



TRAINING MANUAL FOR FOREST-BASED VALUE CHAINS DEVELOPMENT AT THE GRASSROOTS LEVEL

BEEKEEPING, BAMBOO, CARPENTRY, AND CHARCOAL PRODUCTION

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VALUE CHAIN DEVELOPMENT FOR SELECTED FOREST BASED PRODUCTS TO ENHANCE COMMUNITY LIVELIHOODS

BEES, BAMBOO AND FURNITURE PRODUCTS TRAINING MANUAL



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EXECUTIVE SUMMARY

Module 1: Introduction

This module provides key definitions and concepts, value chain process and examples of the value chain and market system components. This Module forms the basis for discussions and step by step guides on the bees, bamboo, charcoal and furniture products value chain development.

Module 2: Bees Products Development

The background states that Tanzania has high number of bees' population due to the presence of high plant species preferred by bees. Beekeeping is an ancient socio-economic activity and in many parts of the country it has remained basically traditional, local honey hunting, and a rural-based activity. Compared to other rural economic activities such as agriculture, beekeeping is given little attention. Many small-scale beekeepers in this country have remained very poor and its contribution to the national economy. Management of beehives, bee colonies, harvesting, processing, marketing and trades are critical challenges in bees' products commercialization for job and wealth creation. Apart from honey and beeswax, other hive products such as propolis, royal jelly and bee venom are yet to be produced or developed commercially. On the other hand, demand for bee's products nationally and internationally has remained high and is increasing. Therefore, it is apparent that efforts are needed to unlock bees' products value chains development for improvement of communities' livelihoods and increase its contribution to the national economy. This module explains in detail about bees' resources, bee's products value chains, business environment and supporting functions/mechanisms required for the development of this sub-sector.

Module 3: Bamboo Products Development

In Tanzania Bamboo grows naturally in highland areas. It is a diverse plant, easily adapts to different climatic and soil conditions. It is reported that bamboo has more than 1,500 documented uses and over 1,000 million people live in houses made of bamboo or with bamboo as the key structural, cladding or roofing element. Products of bamboos are used in many countries. Also, it plays a vital role in soil protection and conservation of water resources in catchment areas. In Tanzania bamboo is still underutilized and underdeveloped. Bamboo is often overlooked. Therefore, there is a need to understand and establish the value chains of bamboo-based products in order to enhance its contribution to livelihoods and poverty reduction of communities. Developing value chains of bamboo products will increase local use and contribute to national economy. This module gives detailed information about Bamboo Products Value Chains, Bamboo resources, how to establish bamboo farm, how to manage bamboo stand, how to harvest, drying, preserving and processing to various products. Important aspects of market systems for bamboo value chain development were also explained.

Module 4: Wood Furniture Products Development

Furniture are objects intended to support seating, sleeping, storing etc. Furniture is also used to hold objects at a suitable height to facilitate working. It can be made

from many materials, including metal, plastic, rattan, bamboo and wood. Designs of furniture in some cases reflect culture of a country. This module focuses on furniture made from wood. Wood furniture industries can be categorized according to products manufactured. Each of products may have own market segment. The harmonized system of product classification distinguishes four wood furniture, namely office, kitchen, bedroom/dining/living and shop furniture. The grouping does not differentiate between craft and mass-produced items or between low- and high-priced furniture. The furniture sub-sector is part of manufacturing industry, mainly processing wood products and may be integrated with other materials such as lather, sponges, cotton covers. Wood is a primary raw materials used in the furniture sub-sector in Tanzania. The furniture sub-sector in Tanzania consists mainly of small and medium scale enterprises, some with low levels of production, currently selling in local markets. Majority have few skilled labour and operating with low capital. Additionally, most of these firms are located in urban and few are in rural areas. Majority are run or managed by individuals or groups with low skills, relying on simple hand tools to process wood into furniture. However, furniture sub-sector has significant contribution to the national economy by employing about 17% of the total workforce in the manufacturing industry. This sub-sector is not import-dependent because most of the raw materials used are locally sourced from forests in Tanzania. Therefore, manufacturers could utilize these advantages to increase quality and production. Some of the furniture industries complain about the quality of the timber supplied in the country. The consequence is some import timber outside the country. Some industries have low competitiveness, mainly due low level of technologies. Low level of technology of the furniture industries lead to less qualities of the furniture produced and much power/energy consumption which results to increase in the costs of production. Inadequate skills (technical capabilities) is an important constraint in business competition. Quality and design capabilities during production are important elements for the furniture enterprises to withheld competition rendered by furniture increasingly exported to Tanzania. This module gives important information that guides wood furniture's value chain development, how to produce quality furniture, which business environment and supporting functions are important to develop the chains.

Module 5: managing business

This module enlightens how and where to serve money, sources of funds, financial and market management for purpose of developing business.

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ACRONYMS AND ABBREVIATIONS

VICOBA	Village Community Bank
R&D	Research and Development
TFS	Tanzania Forest Services
TANAPA	Tanzania National Parks and
TAWA	Tanzania Wildlife Authority
LGA	Local Government Authorities
IUCN	International Union for Conservation of Nature
USA	United State of America
USD	United State Dollar
EU	European Union
WMA	Wildlife Management Areas
BTI	Beekeeping Training Institute
TAFORI	Forestry Research Institute
FTI	Forest Training Institute
SUA	Sokoine University of Agriculture
NAA	Naphthalene Acetic Acid
CBE	College of Business Education
CFWT	College of Forestry Wildlife and Tourism
FITI	Forest Industries Training Institute
TTSA	Tanzania Tree Seed Agency
SMEs	Medium Scale Enterprises

MODULE 1: INTRODUCTION

1.1 Definitions and Concepts

In this manual various terminologies and concepts are used, therefore it is pertinent to define and explain them as part of introduction.

1.1.1. Definitions

Value chain: A 'value chain describes a series of activities from conception of a product or service through various stages/nodes to final consumers and disposal after use. In each node value addition activities are conducted. For example, the value chain for sawn wood starts from tree growing, logging, sawing, transportation, wholesalers/retailers and finally used for construction. At each stage value addition is done.

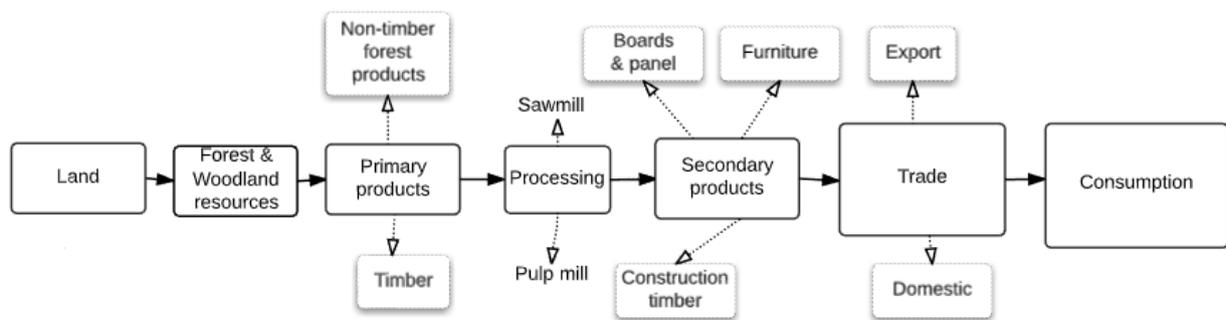


Figure 1: Sawn wood value chain

Node: Is a physical entity in a value chain where planning is done. Example of nodes for sawn wood are sawmilling and market.

Actors: Forest owners, sawmillers/industrialists, transporters/traders, wholesalers, retailers and consumers are major actors in the forest-based products value chain. Actors operations along value chain are influenced by business environment (e.g. policies, laws and regulations) and supporting functions (e.g. finances and researches).

Forest Based Products: Are goods and services produced from forest ecosystems (*provisioning* – firewood, timber, bees' products, charcoal, water; *supporting* – e.g. soil formation, nutrient cycling, crop production; *regulating* – e.g. flood control, climate regulation, diseases and water purification; *cultural:* spiritual, aesthetic value, education, recreation). In this manual bees', bamboo and wood furniture are considered.

Market system: Is a network of buyers, sellers and other actors that come together to trade in a given product or services. It is an interaction between value chain, business environment and supporting functions actors.

Value chain business association: is a group of individuals at a node or combining several nodes with a common goal. They usually promote information sharing,

innovation, collaboration and feedback cycles with aim of improving performance within a value chain.

Bee: An insect of the genus *Apis* (commonly known as honey bee), *Meliponula* and *Trigona* (stingless bee). The genus *Apis* produce significant quantities of honey and beeswax.

Beekeeping: also known as apiculture, is defined in various ways. But all definitions point to the art of managing honeybees sustainably for the purpose of tapping into the resource benefits.

Apiary: is a location where beehives with bees or bee colonies are kept. Apiary can have various size with varied location depending on bee's products operation.

Propolis: Also known as a bee glue is a resinous mixture that honey bees produce by mixing saliva and beeswax with exudate gathered from tree buds, sap flows, or other botanical sources. Bees use it as a sealant for unwanted open spaces in a hive.

Royal jelly: Royal jelly is a protein rich substance that is fed to larvae. More is given to the queen larva, causing her to grow larger than the other bees. It is made from digested pollen and honey and contains sugars, fats, amino acids, vitamins, minerals and proteins.

Beeswax: is a wax secreted by worker bees at a young age to make combs, walls and caps of the honeycomb.

1.1.2 Concepts

Value chain mapping:

The value chain mapping depicts interlinkages between successive stages along the chain. The value chain maps increase understanding on why forest-based products' actors choose a particular type of input given the institutional, market infrastructure and demand. Mapping is usually complex but can be simplified for easy understanding. The first step is to find the core processes (nodes or stages) in the value chain. The core processes are key stages that raw materials or products go through before reach final consumer (Figure 2).

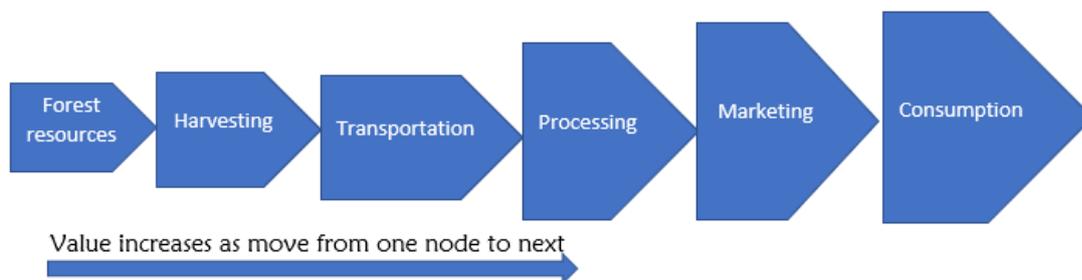


Figure 2: Core processes

The number and content of core processes to be included in mapping the chain depend on various factors such as the types of forest products, size, intended quality, location, nature of market and consumer characteristics. However, in practice there are can be more than one product produced from the original raw material. Similarly, in some cases some of the core processes can be skipped in order to reduce costs and increase competitiveness of a product. As value chain develops, the map becomes more complex with more competing channels both for forest resources and products. In addition, a wide range of actors from producers to transnational traders with a wide range of technologies may participate in value chains. Consequently, these products may have different value chains. In such cases the value chain maps will be complex. Figure 3 shows the complexity of value chain map of forest-based products.

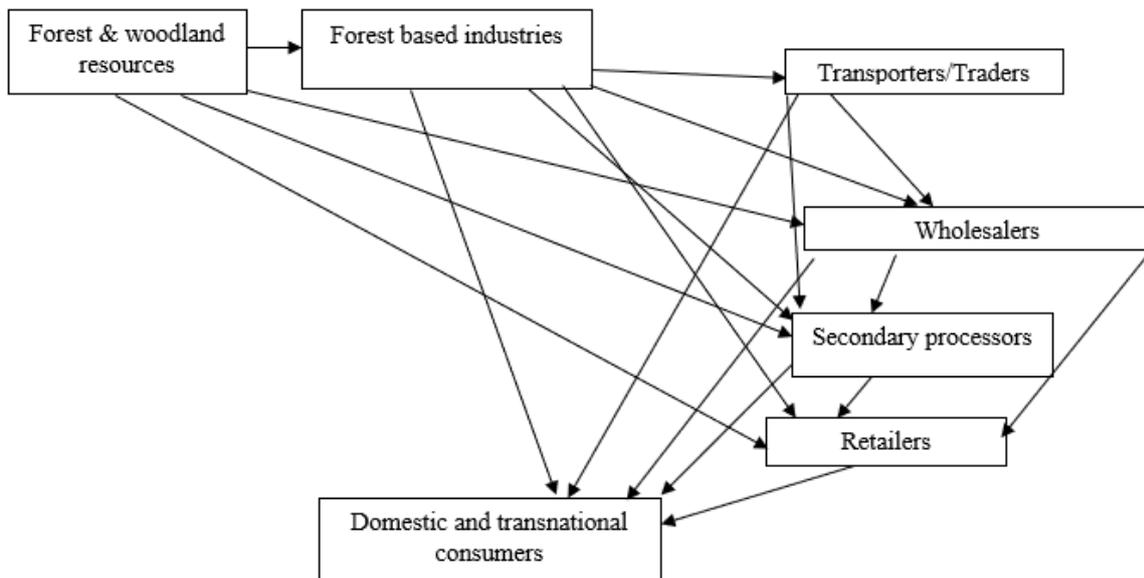


Figure 3: Complexity of value chain map of forest-based products

Market system:

The market system is a tool that helps to understand issues that affect the functioning of a value chain. The issues may emanate from institutions /organizations that provide services. The Market system is made up of three interlinked components:

- Market/value chain of forest-based products (producers, traders, wholesalers, consumers);
- Business environment (policies, rules, regulations, taxation, standards, grading, international agreements, climate change impacts); and
- Supporting functions/service provisions (extension services, VICOBA, Commercial banks, market information, research institutions).

