect
    …………………………………………………………………………………

Appendix 2: Questionnaire for bamboo traders

Questionnaire Number……………………………………….................

Date of interview……………………………………………………………

District…………………………....Village…………………………….....

Section A: Personal information of respondent:

1. Name of the respondent

…..……………………………………………………….

2. Age in years……………………………………..

3. Gender: 1 = male [ ], 2 = female [ ]

4. Marital status:

1= Married [ ], 2= Single [ ], 3= Divorced [ ], 4= Widowed [ ]

5. Level of education: 1 = No formal education [ ]; 2 = Primary school [ ]; 3 =

Secondary school [ ]; 4 = College [ ], 5 =University [ ], 6 = others [ ]

(specify)……………………….

6. How many people are in your household (Household size)…………………..

Section B: Information on bamboo trading

7. Which bamboo products do you trade? Specify the source and market for

each product

S/No	Product(s)	Buying price (TZS)	Selling price (TZS)	Source (village)	Market (category and place)
1					
2					
3					
4					

8. Please indicate the costs involved in your business:

S/No	Item/Activity	Cost (TZS)

9. Where are your customers coming from
1= Inside the country [ ], 2= Outside the country [ ], Both [ ]

10. What is the most traded species?

11. For how long have you been doing this business……….…………………..

12. Do you think Bamboo trade is profitable and why?

………………………………………………………………..

13. Do you receive any extension services? 1= Yes [ ], 2= No [ ].

If yes, what type and source..

14. Have you ever received training on how to improve bamboo trading?

1=Yes [ ], 2= No [ ]

15. Do you get market information? 1 = Yes [ ], 2 = No [ ]

16. If yes to question 15 above, how do you obtain such information?

1 = friends [ ], 2 = from media [ ], 3 = direct visit to the markets [ ],

4 = others specify…...

17. Who sets the price for the bamboo products when selling?

1=buyer [ ], 2=seller (trader) [ ], 3=others [ ]

(specify)………………………………………………………………………..

18. What factors are considered in setting up the price of bamboo products?

1 = production costs [ ], 2= transportation costs [ ], 3= quality [ ], 4=others

(specify)………………………………………………………

19. Are you satisfied with the current bamboo products prices? 1 = Yes[ ], 2 =

No [ ]

If no, why?...

1 = price is low [ ], 2 = operational costs are very high [ ], 3 = buyers offer price

which are in their favour [ ], 4 = others

specify)…………………………………………………..

20. How do you rate the quality of bamboo products you buy from the producers: Very good[ ], Good [ ], Fair [ ]. Explain your choice ……………………….

21. What factors do you think influence/affect your business? …………………………………………………………………………………………

22. Any other comments …………………………………………………………………..

23. Which specific role have you played in adding value to bamboo products in the market?

24. How do you assess the linkage between you and other actors in the value chain?
    1 = very strong [ ], 2 = strong [ ], 3 = weak [ ], 4 = very weak [ ], 5 = none [ ]

25. Who do you perceive as having greater power in the bamboo value chain?
    1 = producers [ ], 2 = traders [ ], 3 =processors [ ] 4 = consumer [ ]

26. How do you assess the current performance of the bamboo value chain?
    1 = best [ ], 2 = good [ ], 3 = worse [ ], 4 = worst [ ]

27. How do you think the performance of the value chain can be improved? ....

28. As a trader, do you have any association in your area? 1 = yes [ ], 2 = no [ ]

29. If yes, to question 28 above,

   a. What is the name of the association …………………………………………

   b. What are the benefits of the association/organization?

      ……………………………………………………………………………….

   30. What values added activities do you perform in your business?

      ……………………………………………………………………………………

   31. What are the main challenges facing bamboo trade?

      ……………………………………………………………………………………

   32. What do you think should be done to make your work easier

      ....

   33. Which laws affect your production activities and how do they affect the process? Please suggest ways to eliminate the effect

      ……………………………………………………………………………….

Appendix 3: Checklist with TFS officer

1. What are the production areas of bamboo – (private, government)?
2. What is the licensed area to be harvested or quantity to be harvested? (species-wise, if possible)
3. How many farmers or companies are involved in cultivation and harvesting?
4. What is the production quantity? (species-wise, if possible)
5. Who are the key farmers and traders of bamboo?
6. How is harvesting and transportation done?
7. What are the harvesting and transporting costs?
8. What are the challenges in harvesting and transporting?
9. Where are bamboo products sold?
10. What are the administrative obstacles in transporting?
11. Discuss on the laws that govern bamboo production
12. Do farmers comply to these laws?
13. What are the opportunities and challenges in the bamboo sector?
14. How many input suppliers are there in the area, and what is their capacity?

Appendix 4: Checklist with enablers (INBAR/SUA)

1. Discuss on seedling production?

2. What is the demand and supply of the seedlings?

3. Any quality issues? If yes, what are you doing or what do you need to do?

4. What are the challenges and opportunities in seedling production?

5. How can value be added to bamboo resources?

6**.** What are the technological gaps in manufacturing bamboo products? What is your institution doing to fill the gap?

7. How do you disseminate the innovation?

8. Is there any advanced technology available elsewhere in the world? What can be done in importing the technology?

9. What are the challenges on R&D in Bamboo?

10. How much of a budget is available for the R&D?

11. How do you see the future of bamboo in Tanzania?

12. What can be done to tap the economic potential of bamboo of Tanzania?

13. What is the employment potential of bamboo sector in Tanzania? How can it be more inclusive?

14. What are the policy issues from cultivation, harvesting, transporting, processing, marketing and exporting?

15. What can be done to strengthen the value chain of bamboo in Tanzania?

Appendix 5: Imports of bamboo products from 2012 to 2020

Product name	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Bamboo shoots	2 957 646	5,489,631	7,972,867	5,336,129	14,590,566	9,825,261	19,870,037	20,614,352	2,638,787	**89,295,276**
Household utensils	420,594,558	76,834,181	178,651,763	256,408,085	1,057,606,838	164,055,049	270,763,113	500,344,132	115,750,004	**3,041,007,724**
Building materials	2,695,996,059	2,604,384,704	8,352,850,020	8,656,277,225	4,214,220,338	4,444,605,747	10,515,537,593	6,207,397,065	880,894,533	**48,572,163,284**
Clothes hangers	1,022,406,350	942,807,000	2,732,940,966	1,635,472,064	1,306,132,448	1,334,912,770	1,124,015,735	1,307,686,000	308,655,315	**11,715,028,649**
Basketry	79,933,331	19,491,587	33,773,167	82,161,049	50,786,611	47,720,151	431,246,226	98,701,690	35,737,396	**879,551,208**
Pulp and paper	-	-	-	-	-	48,607,403	214,789,549	150,921,382	8,613,359	**422,931,694**
Bamboo furniture	-	-	115,089,451	-	-	157,395,138	604,782,853	1,119,272,859	205,530,980	2,202,071,280
TOTAL	**4,221,887,944**	**3,649,007,103**	**11,421,278,234**	**10,635,654,552**	**6,643,336,801**	**6,207,121,519**	**13,181,005,106**	**9,404,937,479**	**1,557,820,375**	**66,922,049,114**

Appendix 6: Export of bamboo products from 2012 to 2020

Product name	2,012	2,013	2,014	2,015	2,016	2,017	2,018	2,019	2,020	Total
Handcrafts	-	-	4,220,763	-	-	-	-	-	-	4,220,763
Bamboo shoots	-		1,665						-	1,665
Building materials	3,110,532	77,440,180	24,039,512	35,014,542	866,202	16,436,741	172,335,064	-	133,300,789	462,543,563
Hangers	3,751,205	2,433,561	121,211,061	20,650,424	3,178,505	5,787,425	6,202,544	97,698,041	9,201,416	270,114,182
Baskets	-	611,834	-	1,850,000	10,289,894	-	32,950,596	50,307,314	-	96,009,636
Household utensils	-	6,313,843	541,475	214,125	43,374	6,477,394	2,889,530	5,945,948	9,000,000	31,425,689
Furniture	-	-	-	-	-	902,848	3,208,802	3,466,918	640,569	8,219,136
	6,861,737	86,799,416	150,014,477	57,729,091	14,377,974	29,604,408	217,586,536	157,418,221	152,142,774	872,534,635

Appendix 7: Contribution of import and export of bamboo products by country from 2012 to 2020