Understanding the market system enable actors to identify opportunities and problems along the value chain. Figure 4 illustrates generic market system of sawn wood.

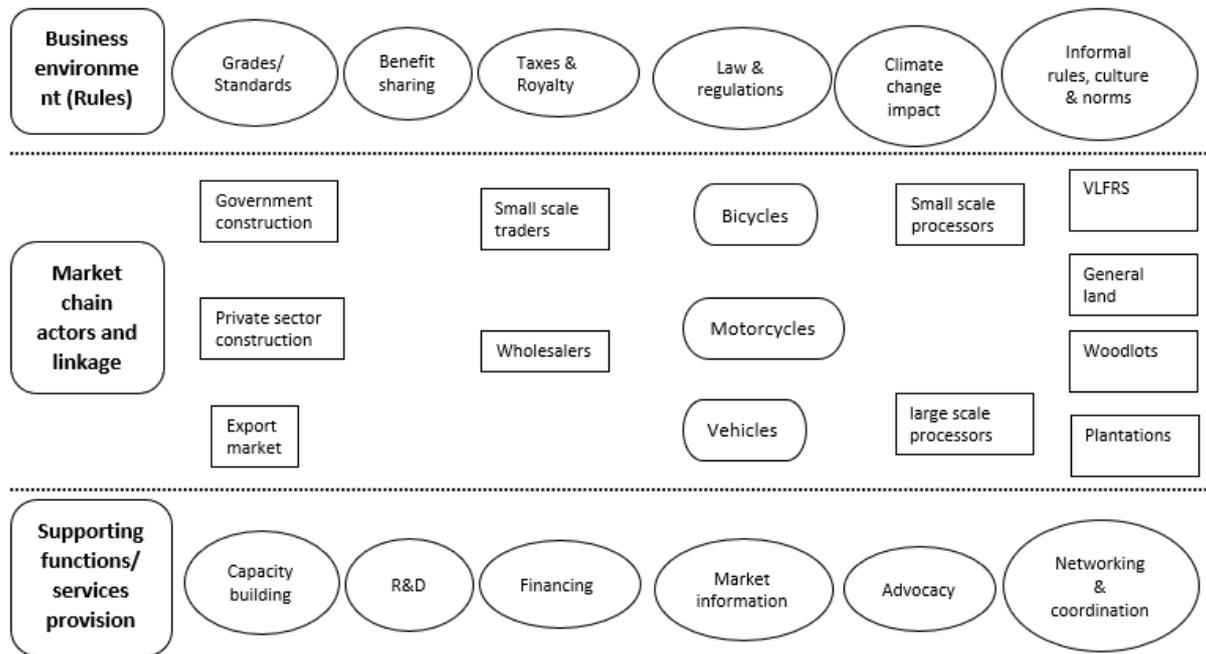


Figure 4: Market system of forest-based products

Value chain business associations

Smaller actors in a value chains face various problem often more vehemently than bigger enterprises. Normally they have low capital, inadequate skilled manpower, limited market information and low innovation. Consequently, their ability to compete with bigger firms is low and, in most cases, they follow decisions done by larger firms. Often, they have no other choice than to accept prices or product requirements that are given by buyer(s). However, individuals may join efforts by making group(s) (legally registered or not registered) for the purpose of improving performance and competitiveness of their value chains by forming business associations. For the value chain business association to be effective, individuals (members) should have at least the following attributes:

- Willingness and ability to work jointly;
- Positive business reputation;
- Good relationship with society;
- Meet deadlines or be time conscious;
- Willingness to contribute to the association;
- Ability to recognize and avoid conflict of interests;
- Ability to promote win-win scenarios;
- Ability to identify problems and solutions creatively;
- Timely decision-making and task completion;

The value chain business associations recognize that value is often created by the simultaneous interaction of several individual nodes. Often, a single work process can concurrently involve several nodes in the value chain and might be considered as value chain business associations. Problems arising in the value chains involving several nodes require immediate participation of actors to find solutions. Therefore, research

and development (R&D), production, marketing and customers may all viewed as working together to add value (Figure 5).

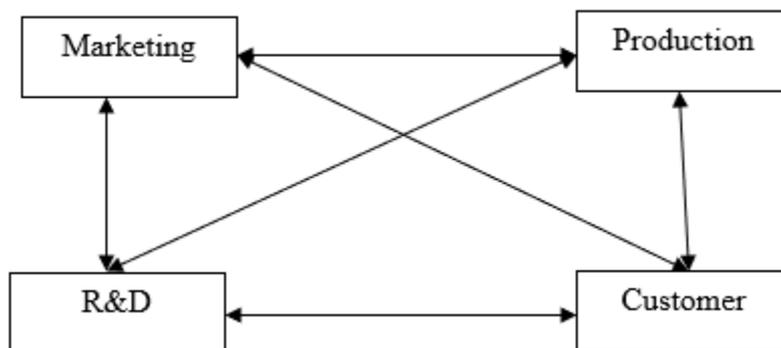


Figure 5: Value chain business association

1.2 Background

All land in Tanzania is considered public land, which the President holds as trustee for the people. The Land Policy of 1995, the Land Act Cap 113 [R.E. 2002] and Village Land Act Cap 114 of 2002 set out the fundamental principles guiding land rights and management. The Land Act classifies land in three categories: (1) reserved land; (2) village land; and (3) general land.

About 55% (48.1 million ha) of total land area of Tanzania Mainland is covered with forests and woodlands. About 93% of the total forest land is woodland and 7% is composed of mangroves, coastal forests, humid montane forests and plantations. The Land Act, Village Land Act and Forest Act of 2002 recognizes the following main land tenure categories and the forests therein:

Categories	Description
Central government land	Forests under this land are reserved and administered by central government agencies such as Tanzania Forest Services (TFS), Tanzania National Parks (TANAPA) and Tanzania Wildlife Authority (TAWA)
Local government land	Forests under this land are reserved and administered by Local Government Authorities (LGAs) and includes forest reserves decentralized to LGAs in the 1970s
Village land	Forests under this land are within village boundaries and administered collectively by village residents under customary law and Village Land Act Cap 114 of 2002 and includes communal land and land held by individuals
Private land	Forests under this land covers all tenure right types giving individual or collective occupancy rights within village, general or government lands. These tenure types are (1) customary right of occupancy, (2) granted right of occupancy, (3) leasehold and (4) residential licence
General land	Category include forests not reserved, not occupied or unused in the village land

Villages are the main owners of forest and woodland with 45.7% of total forest land in Tanzania mainland.

The forests and woodlands are managed based on the Forest Act at central, local, village governments and private/individuals. The Act allows partnerships for the co-management of forest resources. Where forest management is shared between the State and local communities, the relationship is formalized through the signing of a Joint Management Agreement. The central government forests can also be managed under concession where forest management on state-owned forest land is shared with a private company through Public Private Partnership arrangement.

The forests and woodlands are high in biodiversity containing over 10,000 plant species, hundreds of which are nationally endemic. Of the plant species, 305 are identified as threatened in the International Union for Conservation of Nature (IUCN) Red List, with 276 species classified as endangered. These enormous forest resources provide opportunities for business and value chains development.

Investment in beekeeping, bamboo and furniture industries is increasing with high demand of products for both local and export markets. Interests in bees' products production (include honey, beeswax, royal jelly, propolis and pollination service), bamboo and furniture products for poverty alleviation and commercialization is increasing villages surrounding forests and woodland resources. Investment and growth are important parts to any serious business cycles.

However, inadequate business culture (low entrepreneurship tendencies, weak record keeping and limited financing mechanisms) is one of the challenges causing underutilization and or misuse of the forest resources in villages. Most forest investments suffer from inadequate value chain development skills, inadequate information, limited innovations resulting on few species dependences, weak marketing skills and limited market systems. This manual aims to assist practitioners in beekeeping, bamboo and wood furniture making to efficiently develop relevant value chains.

MODULE 2: BEES PRODUCTS DEVELOPMENT

2.1 Background

Tanzania has high population of bee colonies that are estimated at 9.2 million (Kihwele *et al.*, 2001; Latham, 2001). This due to the presence of high number of plant species preferred by bees in many parts of the country.

Beekeeping is an ancient socio-economic activity. In Tanzania, beekeeping is a basically traditional, local honey hunting, and a rural-based activity. It is practiced by local communities, mostly women and the elderly (Mujuni *et al.*, 2012; Nyatsande *et al.*, 2014; Tutuba *et al.*, 2019). Compared to other rural economic activities such as agriculture, beekeeping is given little attention (Match Maker Associates, 2012) when it comes to resource allocation and activity development. It is practiced using local means, limited beekeeping knowledge and skills. Many small-scale beekeepers in this country have remained very poor and its contribution to the national economy is low despite numerous interventions to improve the sector. Implicitly, management of beehives, bee colonies, harvesting, processing, business and marketing are critical challenges in bees' products commercialization for job and wealth creation. Apart from honey and beeswax, other hive products such as propolis, royal jelly and bee venom are yet to be produced or developed commercially.

On the other hand, demand for bee's products nationally and internationally has remained high and is increasing. Therefore, it is apparent that efforts are needed to unlock bees' products value chains development for improvement of communities' livelihoods and increase its contribution to the national economy.

This module covers: Bees resources, bee's products value chains, business environment and supporting functions/mechanisms.

2.2 Bees' Products Value Chain

The bees' products value chain starts with forest and woodlands resources, followed by beekeeping, processing, transportation, wholesaling, retailing and end use. End use can be locally/domestic or internationally (Figure 6).

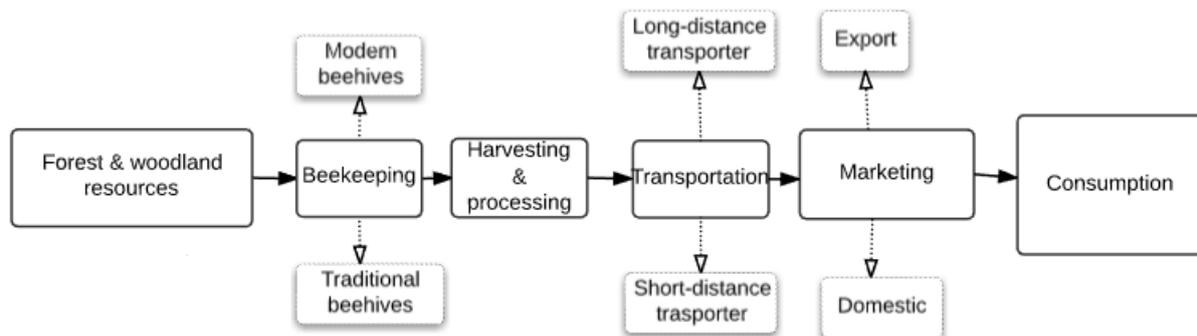


Figure 6: Bee's products value chain

2.2.1 Forest and woodland resources for bees keeping

Areas suitable for keeping bees are riverbanks and area with high *Brachystegia glaberrima* trees, *Julbernardia globiflora* and *Brachystegia* species are the best nectar producing trees. Others are *Brachystegia spiciformis* and *Zanthoxylum chalybeum*. The presence of bee's forage species such as *Dombeya burgessiae*, *Maesa lanceolata*, *Diospyros whyteana*, *Uapaca kirkiana*, *Vitex mombassae* and *Mysalicyfolia* species supports significantly production of bees' products.

Miombo woodlands have favourable conditions for bees' keeping because of the following:

- Have a diversity of plant species that enable bees foraging (Mwakatobe *et al.*, 2006);
- Have trees with high quantity of pollen and nectar which are food for the bees;
- Have two flowering seasons in miombo woodlands. The flowering of *Brachystegia* species contributes to bees' forage between October and December across the country. A second flowering occurs in May-June in areas with plenty of *Julbernardia* and *Marquesia* species. These flowering patterns provide opportunities for abundant and sustained forage for bees; and
- Have *Parinari*, *Cryptosepalum*, *Guibourtia*, *Marquesia* and *Syzygium* that produce nectar between the two main flowering seasons of the dominant trees (Alcobia, 1995; Campbell, 1996; Husselman, 2008).

Miombo woodlands are impacted by wildfire depending on intensity and frequency. In areas with persistent annual wildfires, miombo woodlands can gradually be converted to grasslands (Furley *et al.*, 2008). Wildfire intensity can easily be controlled compared to wildfire frequency, because suppression is expensive and ineffective. High wildfire intensity kills tree top, resprouting and reduce regrowth rates. Additionally, fires used to control the bees can spread and have negative consequences for trees and villages (Ntenga and Mugongo, 1991; Snook *et al.*, 2015, 2016; Ribeiro and Alves, 2019). Wildfire intensity can be controlled through management of fuel load by conducting regular early burning. Formulation and implementation of simple, village level Integrated Fire Management Plan is crucial to minimise intensity and frequency.

2.2.2 Beekeeping

This is the second node along bees' products value chain. Beekeepers are stakeholders that manage beehives for bee's products production. The beekeeping can be done at a level of individual, household, group or association. The number of beehives varies widely from very small to a large number. Majority of beekeepers in Tanzania have few beehives and of traditional types. However, modern beehives are promoted. The following are types of beehives used commonly in Tanzania.

Traditional beehives:

The log hive

The highly favoured species for solid wood beehives making are stems of *Pterocarpus angolensis* and *Sterculia quingueloba*. However, most of miombo tree species can be used to make log hives. A tree is felled and cut down into small billets of about 1.6 m. Caved area is made in these billets so as to create places where combs and bees can stay. They are then sealed, leaving some small holes for bees to exit and enter. In another case, the log is split into halves, hallowed to make caves, then attached together before baiting (usually beeswax is used) and installation. During harvesting, the hive is open and the honeycombs harvested. After harvesting, the two halves are rejoined and the hive installed for another cycle of honey production (Figure 7).



Figure 7: Example of log hive

Bark Hives

Bark hives are extensively used in Miombo woodlands in Tanzania. Barks of different Miombo trees are used. The most preferred tree used to make bark hives are *Julbernardia*, *Brachystegia*, *Cryptosepalum*, *Rauvolfia* and *Cordia* species (Mwakatobe, 2001; Kokwe, 2006; Mtengeti and Mhelela, 2006; Campbell et al., 2008; Husselman et al., 2010).

How to make a Bark Hive?

The following are steps normally used to make a bark hive:

- Identify a suitable tree;
- Peel the tree using appropriate tools such as axes, machete, chisel and hammer;
- Roll the bark to make a cylinder;
- Stitch the cylinder using pegs or ropes;

- Cover the cylinder with lids (made from barks) both side to make a barrel like container which is hive; and
- The hive is left to dry for about two months before hanging.



Figure 8: Debarking of trees for bark hive making

Bark hives are made by cutting down trees or peeling cylindrical sections primarily targeting big trees often leading to their death, deforming forest structure and therefore reducing supply of nectar and pollen. For these reasons bark hives making is highly discouraged.

Other materials

Depending on local situation other materials can be used to make beehives. Such materials include grasses (woven together in a basket or cylindrical form, usually with entry points at both ends), bamboo, gourds (they provide a natural hollow for bees), clay (use to make pot hive). The materials are locally available and environmentally friendly. Therefore, making hives using such materials is highly encouraged.



Figure 9: Beehives made from other materials

Construction of traditional beehives utilize cheap and locally available materials is encouraged because some of which would otherwise be wasted. However, they are not easily manipulated because bees fix combs to the hive body, combs cannot be easily inspected and once the comb is removed cannot be replaced. In addition, they cannot be used efficiently for large scale production of bees' products. Therefore, use of modern beehives is highly encouraged.

Modern beehives

There are two basic types of modern hives used in Africa. These are (i) Top-bar and (ii) Frame hives.

Top-bar hive

As the name implies, have only a top bar to support the comb. These hives are typified by removable frames which allow the beekeepers to inspect the hive. Movable frames also allow the beekeeper to more easily split the hive to make new colonies.

Top Bar Hives are widely used in Tanzania. Construction of these beehives is easy and costs are low. The top-bar design is a single, much longer box with all the bars hanging in parallel. The bees build the comb so it hangs down from the top bar. Because the bees have to rebuild the comb after each harvest, a top-bar hive will yield more beeswax but less honey. There are two forms of top-bar hives (named after their countries of origin):

- the Tanzanian (with vertical sides)
- the Kenyan (with sloped sides) and

The Tanzanian is easier to construct than the Kenyan hive

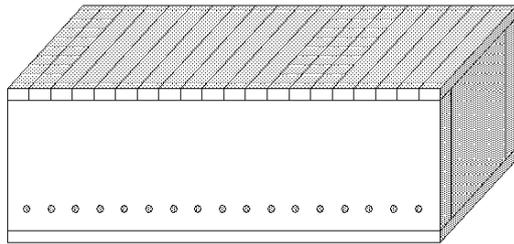


Figure 10: Tanzanian Top-bar hive

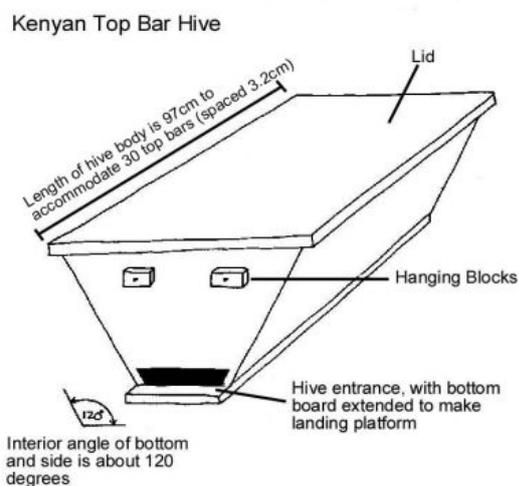


Figure 11: Kenyan Top-bar hive

Advantages of Top-bar hives

- Easy to construct and use: Almost any container may be used as a hive, provided appropriate bars are placed across the top and a weather tight cover and a single defensible entrance are provided;
- Ease to inspect: It is light to lift and inspection can be carried out with less disturbance because only a small portion of the hive is opened at a time. It promotes frequent inspection; and

However, it is not necessary to exclude the queen from the honey stores. Exclusion of the queen tend to slow the ability of bees to quickly deposit nectar and resume foraging.

Frame hives

Frame hives (sometimes known as Langstroth) is any vertically modular beehive that has vertically hung frames, a bottom board with entrance for the bees, boxes containing frames for brood and honey and an inner cover and top cap to provide protection from rains, sun and wind. This type of hives is common in North America and Australia. Figure 12 is an example of Frame hive.

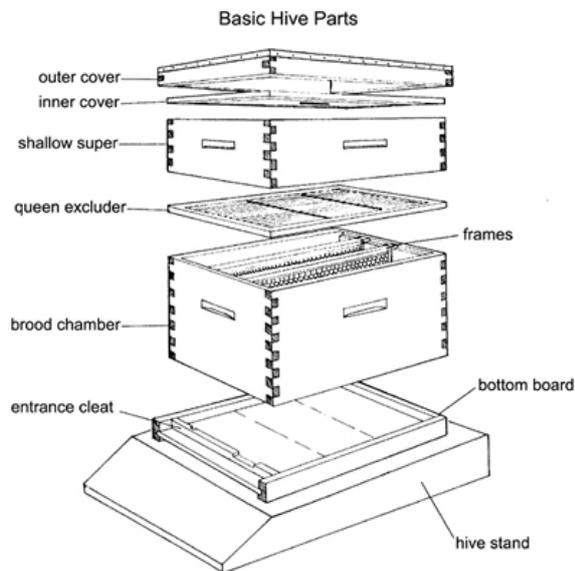


Figure 12: Frame hives

The frame beehives have the following advantages

- Provide high quantity honey;
- No bee killing during harvesting hence environmentally friendly;
- Protective since they cannot allow bees' enemies intrusion into hive;
- Work well with trap boxes;
- Make easy for bees to fan and clean the hive;
- Reduce work for the bees in making combs because they are fitted with wax foundations;
- Promotes cleanliness during harvesting; and
- Brood and honey never mixed as in log hives.

When constructing a beehive observe the following:

- Ensure there are no openings apart from the entrance. Openings attract honey robbers;
- Paint the surface of the hive with plant oils (e.g. coconut oil). Avoid synthetic paints because can contaminate honey and the wax; and
- No paints should be used inside the hive to avoid absorption of the paint by the honey and the wax.

Where to install beehives?

The following should be considered in installing the hives:

- Place hives nearby water resources and forage vegetation. These resources should be within 3 km equivalent to a distance bee can travel;
- High diversity of plants with different flowering periods to sustain nectar and pollen availability are most preferred;
- Avoid direct exposure to sun light. Shaded areas with good aeration are recommended;
- Hive entrances should not directly face winds;
- The entrance of hives should face sunrise to activate bees early;

- If the installation is on a tree, strong branches (for hanging the hive and to support inspection) are required.

Apiary

An apiary can be for honey, pollen, wax, venom production, queen rearing or mating depending on management objectives. The following should be considered for an apiary:

<ul style="list-style-type: none"> • Situated on high ground to avoid moisture; <ul style="list-style-type: none"> • Should be near water and forage sources with high plants diversity for nectar and pollen. Could be situated proximity to miombo woodlands, farms or gardens, which require pollination and allow bees to collect nectar and pollens; • Shade is required, in areas where trees cover is not enough, artificial shade can be provided; • Should be protected from vandalism; The apiary can be fenced to avoid disturbances from humans and animals. • The maximum number of hives that can be placed in one apiary vary depends on management objectives. The number of beehives should correspond to the availability of forage and water. However, beekeepers may choose to keep apiaries of limited size to avoid infection or infestation of bees; and • Keep the apiary clean, where appropriate slash grasses, prune trees to protect hives from fire, ants and other insects. 	
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How to attract bees to occupy the hives?

Normally, bees occupy hives on their own. However, the following procedures can be used to attract bees quickly into the hives:

- Place the hive in a suitable area (where food and water will easily be available to the bees); and
- Encourage quick occupation by baiting the hive with either melted wax, old combs, aromatic substances, orange, lemon or lemon grass oil rubbed onto the interior surfaces of the hive. Additionally, a few drops of queen mandibular pheromone obtained from an old queen can be put in the bait hive.

It is recommended to put a comb with honey into the new hive in order to feed the bees during early days of occupation.

How to capture bees swarm into a hive?

Once a swarm is spotted, it can be captured and taken into a hive. In doing so the following should be observed:

- Wear protective gears before approaching the swarm;
- While in a protective gear sweep swarm into a beehive; or
- Make the swarm docile by smoking or sprinkle the swarm with cool water;
- Shake or brush the swarm in a suitable collecting material such as a basket
- Move the swarm immediately and shake them into an empty hive.



How to manage beehives?

Good management practices include to:

- Prepare material required for managing the hive (smokers, additional hives protective gear);
- Avoid dark and red clothes because bees react to the colours aggressively. Therefore, wear white clothing or any light colour.
- Avoid smells such as secretion, alcohol, soap and perfume when working with bees because bees may react aggressively;
- Walk slowly and calmly because bees are very sensitive and react aggressively to rapid movement and noise;
- Carefully remove the lid and top-bars and gently blow smoke around the entrance;
- Do not squash bees because they release odour causing other bees to attack;
- Provide extra room if bees have filled all the bars with food and brood;
- Separate honeycombs from the brood rooms to prevent the later to develop in the honeycombs room;
- Remove old combs from hives without bees;
- Inspect the hives regularly to check whether the bees are working normally;
- Ensure that not many bees move out of the hive during inspection;
- Place a wet cotton cloth over the opened hive to lower temperature;
- Limit working time in a beehive or apiary to about 45 minutes beyond which bees become aggressive; and
- Wash gloves before moving to other hive or apiary to avoid spread of diseases.

Most bees will not attack, if they are not provoked. A bee will usually only sting in self-defence or to defend its colony

2.2.3 Harvesting and processing

2.2.3.1 Primary products

There are various products that can be harvested depending on management objectives of the beekeeper.

Honey: in harvesting honey the following should be taken into consideration:

- Ensure that the beehive is ready i.e. has enough honey to be harvested. In most part of Tanzania, flowering period is between May to June and October to December. Therefore, beehives are ready for harvesting at the end of the flowering period.
- During harvesting the following observed:
 - wear protective clothing: overall, veils, gloves, boots. These can be simply and cheaply locally made;
 - light the smoker;
 - gently open the hive;
 - select combs with honey and avoid those with brood;
 - lift comb, blow smoke on both sides and gently brush bees back into hive;
 - take honeycombs, leaving about 1 cm of comb on the bar. This will a foundation for bees to build on;
 - leave some combs in the beehives as bees' food;
 - place the harvested honeycombs in a dry clean container with a cover; and
 - push the unripe combs next to brood and place harvested bars behind these before closing the hive.

Honey is processed as follows:

- Use a hot rod or knife to open cells on one side of the honeycombs;
- Place the comb on and let the honey drip through the filter into a container below until the cells of the combs are empty;
- Turn over the comb and repeat the above process;
- Pack honey in clean, dry container with a seal/lid; and
- Properly label the container and store in a cool dry place.