IMPORTS			EXPORTS		
Country	**Frequency**	**Per cent**	**Country**	**Frequency**	**Per cent**
China	3367	41.8	Congo	278	27.1
United Arab emirates	1011	12.6	Zambia	85	8.3
South Africa	591	7.3	Kenya	77	7.5
Kenya	341	4.2	Burundi	74	7.2
United Kingdom	307	3.8	Mozambique	69	6.7
United States of America	275	3.4	Malawi	47	4.6
India	196	2.4	United Kingdom	30	2.9
Italy	152	1.9	Zimbabwe	27	2.6
Turkey	145	1.8	South Africa	24	2.3
Hong Kong	127	1.6	United States	24	2.3
Japan	102	1.3	Sudan	22	2.1
France	90	1.1	Comoros	17	1.7
Germany	86	1.1	Angola	12	1.2
Belgium	74	.9	Germany	12	1.2
Korea, R	69	.9	Netherlands	12	1.2
Thailand	64	.8	Rwanda	12	1.2
Netherlands	62	.8	India	10	1.0
Indonesia	49	.6	Belgium	9	.9
Canada	47	.6	Uganda	9	.9
Egypt	47	.6	United Arab Emirates	9	.9
Lebanon	47	.6	Egypt	8	.8
Malaysia	40	.5	Sweden	7	.7
Spain	39	.5	Australia	6	.6
Australia	38	.5	Canada	6	.6
Denmark	31	.4	Denmark	6	.6
Oman	30	.4	Japan	6	.6
Switzerland	29	.4	Korea	6	.6
Zanzibar	27	.3	Mali	6	.6
Sweden	26	.3	Spain	6	.6
Uganda	26	.3	Turkey	6	.6
Pakistan	24	.3	France	5	.5
Taiwan,	24	.3	Senegal	5	.5
Viet Nam	24	.3	Singapore	5	.5
Israel	22	.3	Cameroon	4	.4
Ethiopia	21	.3	Italy	4	.4
Saudi Arabia	20	.2	Lebanon	4	.4
Zambia	20	.2	Ethiopia	3	.3
Mauritius	19	.2	Ghana	3	.3

Botswana	16	.2	Indonesia	3	.3
Syrian A	15	.2	Ireland	3	.3
Mozambique	14	.2	Mexico	3	.3
Malawi	13	.2	Nigeria	3	.3
United R	13	.2	Norway	3	.3
Iran, Is	11	.1	Brazil	2	.2
Poland	11	.1	Cambodia	2	.2
Singapore	11	.1	Costa Rica	2	.2
Norway	10	.1	Cyprus	2	.2
Swaziland	10	.1	Finland	2	.2
Bangladesh	9	.1	Israel	2	.2
Ghana	9	.1	Mauritius	2	.2
Philippi	9	.1	Myanmar	2	.2
Nigeria	8	.1	New Zealand	2	.2
Qatar	8	.1	Philippines	2	.2
Brazil	7	.1	Qatar	2	.2
DRC – De	7	.1	Sri Lanka	2	.2
Namibia	7	.1	Austria	1	.1
Zimbabwe	7	.1	Botswana	1	.1
Burundi	6	.1	China	1	.1
Cote d'Ivore	6	.1	Cote d'Ivoire	1	.1
Monaco	6	.1	Croatia	1	.1
Czech Re	5	.1	Dominican Republic	1	.1
Ireland	5	.1	Gabon	1	.1
Rwanda	5	.1	Georgia	1	.1
American	4	.0	Guinea	1	.1
Greece	4	.0	Haiti	1	.1
Guinea	4	.0	Iran, Islamic Republic of	1	.1
Jamaica	4	.0	Jordan	1	.1
Portugal	4	.0	Latvia	1	.1
Russian	4	.0	Malta	1	.1
Sudan	4	.0	Morocco	1	.1
Croatia	3	.0	Pakistan	1	.1
Finland	3	.0	Papua New Guinea	1	.1
Guatemala	3	.0	Peru	1	.1
Jordan	3	.0	Poland	1	.1
Korea, D	3	.0	Romania	1	.1
Liberia	3	.0	Saudi Arabia	1	.1
Madagascar	3	.0	Seychelles	1	.1
Myanmar	3	.0	Sierra Leone	1	.1
Nepal	3	.0	Somalia	1	.1
Romania	3	.0	Switzerland	1	.1
Ukraine	3	.0	Syrian Arab Republic	1	.1
Albania	2	.0	The former Yugoslav Rep. Macedonia	1	.1

Angola	2	.0	Tokelau	1	.1
Argentina	2	.0	Trinidad and Tobago	1	.1
Austria	2	.0	Ukraine	1	.1
Bahrain	2	.0	Viet Nam	1	.1
Gambia	2	.0	**Total**	**1025**	**100.0**
Honduras	2	.0			
Morocco	2	.0			
New Zeal	2	.0			
Senegal	2	.0			
Serbia	2	.0			
Sierra L	2	.0			
Slovenia	2	.0			
Tunisia	2	.0			
Afghanistan	1	.0			
Azerbaijan	1	.0			
Belize	1	.0			
Benin	1	.0			
Bolivia	1	.0			
Bulgaria	1	.0			
Burkina	1	.0			
Cambodia	1	.0			
Cameroon	1	.0			
Cocos (Keeling) Islands	1	.0			
Colombia	1	.0			
Comoros	1	.0			
Congo	1	.0			
Cuba	1	.0			
Cyprus	1	.0			
Ecuador	1	.0			
Eritrea	1	.0			
Hungary	1	.0			
Kuwait	1	.0			
Libyan A	1	.0			
Lithuania	1	.0			
Mongolia	1	.0			
Niger	1	.0			
Sri Lanka	1	.0			
Tonga	1	.0			
Total	**8051**	**100.0**			