Pollen: Although pollen is potentially a lucrative business nationally and internationally, it is a rarely economic activity in the beekeeping sub-sector in Tanzania. In harvesting pollen, the following should be taken into consideration:

- Quality pollen is harvested in areas about 3km distant from contamination sources such as pesticides and highways;
- Pollen is harvested using a pollen trap;
- Place the trap on the entrance of the hive;
- Traps vary in size, appearance, and method of installation on the hive. Each has some feature that makes it particularly adaptable for a specific purpose.
- Traps should have a grid through which bees must crawl to separate the pollen from the bees;
- Bees entering the hive are stripped off pollen by trap which fall in a container bellow;
- The harvested pollen has to be immediately placed in a freezer for two days for quality preservation;
- The pollen should be oven dried as soon as possible using a maximum temperature of 30°C for a short duration in order to avoid vitamin losses;
- Purification is done in a special machine, similar to the seed cleaning machine;

Propolis: is a very important product from beekeeping nonetheless rarely harvested in Tanzania. In harvesting propolis, the following should be taken into consideration:

- Should not be harvested from the hive until there is sufficient volume to sell;
- Commercial harvest is mainly from *Apis mellifera* kept in frame hives;
- a plastic sheet with multiple small slots (each with less than six millimeters) is placed in the hive. The bees seal these gaps with propolis
- Remove the sheet from the hive and placed in freezer in order to stretch the sheet and release the propolis;
- Keep the harvested propolis in dark containers, protect from light and heat;
- Maintain physical and chemical properties by freeze-dried the propolis, alternatively dissolve propolis in ethyl alcohol; and
- Dissolve the extract in organic amine solution, filter to remove wax residues. The resulting solution is soluble in aqueous solution and can be freeze-dried.

Venom: Venom is another potentially lucrative bees' products, but infrequently harvested. Venom used in the bee sting is made up of a complex mixture of proteins. Recent research shows that venom have benefits to humans. The following should be taken into consideration during harvesting:

- Harvesting venom involve exposing bees to electric fields;
- Place bee venom collector with a metal gauze and glass sheet in appropriate location;
- Electric shock makes bees to sting a metal gauze, behind which is a glass sheet;
- The collected venom is left on the glass sheet in the hive for a few hours so that sting continues; and
- Dried venom is scraped from the glass sheet.



Courtesy: Mr Philemon Kilemi - 0656104141/0765895805

Figure 13: Pollen harvested by Tanzania Beekeeping Village, Singida

Tanzania Beekeeping Village has very high experiences on various beekeeping products including pollen harvesting and processing.

Royal jell: the following are steps to harvest royal jelly:

- Clean and sanitise by heat or alcohol all equipment that will be used to harvest and store royal jelly;
- Wash hands before starting harvesting;
- Cut wax from queen larvae cells to speed up collection of the royal jelly.
- Remove larvae carefully to reduce contamination of the jelly;
- Remove royal jelly from each cell;
- Filter the royal jelly using fine sieve to remove traces of wax or larvae; and
- Store the royal jelly into appropriate containers and in a refrigerator.

Beeswax: this is a secondary bee's product obtained after harvesting honey. Many people harvest beeswax for various purposes like candles, lip balms, creams, polish and conditioners just to name a few. The following are some of the main approaches to extract beeswax:

- Hot water extraction using forced immersion
 - place combs in a tight tied jute sack;
 - The sack is placed in a boiling water;
 - Since the wax is lighter than water, it will filter through the jute and rise to the surface;
 - let the pot cool down after all combs have all melted;
 - Let the wax solidifies as it cools, forming a block on the water surface; and
 - throw out waste left in the sack.
- Extraction with boiling water and a wax press
 - place combs in a container of boiling water and left to melt.
 - Let the wax melt
 - Put the melt wax into sack and press.
- Centrifugal extraction
 - Combs are meted in boiling water
 - poured the boiled mixture into a centrifugal wax extractor,
 - spin at more than 1500 rpm while keeping temperatures over 65°C to prevent the wax from setting.
 - Pure wax runs out of through an opening from the extractor. This method is used by largescale units

2.2.3.2 Secondary products

Candles: Various types of candles can be made depending on the type of market and the available moulds. Candle moulds vary, one can use eggshells, bamboo, water pipes or papaya stalks. Procedures for making candle is the same in each case. To make a moulded candle the basic steps below can be used.

Table 1: Steps for making candles

Step	Illustration
<p>1. Wax must be clean, and melt to liquid in a double boiler over the fire</p>	 <p style="text-align: center;">boiling water melting wax</p>
<p>2. Cut the wick to size. Some people coat the wick in wax to keep it straight.</p>	
<p>3. When mould is bamboo, soap the mould to stop the candle sticking</p>	
<p>4. Make sure the bottom end is well plugged so that wax cannot leak out</p>	
<p>5. Set the wick in the centre of the mould using a split stick or hairpin to hold it in place</p>	
<p>6. Pour the melted wax carefully into the mould</p>	

<p>7. Wait to coal, then you will have a candle</p>	
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Ointment:

Table 2: Steps can be used to make ointment

Step	Illustration
<p>1. Put portions oil and beeswax into a heatproof container.</p>	
<p>2. Place the container into a double boiler over the fire.</p>	
<p>3. Heat and stir until the wax melted and blended into the oil</p>	
<p>4. Add scents or medicinal ingredients if you need. Stir and pour into a container and store to cool</p>	

Soft cream: this is made by adding water to the basic recipe. Use emulsifier to mix oil and water.

Table 3: Steps for making soft cream

Step	Illustration
<p>1. Put oil and beeswax into a heatproof container and heat until blended together. Add water and emulsifier (if available) into a second heatproof container. The simplest emulsifier is borax (<i>Sodium borate</i>)</p>	
<p>2. Blend water into the oil and wax while stirring until the mixture turn thick. One person may stir the mixture while another adding water.</p>	
<p>3. Pour into a suitable container.</p>	

Shoe polish:

This can be made by following the steps below (Table 4).

Table 4: Steps for making shoe polish

Step	Illustration
<p>1. Ensure that you have all the required items (beeswax, dye, spirit/ turpentine, double boiler container and heat)</p>	
<p>2. Melt beeswax in a double boiler container</p>	

<p>3. Add melted beeswax into turpentine/spirit and mix repetitively to blend</p>	
<p>4. Beeswax can be coloured using dyes. Hair dye can be used to colour black shoe polish</p>	
<p>5. Uncoloured polish will still polish all types of things keeping them protected and waterproof.</p>	

Beekeeping equipment

Various equipment can be used along the bees' products value chain. The equipment and respective functions are summarized in Table 5.

Table 5: Beekeeping equipment and their functions

<p>Personal Protective Equipment (PPE): These include bee veil, coverall, gloves, boots and hat. They can be made using local materials</p>	
<p><i>Bee Veil:</i> is a flexible wire, nylon, or cloth mesh worn to cover the head including the face against bees' stings</p>	
<p><i>Bee coverall:</i> This is a body cover with zippers to allows easy attachment and removal of the bee veil. Avoid dark colours, nylon, and rough textures</p>	

<p><i>Gloves:</i> These are hand protectors against bees' sting. Can be made from different materials</p>	
<p><i>Boots:</i> They are foot wear. Should be long enough to connect with the overall</p>	
<p><i>Bee smoker:</i> a device used to produce smoke aiming to calm the bees. Smoke masks alarm pheromones released by guard bees providing an opportunity for the beekeeper to open the hive and work without triggering a defensive reaction</p>	
<p><i>Hive opener and brush:</i> Combs are not easy to separate because are glued each other by resin-like propolis. Hive opener is used to detach, cut, scrape combs from each other and open hives Bee brush helps to remove bees from combs. It is also used to sweep a swarm into a suitable collecting container</p>	
<p><i>Processing equipment</i></p>	
<p><i>Centrifugal honey extractor:</i> is a mechanical device used to extract honey from combs. During spinning of honeycombs, the centrifugal force pushes out honey to the sides and eventually down into a container</p>	
<p><i>Honey strainers:</i> These are series of funnels fitted to each other, lined with layers of strainers (of different sizes starting with large to small sizes) to remove impurities from honey</p>	
<p><i>Storage equipment:</i> Used to store honey. Aluminium, stainless steel, glass or plastic are preferable material to make storage equipment. They should be clean, dry container with a seal/lid (or airtight) and should be properly labelled and store in a cool dry place</p>	

2.2.4 Packaging and labelling

Packaging varies depending on bee's products and intended market. For example, if packaging is for retailing small units are used, if is for wholesaling bulky package materials are used. Packaging should not only aim to easy transportation or delivery of the product, but also to add value to the product. The package should be properly labelled. The following are information that can appear as a label on a package for value addition to the product:

- Name of the product;
- Type of the product. For example, if it is honey, could be honeycomb, granulated or cream honey;
- Name and address of the producer/trader;
- Source of the product e.g. from Miombo woodlands, thickets, rainforest etc.;
- Show that the product is made in Tanzania;
- Processing and packaging date;
- Expiry date;
- Net weight of the product;
- Additional information to attract customers e.g. *Help to alleviate poverty through environmentally friendly beekeeping*;
- Lot number;
- Barcode to enhance trade and traceability;
- Tanzania Bureau of Standards approval; and
- Attractive image.



2.2.5 Transportation

Transportation has a role in the development of bee' products value chain. It physically connects nodes (producers, wholesalers, retailers and customers) along value chain. Transportation is also important when exporting products. Mode of transportation are land, water and air. Each of these modes require transport documents. Therefore, transportation of bee's products should abide to policies, laws and regulations which are discussed in Section 2.2.

Mode of transportation should be able to deliver products without affecting the quality i.e. should not cause mechanical damage and contamination (of toxic residue or odour). Proper management of transportation along value chain can ensure efficiency in delivery and consistency customer satisfaction. High transportation costs is one of limiting factors to access markets.

2.2.6 Marketing of bees' products

The global demand for honey and beeswax and other products has been increasing over the past 10 years. The major producers of honey worldwide include Russia, China, USA, Mexico, Argentina, Canada, Brazil and Australia (FAO, 2014). The global demand for pure honey is constantly exceeding supply, and, honey is increasingly becoming valuable and an expensive commodity. For example, it is reported that the

price of honey in the USA is rising more than 6 % annually. The major exporters however are China, Mexico and Argentina.

More than half of honey produced in Tanzania is consumed locally as food. The prices in the rural areas, range from USD 1.5 to 2.5 per litre. In cities, a price per one litre range from USD 4 to 7. For beeswax only a small fraction is consumed locally. In the rural areas 1kg of beeswax is sold between 3 to 5 USD.

- Individual member(s) of the community or the village who either buy for brewing (20 litres) or for home use (1 litre).
- Traders who purchase honey at village level. They buy combed or semi processed honey mainly in the 20 litre containers. These either process the combed honey or pack for selling to markets or they resell unprocessed combed honey to processors.
- Beekeeping associations or beekeepers' cooperatives that mainly buy combed honey and process this and pack for either wholesale or retail.
- High amount of processed and packed honey is transported to Dar es Salaam, Mwanza, Arusha and to be sold in shops, supermarkets, exhibitions and sometimes at open air stalls.

For the external market, main buyers of Tanzania's honey: EU, Oman, UAE, Kenya, Rwanda, Uganda and Iran while main buyers of beeswax: Japan, USA, and Germany. The prices of honey range from USD 1.8-4.5 per kg. The price of beeswax ranges from 4.5 to 7.5 USD per kg (FAO, 2014).

2.3 Bees' Products Business environment

The business enabling environment includes norms and customs, laws, regulations, policies, international trade agreements and public infrastructure that either facilitate or hinder the movement of a bee's product along its value chain. The following are some of the main business enabling environment in Tanzania;

The National Beekeeping Policy (1998): The overall goal of the Policy is to enhance the contribution of the beekeeping sector to the sustainable development of Tanzania and the conservation and management of its natural resources for the benefit of present and future generations. The policy encourages active participation of all stakeholders in establishment and sustainable management of bee reserves and apiaries, promoting beekeeping-based industries and products and promoting sustainable management of beekeeping in cross – sectoral areas for ecosystem conservation and management. Among the key policy objectives are:

- To ensure sustainable existence of honeybees by maintaining and managing bee reserves. The Policy encourages the participation of the stakeholders (including the private sector) in the establishment and sustainable management of bee reserves and apiaries;
- To improve the quality and quantity of bee products;
- To improve the contribution of the honey sector to national development and especially poverty alleviation; and
- To improve the national capacity to manage and develop the beekeeping sector in collaboration with other stakeholders.

Beekeeping Act, 2002: This guides beekeeping value chain development in the country. Key objectives of the Act are:

- To promote, and enhance the contribution of the beekeeping to the sustainable development of Tanzania and the conservation and management of her natural resources for the benefit of present and future generations;
- To enhance national capacity to manage and develop the beekeeping sector and enable the sector to make a contribution to the alleviation of poverty;
- To ensure that the management and development of beekeeping is devolved to the lowest possible level of Government consistent with maintaining and promoting high standards of quality;
- To ensure the sustainable existence of honeybees by the creation, maintenance and effective management of bee reserves and apiaries;
- To improve the quality and quantity of honey, beeswax, and other bee products to ensure the sustainable supply of the same; and
- To improve bio-diversity and increase employment and foreign exchange earnings through sustainable bee products-based industrial development and trade.

The National Beekeeping Programme (2001-2010)

The National Beekeeping Programme is an instrument designed to put into practice the beekeeping with emphasis on stakeholder's participation in the planning, management, ownership and sustainable utilization of bee resources for poverty eradication, improved biodiversity development and environmental conservation.

Wildlife Policy of Tanzania, 1998: encourages beekeeping activities to be carried out in Wildlife Management Areas (WMA) by involving local communities. With permission from the Director of Wildlife (currently known as Conservation Commissioner of Tanzania Wildlife Authority) beekeeping activities are allowed to be carry out in game reserves and game-controlled areas.

Village Land Act, 1999: permits communities at village level to own and manage land. In view of this, when designing village land use plan, beekeepers can be allocated land for beekeeping development.

National Environmental Policy, 1997: inspires communities to own and manage bee reserves as one of the strategies to control forest degradation and destruction of water sources.

Guideline for Quality Assurance of Bee Product in Tanzania, 2007: Tanzania bees' products have high quality when in the hives. The quality of the products often is reduced during harvesting, processing, transportation and trade. In order to ensure maintenance of quality the Guideline for Quality Assurance of Bee Products in Tanzania was developed. Adherence to the guideline will enable increase in bees' products quality and price. The Quality Assurance of bees' product is aligned with the European Union Standards. Honey exporters are required to comply with European food legislations foundation whose principles are traceability (aims to become aware of supplier), risk analysis and precautionary measures. European food legislations of which this guideline is aligned with are: Pre-market approval (which a country via its

relevant ministry is included in approved third country list), EU General Food Law Regulation (EC) 178/2002, EU legislation on hygiene of foodstuffs Regulation (EC) 852/2004), EU Regulation (EU) 1169/2011 on labeling, Health Certification Regulation (EC) 1664/2004, Directive (EC) 110/2001 (sets European requirements concerning honey quality standards and labelling); Residues Regulation (EC) 470/2009, Regulation (EC) 2377/90 (that establishes maximum residue levels of authorised veterinary drugs) and Pesticide Regulation (EU) No. 485/2013 (on pesticides and Genetically modified organisms).

Beekeeping Regulations (Government Notice No. 454) 2019

This regulation stipulates rates of fees for various activities or services related to bees' reserves or bees' products. The categories of the fees are:

- Licence fees;
- Fees for entrance, camping, film making, research, etc. In bee reserve
- Grading export certificates;
- Registration of apiary products or bee products dealers for each financial year
- Mineral exploration or mining in national or local government bee reserves
- Any application forms;
- Bee products from Tanzania Forest Services Agency (TFS);
- Beehives produced by TFS;
- Permit for movement of bee colonies and beekeeping appliances;
- Inspection for bee products or apiary products for internal market;
- Import certificate for bee products and beekeeping appliances; and
- Transit pass for apiary products or bee products.

Value chain actors are required to be aware of these fees and pay the appropriate ones whenever engaged with bees' products trades. For example, a trader is required to pay a Transit Pass of TZS 7,500 for any baggage of honey ranging from 31kg to 1000kg, for a weight between 1001kg and 7000kg a Transit Pass of 15,000 has to be paid and more than 7000kg the TP is 20,000/=.

Initiatives for development of bees' products value chain

The Government

One of the core functions of TFS are to establish and manage bee reserves; establish apiaries, managing bee resources in general land, enforcing beekeeping legislation in areas of TFS jurisdiction, provide beekeeping extension services in areas of TFS jurisdiction, develop human resources; collecting beekeeping revenue, and marketing bee products and services. Promotion of beekeeping is done through provision of knowledge and awareness raising. *Saba Saba, Farmer's day) Nane Nane*, National Beehive Setting Day and World Environmental Day are also used to promote beekeeping activities in the country. Other means include production and dissemination of leaflets and posters, radio and Television programmes on sustainable bee keeping.

Each year Tanzania Forest Fund (TaFF) calls for proposals under Small Grant and long term programme. This is a reliable and sustainable financial support for funding among other things beekeeping projects to conserve forest for present and future

generation. Through this initiative, the fund has trained 1,400 beekeepers, 144 beekeeping groups and offer 5,288 beehives and 160 pair of PPEs in 2019/2020. Also, the fund has supported renovation of eight (8) beekeeping station dealing collecting and processing of bee products. The stations include Geita Mbogwe (1), Shinyanga – Kahama (1), Dodoma - Kondoa (1), Mbeya - Rungwe (1), Tabora - Igunga (2), Mara – Bunda (1) and Beekeeping Training Institute (BTI) – Tabora (1). Additionally, TaFF supports establishment of private bee reserves and collection centres to link beekeepers and traders. Beekeepers are supported and encouraged to participate in various trade fairs and National Exhibitions to promote their products. Therefore, the Fund is an opportunity that can be utilized for the bees' products value chain development.

Research Institution

Tanzania Forestry Research Institute (TAFORI) is mandated to conduct beekeeping research and offer advice to improve the role of the beekeeping sector on community livelihoods and national economy. Other research institutions including Sokoine University of Agriculture (SUA), Beekeeping Training Institute (BTI) – Tabora, Forest Training Institute (FTI) to mention few are also doing beekeeping research.

2.4 Bees' Products Supporting Functions

Supporting functions

The role of support function is to help value chain activities to be more efficient. This include extension services, VICOBA, Commercial banks, market information, research institutions. The supporting function can play vital roles in the beekeeping value chain on;

- Provision of materials;
- Technology development through R&D. For example, designing and developing manufacturing techniques and automating processes can be achieved;
- Training human resources who will facilitate beekeeping business activities and help design, market, and sell the product;
- Networking and information sharing; and
- Financing mechanism.

In Tanzania beekeeping is operate at household/individual, groups, cooperatives or at council level:

Beekeeping groups: In most districts were beekeeping is operating individuals and groups are found. Groups approach is preferred by government and supporting agencies because of the following advantages:

- Efficient delivery of training, extension services and other support to beekeepers
- Easier to organise financing and other forms of revolving funds like VICOBA and SACCOS; and
- easier to bulky supply, processing and storage using collection centres.

Beekeepers cooperatives

Cooperative is higher form of organisation compared to groups. Several groups can merge and form a cooperative. They can be primary society, secondary society (Kasulu Beekeepers Cooperative Society and Tabora Beekeepers Cooperative Society), apex or federation. Normally, cooperatives have registrations and regulated under cooperative laws. Usually, cooperatives are able to handle bulky supply of bees' products, can invest in processing technologies and deal with market forces than an individual would be able to do. Other advantages are: they have open membership, leadership with agreed office tenure, limited liability and guaranteed government patronage/guidance. Limited capital, inefficient and corrupt leadership, low motivation of some members, rigid rules, over regulations and lack of business secrecy are some of factors that landed some beekeepers cooperatives in challenges. For example, Tabora Beekeepers Cooperative Society is no longer in operational because of those factors. However, these factors can be minimised if regular training and government intervention and patronage are provided.

Beekeepers and traders'/processors agreements

Medium and large honey processors enter into agreements with beekeepers either individually, groups or cooperative. Traders in this arrangement may provide hives or packaging materials for packing semi processed products. The advantage of this arrangement is that traders are assured of availability of bee's products and producers are guaranteed with ready market.

Tanzania Honey Council

This is non-governmental, non-profit apex body that embraces all actors (individuals, cooperative, institutions, industries and traders). The Council is registered as a company. The aim of the Council is to improve competitiveness, marketing and trade promotion of the beekeeping sector. In addition, it aims to improve coordination and communication efficiency. However, the council has limited funds to enable provision of its services to its members.

MODULE 3: BAMBOO PRODUCTS DEVELOPMENT

3.1 Background

Bamboo is a fast-growing woody grass of a family Poaceae. Worldwide, it comprises of over 1642 species belonging to 91 genera (Vorontsova *et al.*, 2017). It is found in the tropical and sub-tropical regions in about Latitude 46° North and 47° South. It is commonly found in Africa, Asia and Central and South America. However, some species may also grow in mild temperate zones in Europe and North America.

In Tanzania Bamboo grows naturally in highland areas. It is a diverse plant, easily adapts to different climatic and soil conditions (FAO, 2007; Chihongo *et al.*, 2000).

It is reported that bamboo has more than 1,500 documented uses and over 1,000 million people live in houses made of bamboo or with bamboo as the key structural, cladding or roofing element (Baksy, 2013; Khan *et al.*, 2007). Products of bamboos are used in many countries and bamboo industries are thriving in Asia and are quickly expanding across the continents to Africa and America (FAO, 2007). Also, it plays a vital role in soil protection and conservation of water resources in catchment areas.

It has a tremendous potential for economic (local and international trade) development and environmental conservation. It is a major construction material in many countries, particularly in rural areas. It can be used for almost all parts of houses, including posts, roofs, walls, floors, beams, trusses and fences. Also, it is used to produce pulp and paper, panels, boards, veneer, mats, baskets, tools, handles, hats, traditional toys, musical instruments, furniture. It is also important for charcoal production, fencing, basketry, horticultural flower farming and ensure a sustainable supply for various cottage industries and. A wide variety of basic bamboo products such as baskets, trays, lampshades, chairs, tables etc. are crafted in the country to meet domestic demand.

Shoots of young bamboo can be processed into various delicious healthy foods and sometimes used as medicines. Young bamboo shoots are usually consumed as vegetable in curry and also as pickle. The nutritional value of bamboo shoots varies from species to species, harvesting procedure and growing environment (FAO 2007; Vorontsova *et al.*, 2017).

In Tanzania bamboo is still underutilized and underdeveloped. Bamboo is also often overlooked, with timber receiving much more attention. Therefore, there is a need to understand and establish the value chains of bamboo-based products in order to enhance its contribution to livelihoods and poverty reduction of communities. Developing value chains of bamboo products will increase local use and contribute to national economy.

3.2 Bamboo Products Value Chains

Value chains of bamboo products start from bamboo resources (owned by institutions, villages, groups of farmers, individuals etc.) and include harvesting (e.g. by village and traders), processing/manufacturing (e.g. by traditional handicraft makers and professional firms to make various products), transportation (short and long distance transporters), trading (Local, national and international markets) and end-use (by domestic and international users). The chain is summarized in Figure 14.

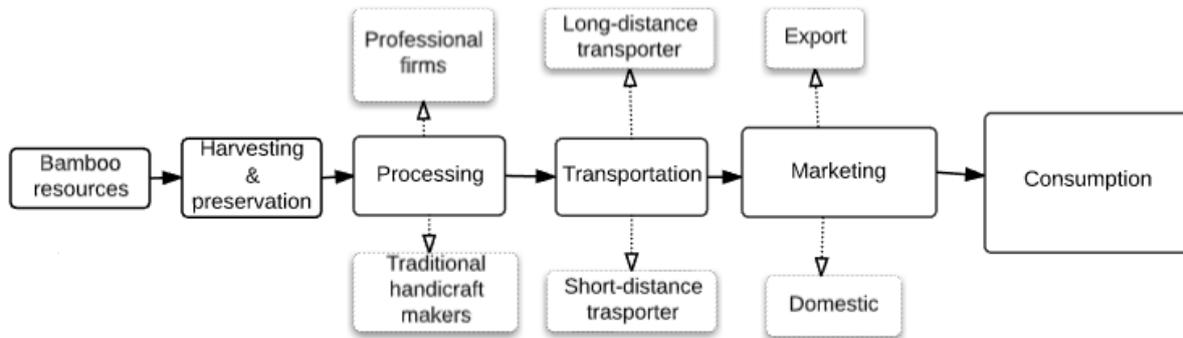


Figure 14: Bamboo products value chain

3.2.1 Bamboo resources

Bamboo covers about one million ha in Mainland Tanzania. About 62% (636,545 ha) of bamboo are in Lindi, Mtwara and Ruvuma regions (Table 6).

Table 6: Coverage of bamboo resources Tanzania by zones

Zone	Regions	Coverage (ha)
Southern zone	Lindi, Mtwara and Ruvuma	636,545
Southern highland zone	Iringa, Njombe and Mbeya	165,030
Western zone	Kigoma and Katavi	128,129
Eastern zone	Morogoro	77,903
Northern zone	Arusha	17,426
Total area		1,025,033

Other regions where bamboo is found in substantial quantities include Arusha, Tanga, Morogoro, Njombe, Iringa, Mbeya, Katavi and Kigoma. There are more in lower than in high altitudes. More than 80% of bamboos are located below 1500 m.a.s.l. (Lyimo *et al.*, 2019). The common bamboo species in Tanzania are *Yushania alpina*, *Bamboo spp.*, *Bambusa bambos*, *Bambusa multiplex*, *Bambusa nutans*, *Bambusa spp.*, *Bambusa vulgaris*, *Dendrocalamus strictus*, *Dendrocalamus nutans*, *Oreobambos buchwaldii* and *Oxytenanthera abyssinica* (Lyimo *et al.*, 2019). Figure 15 shows a map of bamboo species distribution in Tanzania.

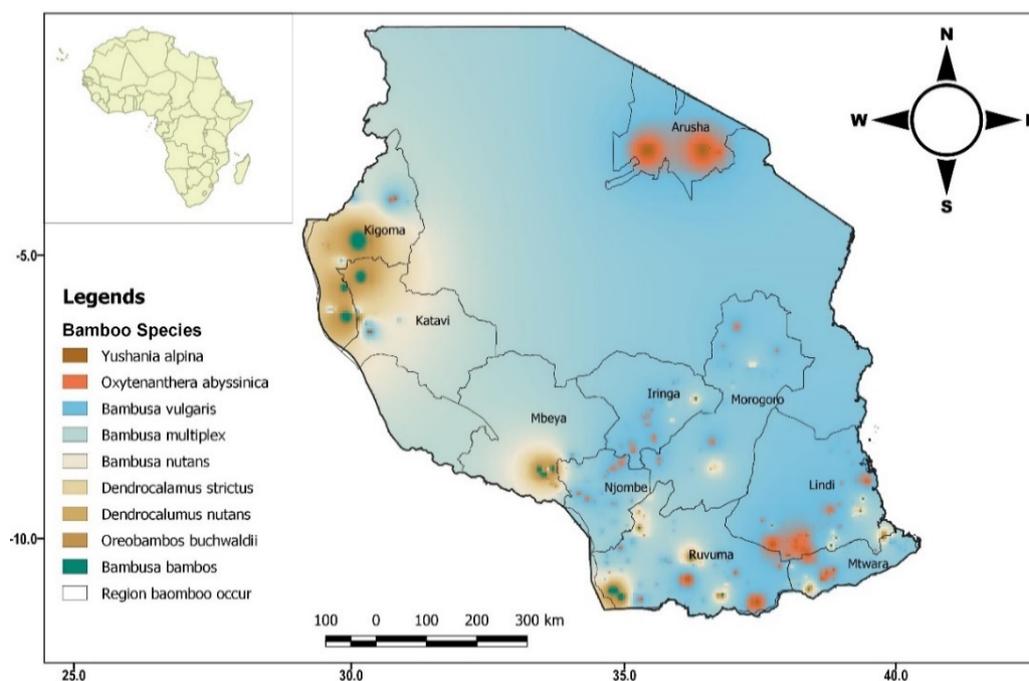


Figure 15: A map of bamboo species distribution in Tanzania

Bamboo resources are distributed across different land use types in Tanzania (Table 7). The highest proportion of resources are in woodland, cultivated land and forest with 66% 12% and 10% respectively.

Table 7: Bamboo resources coverage by type of land use in Tanzania

Land use type	Coverage (ha)
Production forest	458,189
Protection forest	98,403
Wildlife protected areas	118,903
Shifting cultivation	116,854
Agriculture	199,881
Grazing land	3,075
Built up areas	16,401
Water body/wetland	4,100
Others	9,227
Total	1,025,033

3.2.2 Establishment of bamboo resources

Preparation of planting materials

Bamboo propagation can be done using Sexual or Asexual methods (Figure 17).

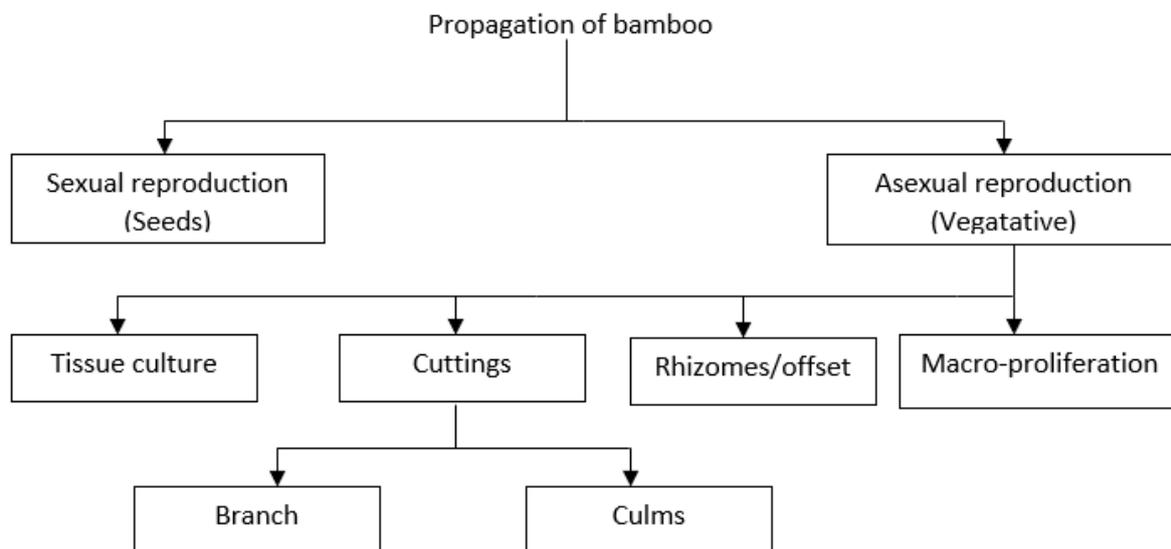


Figure 16: Propagation of Bamboo

Sexual reproduction (seeds)

This is reproduction of bamboo by propagules from seeds, is also known as conventional method. However, availability of seed is a challenge because bamboo flowers once in a life time. Depending on species, most bamboos flower from 10 to over 60 years. Usually, the flowering cycle is gregarious and after flowering, the entire population of bamboo dies. The seeds produced are either washed away on hill slopes during rains, or eaten by rodents (rats). The remaining seeds that fall in a favorable condition germinate to seedlings for another regeneration.

After the gregarious flowering, seeds can be collected, cleaned and stored for 6 months to more than a year. A storage facility with a controlled moisture and low temperature increases longevity of the seeds. Germination capacity of bamboo seeds falls gradually after two months if not stored in such facilities. Or else, seeds should be sown soon after collection. The collected seeds should be properly cleaned, sun dried for 1 to 2 hours and soaked in clean water for 6 to 12 hours to break the dormancy and water is then drained out for 10 to 20 minutes before sowing.

Asexual reproduction (vegetative)

Asexual reproduction is when bamboo is raised by propagules from vegetative parts, is also known as non-conventional method. The following are the types of asexual reproduction of bamboo;

Propagation through Off-set planting

Vegetative propagation by rhizome or off-set is old methodology and the most commonly used to propagate bamboos in Tanzania. It is a feasible method when the planting area is small because availability of large number of propagules is a challenge. It is best if offsets are planted just before the rainy season. In general, success of off-set planting in thin-walled bamboo species is relatively poor and varies greatly from

species to species. Bamboo species with large diameter culms requires larger rhizomes for planting. Off-sets from 1 to 2-year age culms are cut at about 1 to 1.5 m height (with 3 to 5 nodes that can bud) and is excavated along with a portion of rhizome with its root system. The rhizome must be separated by cuttings from its neck carefully causing minimal damage during excavation. Off-sets should be transplanted immediately after the extraction from mother clump and kept in moist gunny bag during transportation. Plant the off-sets in the beginning of the rain season to enable them to establish enough roots to endure dry season.

Propagation through culm cuttings

Vegetative propagation using culm or stem segments is a viable alternative and has several advantages over the other methods. The success and survival rates are higher than in the offset method. The method involves treatment of culm cuttings with growth chemicals to induce root formation. This method can also be used when largescale multiplication of superior varieties is required. Plants raised from cuttings develop to culms much faster than seedlings. The following steps can be used to propagate bamboo through culm cuttings:

- Prepare the nursery beds of about 10m X 1m size;
- Collect and prepare bamboo cuttings;
- Extract 1.6 to 2 years old culms from healthy clumps by cuttings them at the ground level or just above the first node. The propagation should be done before shoot initiation preferably during the month of December-January.
- Remove the tender top thin part of culm bearing leaves and trim the side branches. Do not injure the auxiliary buds on nodes when removing leaves and side branches;
- Transport the culms to the nursery site as quickly as possible. Maximum care should be taken to prevent drying. This can be done either by wrapping the cut end with moist gunny bags or embedding in boxes containing moist saw dust;
- Prepare one or two noded cuttings (cutting with 1-2 nodes leaving 5-cm on either side of nodes) using preferably a hacksaw or a sharp knife. For thin walled bamboos use of hacksaw is advised to avoid splitting of the cut ends; and
- Make an opening (about 2 cm in length and 1 cm in width) or drill two holes (about 7 mm diameter) in the centre of internodes. Care should be taken while making hole that auxiliary buds or branches on both the nodes must lie in lateral plane to the ground.

Treatment of cuttings for root induction

- Dissolve 20 g Naphthalene Acetic Acid (NAA) or Boric Acid in water (0.5 litre). Pour this solution to a clean container and add water to make up 100 litres. Mix the solution thoroughly by stirring. The final concentration of boric acid will be 200 mg/litre of water or equivalent to 200 part per million. This solution is sufficient to treat 1000 cuttings.
- Pour about 100ml of the solution to the culm cavity. To avoid spillage, use wash bottle or funnel to pour the solution through the drilled holes.
- Close the hole by melted wax or by wrapping and tying with a polythene strip (6cm width and 60cm length) or by cello-tape. Ensure that the polythene

wrapping is tight so that solution does not leak out. Keep the cuttings horizontal with the opening facing upwards.

- After extraction, culm cuttings should be treated with NAA/Boric acid as quickly as possible (preferably the same day). If the planting site is far away and there is unavoidable delay for planting, the treated cuttings can be preserved up to three days by keeping in moist.

Planting of cuttings

- Make 10 to 16cm deep furrows at a distance of 40 to 50cm apart across the nursery beds. Depth and distance of furrows can be decreased or increased depending on the diameter of culm cuttings;
- Place the cuttings in furrows horizontally across the nursery beds in such a way that the opening face upward or buds placed laterally. About 50 to 60 cuttings may be planted and raised in the nursery bed of 10m X 1m.
- Cover the cuttings with a 2 to 3 cm layer of soil.
- Frequent irrigation should be given until the roots are properly developed.
- Rooted culms are taken out after flooding the field or during rainy days when bed is loosened. The well rooted plants are detached from culm with roots and poly-potted. The saplings are de-topped with a secateurs or sharp knife to avoid excess respiration.

Propagation through branch cuttings

Thick-walled bamboo species have conspicuous primary branches, therefore branch cutting is the ideal planting material. Its small size and the fact that many branches can be extracted without damaging the mother clump makes it the propagating material of future. In order to guarantee survival, the age of the branch should be between 0.5 to 1 year. Discard the top portion leaving two nodes and the basal swell. Then dip the cuttings in growth regulators like IBA/NAA 200mg/L. Add up to 200 litres equivalent to 200mg/l of water or rootex-3 powder for 24 hours. Seal the cut ends with wax to prevent desiccation. Dip the cuttings in Bavistin (0.1%) solution just before planting. Plant the cuttings vertically either in polybags or raised beds in such a way that the rhizomatous swelling and one node remain below the soil surface. The polybags should be kept under partial shade (75% shade provided by agro shade nets) and irrigated daily. The sprouting and rooting take 1 to 4 months after planting. The successfully rooted and rhizome cuttings be planted in the next rainy season.

Macro-proliferation (Seedling Multiplication)

This method is generally practiced in small seedlings. A bamboo propagule, for successful establishment and growth must possess a well-established root system, rhizome and shoots. The multiplication of bamboo seedlings by rhizome separation leading to smaller sized planting materials is known as macro-proliferation. In order to increase planting stock before transfer to the field, macro-proliferation is practiced. A bamboo seedling, of about 30 to 40 days old, produces new culms and start developing rhizome. At four to five months' period, these plantlets develop five to six culms (tillers). These tillers may be separated into as many units with a small piece of shoot, rhizome and roots. In order to avoid/minimize casualties the seedlings, after separation, should be kept in shade, watered regularly few days and then brought to the nursery beds.

These propagules can attain sizes that can be planted within four months, or they can be further multiplied through macro-proliferation. Banik (1985) reported that five to nine months old seedlings of *B. tulda* can be multiplied 3 to 5 times through this method. The survival rate of these multiplied seedlings is 90 to 100%. By this method a large number of identified planting stocks can be made available. Advantages of this method are that once seedlings of a bamboo species are available the process can be continued at least for a number of years. It is easy to handle and transport the proliferated seedlings (Banik, 1985; Tewari, 1992) as they are small in size due to continuous rhizome separation. Banik (1985) suggested that such a seedling multiplication should not be continued for a very long time. The advantages of this method are that once seedlings of a bamboo are available, the process can be continued at least for a number of years.

Tissue culture

Tissue culture is the development of new plants in an artificial medium under aseptic conditions. Different parts of a plant are used as starting material to establish an *in vitro* culture. These will include embryos, pollen grains and parts such as stems, shoot tips, nodes, root tips, callus and single cells.

Seeds or embryos are germinated directly *in vitro*. seeds may be induced to form multiple shoots or callus depending on the culture medium and environment. Seedlings may be used as sources of nodes for multiple shoot formation in media with cytokinins and auxins. Subsequently, shoots may be rooted *in vitro* with auxin-supplemented medium. Also, seedling tissues may be induced to form calli. By sub-culturing, calli may be multiplied in an appropriate culture medium (usually with 2,4-D or a combination of auxins) and induce them to regenerate new shoots

These different approaches using seed, embryo, seed/seedling tissues will give more plants. By labelling the individual sources, it will be possible to compare the sources.

Planting bamboo

Land preparation should be well done to reduce weeds and other woody growth. However, sparsely distributed trees may be retained as partial shade is beneficial for the bamboo growth. Closely grown clumps create congestion and there will be less workable space. Therefore, most of commercially important bamboo species particularly *Bambusa spp.* needs 5x5-7x7m spacing. In case of a large clump forming bamboos viz. *Dendrocalamus giganteus*, *Dendrocalamus hamiltonii*, 10x10m spacing is recommended.

Pits should be dug at the prescribed distance well before the planting season and kept for weathering for some time. For rhizome and offsets planting pit size should be at least 50x50x50cm and for seedlings or rooted cuttings it may be of 30x30x30cm. The bigger size pits provide sufficient working space for easy establishment and growth of rhizomes.

The good planting season of bamboo is when the physiological changes are inactive. The appropriate time for plantation is during rainy season and the mother bamboo should be planted immediately after pit preparation. During pit preparation, the top

soil and subsoil are kept separately. During planting, top soil is put first around the rooted cuttings offset/ rhizomes/seedlings. After planting, the soil shall be kept moist.

3.2.3 Management of bamboo stand

One of the major causes of the low productivity in the bamboo plantation is the negligence or insufficient tending. Regular weeding is necessary in the first year to reduce competing vegetation, especially the removal of twiners/climbers and mounding/heaping soil each year around the clump before rainy season should be carried out. The weeding regimes need to be decided in accordance with the climatic conditions. Loosening the soil, mulching and mounding may be carried out in the colder months. Productivity can be increased twice by regular tending operations.

Pruning is practiced only in those species that produce thorny thickets like *Bambusa bambos*. This should be started in the second year after planting. All the branches up to 1.5m heights should be pruned leaving one node on the branch stalk.

Thinning is practiced to remove all malformed and damaged culms to ensures the healthy clumps reach their productive age without much congestion. This, also, provides working space and act as a stimulus for vigorous new culm production.

3.2.4 Harvesting, drying and preservation

3.2.4.1 Harvesting

In most cases, harvesting of bamboo is through selection of culms for cutting rather than clear felling. The planted area should normally be ready for first harvesting in about five to seven years. Proper harvesting technique and schedule should be followed in order to ensure continuous production for a long period of time.

- (i) All culms older than 4 years can be harvested.
- (ii) In each clump a few old culms equal to the number of new culms, must be retained.
- (iii) Clumps should never be so overcrowded that culms touch one another at the base.
- (iv) The culms should not be cut lower than the first node above ground level
- (v) Bamboos should be thinned annually during raining season.
- (vi) Damaged, dead and dry culms, debris and cut branches should be removed.
- (vii) The leading exterior culms should not be harvested, even if they are malformed.
- (viii) In case of flowered culms, harvesting should be done after seed shedding.

3.2.4.2 Drying

Drying culms is common in the processing of bamboo for most uses. Culms are also subjected to seasoning prior to machining, processing, and finishing products that are durable, stable and of a high quality. Bamboo culms can be air-dried with or without sunlight or they may be kiln-dried. Air-drying is more common than kiln drying. Bamboo culms may be split into halves to speed up drying operations. Bamboo culms may be thoroughly air-dried in well-ventilated shade for several weeks. Drying can be done by letting the culms stand in a covered area with good air circulation.

Drying can also be done by stacking culms horizontally on racks. In drying large quantities, the butts and tops of the culms are placed alternately, and then tied in bundles to prevent bending. Straightening green culms without application of heat requires several weeks. This is done under the shade, either by suspending the freshly-cut curved culm by the tip and attaching a weight at the other end, or by laying the green culm on a flat surface and applying sufficient pressure over the culm during the period of drying and setting.

3.2.4.3 Preservation

Bamboo culms are vulnerable to decay and attack by fungi or insects, especially powder post beetles. Such attacks reduce the natural durability of bamboo and diminish its value and utility. Post-harvest treatments can help to reduce the risk of decay and attack by pests and thereby increase the useful life and value of bamboo culms. Depending on the end use of the culm, several methods of preservation may be applied to culms prior to their sale or processing. Methods to increase the durability or prolong the service life of bamboo culms are broadly classified into non-chemical and chemical methods

Non-chemical methods

Methods mentioned below are practiced traditionally and are suitable for small-scale industries or farmers with limited resources:

- **Curing:** After harvesting, the culms are left in the field for some time with branches and leaves intact. The transpiration of moisture through the leaves contributes to the reduction of starch in the culm.
- **Smoking:** The bamboo culms are cut into the desired length and stacked above a fire in an enclosed area. The smoke causes the culms to blacken and the heat destroys the starch in the parenchyma cells. Bamboo culms cured with smoke are known to last more than 15 years.
- **White washing:** whole or split bamboo culms are painted with slaked lime. This prevents the entry of moisture into the culm, keeping away stain fungi and halting decay.
- **Construction methods:** mounting bamboo poles over a concrete or stone foundation helps prolong their service life. Since the bamboo is not in contact with the ground, it is less susceptible to attack by fungi and termites.
- **Time of harvesting:** harvesting mature (3 years old or older) culms during the dry season when their starch content is lowest makes them less vulnerable to attack by termites and fungi. If properly dried after harvesting, their useful life is significantly extended.
- **Plastering:** plastering bamboo culms or strips using cow dung mixed either with lime or mortar is effective in extending the durability of low-cost bamboo constructions.

Chemical preservation methods

This approach provides more effective protection than non-chemical methods, however imply greater costs and are only used when greater added-value and a higher quality product are required. Chemical methods include:

- Fumigation: involves the use of chemicals such as Methyl bromide for insect control.
- Steeping or Sap Displacement: green bamboo culms are allowed to stand vertically in a container of preservative solution till adequate chemical is picked up. At times, the culm may be freshly cut with branches and leaves on.
- The Open-tank Treatment: culms are cut to a desired length and are soaked in a solution of a water-soluble preservative for several days. The solution penetrates the culm by diffusion through the ends and partly through the sides.
- Butt Treatment: the bottom part of green bamboo or dried bamboo culm is immersed in a container of preservative, for example an old oil drum. The culms are left for about one week.
- Old Engine Oil: many farmers have been reported to use old engine oil particularly for green culms. The effectiveness of this method has not been widely reported and documented.

The risk of molding in bamboo culms can be reduced by drying culms such that the water content is reduced to less than 15 percent. Stacking bamboo culms above the ground helps prevent molding and subsequent rotting. Storing bamboo in a cool and dry area also helps reduce decay from molding. Coating the bamboo culms with borax or wood preservative chemicals inhibits the formation of molds.

3.2.5 Processing/manufacturing (Processors)

Bamboo can be processed into variety of commercial products such as furniture, building, fencing and roofing materials, floor tiles, ceiling panels, scaffolding, frames for doors and windows as well as window blinds. They can also be used in the pulp industries to manufacture paper, toilet paper and cardboard. Some use bamboo to make fabrics, biochemicals, wine, vinegar and pharmaceuticals.

Some processors in Mbeya and Iringa regions are producing trays, baskets, dustbins, bowls and lampshades. Ruanda Prison Soap Factory produces furniture. The rest of the processors are either private traders or cottage industries. Example of private manufacturers of bamboo furniture are Mbeya Bamboo Women Group, Isongole Bamboo Group in Mbeya and the Njombe Prestige works in Iringa region.

Dar es Salaam, Zanzibar, Moshi and Arusha are main markets for the bamboo products manufactured by processors. The main products preferred in these markets are furniture, lampshades, trays, baskets, dustbins and flower holders. Markets for some bamboo products fluctuate with season. For example, demand for baskets is higher during crop harvesting season because farmers use them to transport their products to market places. In Dar es Salaam some processors earn about Tshs. 50 million annually from bamboo products trade.

Example of products that can be processed from bamboo

Bamboo canes

Bamboo canes are selected from clump and can easily be harvested mostly for domestic use. However, there are some actors harvest for sale. The size of a cane can

reach 10m and this can fetch market price between TZS 1,000 to 2,000 depending on species and distance to area where they are harvested.

Weaving/ handicrafts products: Cut the culm of bamboo into strips. The culm can also be used to produce threads. The strips and threads can be weaved to make fences, mats, walls and baskets.



Figure 17: Handicrafts products

Bamboo semi-products

These products include toothpicks, chopsticks and slats. These are semi-products manufactured in factories (Figure 18).



Figure 18: Various bamboo semi-products

Pictures in Figure 19 shows various bamboo products that can be manufactured. However, in order to make these products skills and machines are required.

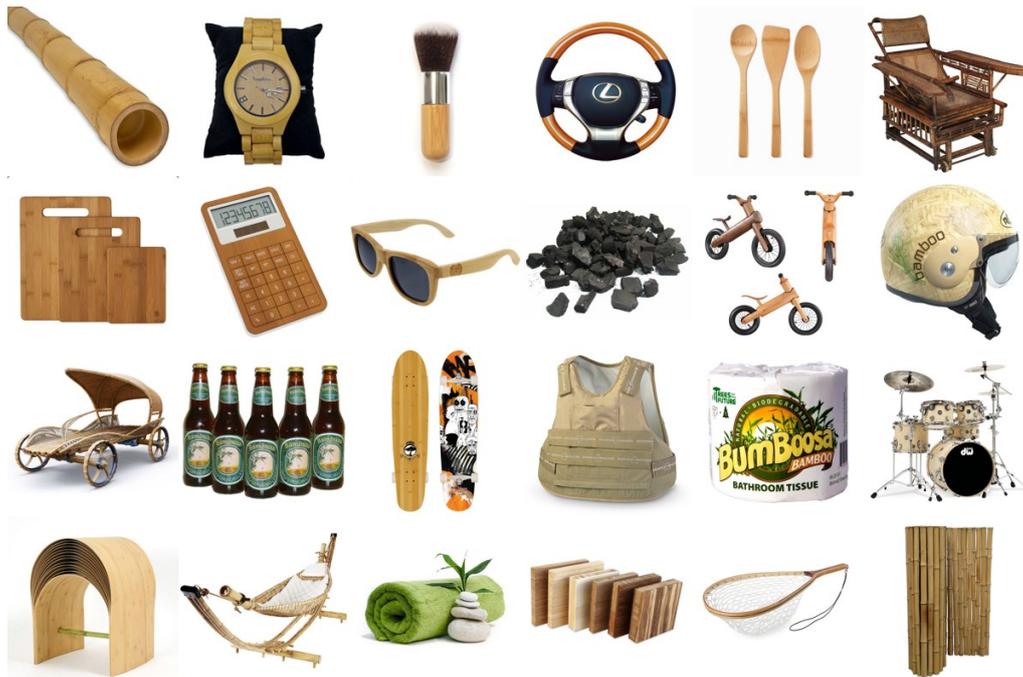


Figure 19: Various final bamboo products

Bamboo wine (Uhazi)

Bamboo wine (*Uhazi*) is one of the popular bamboo products in southern highland of Tanzania). This is made by tapping bamboo sap (Figure 20) especially during rainy season. High volume of wine is tapped if a growing tip is removed and a container is fixed underneath to collect the sap. Can be utilized after fermentation or unfermented.



Figure 20: Tapping of Uhazi in Iringa, Tanzania

Colour, flavour and clarity determine the quality of the wine. To reduce contamination a clean container is needed when tapping the sap. Also, a clean storage facility increases quality.

Bamboo panels

Bamboo panels is old age product. China started producing in the early 19th century. Currently, more than 20 different types of panels are produced in Asia. The panels are

widely used in modern construction as structural elements or as forms for concrete moldings. They are also used for flooring, roofing, partitions, doors and window frames. Bamboo panels have some advantages over wooden boards due to their strength and durability. Various types of bamboo veneers, panels and boards can be broadly classified as: veneers, stripboards, matboards, fibreboards, particle boards, medium density boards, combinations of these, and combinations of these with wood and other ligno-cellulose materials and inorganic substances.

Bamboo flooring: Bamboo provide high quality flooring that can fetch international market (Figure 21). Its smoothness, brightness, stability, resistance, insulation and flexibility make bamboo flooring to have more advantages than that of wooden floors. Bamboo flooring has a soft natural luster and maintains the natural gloss and elegance of bamboo fibre. Europe, Japan and North America are main markets for this product. In 2004, it was estimated that China annual production of bamboo flooring was 17.5 million m² and its exports account for about 65 percent of total production.



Figure 21: Bamboo flooring

Bamboo fuel

Through pyrolysis, bamboo can be converted into three valuable products: charcoal, oil and gas. Bamboo extracts contain valuable elements and can be used in pharmaceuticals, creams and beverages. Bamboo gas can be used as a substitute for petroleum. Its charcoal (Figure 22) is an excellent fuel for cooking and barbequing. Activated charcoal is used as a deodorant, purifier, disinfectant, medicine, agricultural chemical and absorbent of pollution and excessive moisture.



Figure 22: Bamboo charcoal

Bamboo furniture

Compared to wood, bamboo furniture has low weight, therefore efficient to transport long distances (Figure 23). Bamboo can also be glue-laminated to make panels and used to make various items including furniture. Unlike the traditional design, this furniture may be shipped from the country of origin as compact flat packs, and thereafter be assembled in the country of destination. This innovative style overcomes many of the problems of traditional bamboo furniture, such as high labour and transportation costs, low productivity, instability, varying quality and susceptibility to insects and fungi. At the same time, it retains its physical, mechanical, chemical, environmental and aesthetic features of bamboo. Export markets for the laminated bamboo furniture is growing rapidly.



Figure 23: Example of bamboo furniture and other products in Wood Utilization Workshop at Sokoine University of Agriculture

Bamboo Ply board

Bamboo can be used to make ply board especially from matured ones. However, this requires a specific industry.

Activated carbon from bamboo

Activated carbon is a non-graphite form of carbon and is microcrystalline in nature. It has markets in various industries as it is used as absorbent for odour or colour. Other uses include solvent in extraction plants, glucose and sugar industries, water treatment, chemicals, pharmaceuticals, synthetic rayons, electrochemical industries etc.

3.2.6 Transportation

The common transportation mode for bamboo products in many places in Tanzania is bicycles and moto bicycles for shorter and trucks for longer distances. Transportation can be done by traders that owned trucks or transporters. The costs for transportation is usually higher and is directly propositional to the market distances. However, bamboo is characteristically low weight compared to wood, therefore innovative producers could utilize this advantage to reduce transportation costs.

3.2.7 Marketing

Bamboo products access local, national and international markets depending on the quality. Demand is very high for handicrafts despite moderate growth. Chopsticks and toothpicks are highly commoditized with low growth and low profit margins. Emerging bamboo markets is on building products and furniture.

The international market is influenced by:

- Growth in global markets is influenced by the global Gross Domestic Product growth; and
- The attitudes of buyers, prices, market distances, competitiveness of bamboo products compared to alternatives.

Retailers of bamboo products in Dar es Salaam are Handico – Ilala found in Kariakoo Market and Umoja Green Garden at Namanga area, Oysterbay. Although most of the retailers purchase from processors, middlemen are also engaged in the trade. Traders purchase the handicrafts from processors, sell to wholesale in urban centres, who transport to distant markets to end users.

3.3 Bamboo Products Business environment and Supporting Function

The National Forest Policy, National Forest Strategy, National Forest Act and Forest Regulations have various provisions on bamboo. TFS Agency is mandated to administer forest products (including bamboo) trade in Mainland Tanzania. The Forest Regulations provide payable fees that are required to be paid to the Central Government. Table 8 shows historical trend (year 2014 to 2017) of the payable fee for bamboo extracted from natural or plantation forests.

Table 8: Trend of Bamboo payable fees

Payable fee	2014	2015	2017
Diameter under 5cm per piece	1536	1500	900
Diameter over 5cm per piece	1664	1400	600
Transit Pass 7 tonne	6500	7500	7700
Transit Pass above 7 tonne	13000	15000	15400

The price a producer receive in the local market is TZS 2000 per piece. This means that the gross profit (before deducting production costs) is TZS 1400. Local governments have powers to establish their own bylaws, provided that they do not contravene the policy or other national regulatory frameworks.

TAFORI is mandated to provide research leadership. College of Forestry Wildlife and Tourism (CFWT) of Sokoine University of Agriculture, provide professional education, advisory services and research. CBE, FTI and Forest Industries Training Institute (FITI) are required to provide training to technicians and lower cadres. FITI teaches furniture making courses. Tanzania Tree Seed Agency (TTSA) is under TFS among other things is required to provide quality seeds, seedlings and other propagating materials for planting. TaFF is mandated to provide supports to research and intervention projects including bamboo. Also, some non-state actors such as The International Network for Bamboo and Rattan, NGOs and CBOs and private sector provide important roles in support of bamboo value chain development and management and related activities usually in collaboration with government.

Bamboo research in Tanzania under TAFORI dates back between 1902 -1930 when Amani Botanical Garden plantations were established. Among the plants that were introduced in the area were the bamboo species. The researches on bamboo were on soil stabilization, ornamental, agroforestry and for wood production. A large number were planted on steep slopes to stabilize the soil and road banks. Other researches focused on testing suitable species for increasing product diversity in the country.

TAFORI introduced *Bambusa vulgaris* (the golden yellow green and stripped, low altitude bamboo), *Bambusa multiplex*, *B. nutans*, *B. multiplex*, *Chimonobambusa hookeriana*, *Dendrocalamus strictus*, *D. giganteus*, *Gigantochloa aspera*, *Phyllostachys aurea* in Amani arboretum in Muheza District, Tanga Region. All the species showed adaptability to Tanzanian conditions. The species were also planted at a smallscale at Mzinga in Morogoro Region. Another trial recently established focusing on spacing and weeding is of *Dendrocalamus membranaceus* cv. *grandis* in Kibaha, Pwani Region. Additionally, TAFORI researched on the potential of bamboo as an alternative woody supplement in Tanzania. All this research information is available to farmers to develop bamboo value chain in Tanzania.

MODULE 4: WOOD FURNITURE PRODUCTS DEVELOPMENT

4.1 Background

Furniture are objects intended to support seating, sleeping, storing etc. Furniture is also used to hold objects at a suitable height to facilitate working. It can be made from many materials, including metal, plastic, rattan, bamboo and wood. Designs of furniture in some cases reflect culture of a country. This module focuses on furniture made from wood.

Wood furniture industries can be categorized according to products manufactured. Each of products may have own market segment. The harmonized system of product classification distinguishes four wood furniture, namely office, kitchen, bedroom/dining/living and shop furniture. The grouping does not differentiate between craft and mass-produced items or between low- and high-priced furniture.

The furniture sub-sector is part of manufacturing industry, mainly processing wood products and may be integrated with other materials such as lather, sponges, cotton covers. Wood is a primary raw materials used in the furniture sub-sector in Tanzania. The furniture sub-sector has undergone various reforms, for example, during and before independence the furniture industries were under state ownership. Privatization of state-owned enterprises (including furniture) in Tanzania was an essential part of the economic reform process that started in the 1980s. Consequently, all state owned furniture industries were privatized (Temu and Due, 2000). Unfortunately, most of the privatized industries did not perform well. To date, the furniture sub-sector in Tanzania consists mainly of small and Medium Scale Enterprises (SMEs), some with low levels of production, currently selling in local markets (Olomi, 2006). Majority have few skilled labour and operating with low capital (Kristiansen *et al.*, 2005). Additionally, most of these firms are located in urban and few are in rural areas. Majority are run or managed by individuals or groups with low skills, relying on simple hand tools to process wood into furniture (Naliotela and Elias, 2003).

However, furniture sub-sector has significant contribution to the national economy by employing about 17% of the total workforce in the manufacturing industry (Murphy, 2006). This sub-sector is not import-dependent because most of the raw materials used are locally sourced from forests in Tanzania. Therefore, manufacturers could utilize these advantages to increase quality and production (Ishengoma, 2005). Some of the furniture industries complain about the quality of the timber supplied in the country. The consequence is some import timber outside the country, for example from Democratic Republic of Congo. Some industries have low competitiveness, mainly due low level of technologies (Olomi, 2006). Low level of technology of the furniture industries lead to less qualities of the furniture produced and much power/energy consumption which results to increase in the costs of production. Shortage of skills (technical capabilities) is an important constraint in competitiveness. Quality and design capabilities during production are important elements for the furniture enterprises to withheld competition rendered by furniture increasingly exported to Tanzania (Naliotela and Elias, 2003).

Tanzanians also lack sufficient training on furniture design specifically geared towards creativeness on designing varieties and quality furniture. The furniture industry accordingly lags behind most major furniture manufacturers in design education (Olomi, 2006). On another hand Research and development that is needed to support a growing industry. The local taxing policies do not favour furniture SME's prosperity also distribution and transportation costs vary much which affect the consumer prices.

As high local taxes involved on a product until it reaches a domestic consumer lead to increase in price of locally produced product, then obviously local produced products such as furniture may fail to compete with imported products due to high price and low quality of furniture meaning when the price of the local furniture is too high then its demand on local market will be too low as local customers will go to the substitute imported furniture with low price and good quality as well.



Figure 24: Imported furniture and locally made furniture

4.2 Wood Furniture's Value Chain

The main value chain of furniture industries in the country are: (i) from forest, to sawmilling, producers (local, town and in cities – e.g. Dar es Salaam to users; (ii) from forest, sawmilling, producers (local, town and in cities – e.g. Dar es Salaam and to outside the country; and (iii) from outside the country (e.g. Mozambique and DRC Congo) to the cities and local users.

4.2.1 Forest as source of raw material for furniture production

Wood furniture value chain process start from the forest which is the supplier of raw materials for production of wood furniture's. The quality of logs available accompanied with the method of harvesting and processing have the direct impact on the quality of furniture's that will be produced. In harvesting we have to apply proper harvesting techniques in order to avoid destruction of the harvested trees and logs which might cause the breakage of the whole tree or cause internal breakage in the logs as a result timber that will be produced might have cracks which are not suitable for timber aiming for furniture production. In tree felling we have also consider to protect younger trees which will form the logs for the future harvesting, the protection of young trees can be done by proper selection of tree felling direction where by proper formation of notch, back cut and proper tree stump height are

decisive factor toward proper tree felling. After tree felling it follows the process of removing tree branches, log scaling and log cross cutting. The process of logs scaling and crosscutting are prerequisites conditions for production of high quality timber for furniture production and improving yield of logs produced especially when harvesting bent and crooked logs in natural forest.

4.2.2 Sawmilling

Sawmill produced timber which are raw materials for furniture production, sawmilling has big role to play in value addition in furniture production. In production of high quality sawn timber for furniture production saw miller must have knowledge of wood anatomy features of different wood species which will assist in the consideration of producing timber with attractive features which enable the furniture designer to design high quality furniture. Some important wood features that are to be considered when sawing wood for furniture production are shown in Figure 25.



Figure 25: Luster in wood

Some wood possesses a natural luster, which may be distinguished from artificial luster (applied by polishing), in that the former has depth while the latter is superficial. As a rule woods exhibit more luster on radial surface due to exposure of rays.

Wood comes in varieties of natural colours which may range from almost white, as in the sapwood of many species to the jet black of the heartwood of black ebony. Colour differences may exist, however, in a single sample wood, as between sapwood and heartwood (Figure 26:). Heartwood presents a wide variation of colours. Brown of various shades predominate sapwood which is always lighter in colour.



Figure 26: Color in wood

Grain (Figure 27) is unfortunately used wrongly, often confused with figure or texture. Grain refers to the direction of fibers in relation to the long axis of the tree or individual piece of wood.



Figure 27: Wood grain

Figure (e.g. in Figure 28) is used to describe the natural design or pattern on wood surface. Figure of wood of normal structure may be pleasing, more attractive figure may in some cases be produced by structure abnormalities. Grain deviations, burls (rounded outgrowth on stems) and crotches (forked portion of stems), eccentric growth, uneven deposition of color and other irregularities may produce beautiful figure.



Figure 28: Figure in wood

4.2.2.1 Sawing methods for timber value adding

As it was discussed above, in order to produce high quality furniture, saw miller need to know important wood anatomy features. To achieve the required wood features saw miller need to apply appropriate sawing methods. In Tanzania the common method of producing sawn timber is 'through and through' sawing method, this method includes defects such as knots, rot or cracks in piece of wood which lower the

grade of timber. Further this method does not take care of wood anatomical feature, sawn timber produced cannot behave intended wood features as may be requested by furniture designer. In order to achieve the intended wood features taking into consideration the sawing technology employed (Circular sawing Figure 29 or Band sawing Figure 30) the following sawing methods are used;

- Grade sawing method
- Quarter sawing method



Figure 29: Circular sawing technology



Figure 30: Band sawing technology

4.2.2.2 Grade sawing method

In this system of conversion, timber is plain sawn displaying wood features mostly grain, color and luster. Larger diameter logs from the tropical regions are often sawn by this method which maximizes value recovery from logs containing high grade timber. The best quality timber found in the outer parts of the logs (for softwood) and this can be obtained and separated from the lower grades in the inner areas by sawing round the log. Hardwood on the other hands, the outer part of the logs containing sapwood are considered not suitable for furniture production instead the inner part of log consisting of heartwood. The timber is obtained by either cant sawing or grade sawing method. The skill of the sawyer is crucial to achieve high grade timber. The log is first cut to remove slabs to obtain flat base, then turn the log 90 degrees and the process continue. When all four faces have been cut the central cant containing low grade timber is re-sawn. There are very many variations of this technique and the sawyer constantly revises his cutting plan as the interior of the log is exposed. The cutting pattern will also vary depending on the re-sawing machines available at the mill.

The main advantage of this system is its flexibility and high grade timber can be sawn from logs of varying quality. For large and mature logs, a defective interior can be separated from an outer are of clear wood. Large ring shakes or gum pockets may be cut out in one board, instead of affecting a number of boards. The largely plain sawn boards will dry rapidly than quarter sawn pieces.

4.2.2.3 Quarter sawing method

With this method, the log is sawn with the cuts placed parallel (as far as possible) to the wood rays and perpendicular to the growth rings. The aim is to produce boards which are quarter sawn to varying extent. The name comes from the act that the log may be first sawn into quarters (along two diameters roughly at right angles) before subsequent sawing.

The quarter sawing is time consuming and wasteful and requires frequent turning of the log (fig...). Quarter sawing is mainly, but not solely confined to the conversion of the more decorative and valuable hardwoods, where an attractive appearance or stability such as Oak, Sapele and some Mahoganies are sometimes converted in this way to reveal the figure, color and luster. In this type of conversion, value recovery is more important than volume recovery as the low recovery is compensated with high price of sawn timber.

4.2.2.4 Timber seasoning

Wood drying (also seasoning lumber or wood seasoning) reduces the moisture content of wood before its use. When the drying is done in a kiln, the product is known as kiln-dried timber or lumber, whereas air drying is the more traditional method. Seasoning is the process of removing the moisture content from wood to minimize structural problems and improving its workability in furniture making, when using dry wood, it is easy to make different machining process such as planing sanding, gluing, boring etc. There are two main ways of seasoning timber, Natural (Air) and Artificial (Kiln) drying. Both methods require the timber be stacked and

separated to allow the full circulation flow of air, etc. around the stack. Air seasoning is the method used with the timber stacked in the open air.

4.2.2.5 Furniture production

Workshop and workshop equipment

A perfect workshop is barely existing; it will always outgrow itself, or changing fashions will create other demands in working space or equipment. Ideal working conditions regardless of expense could probably be formulated; but in all professional work the prime necessity is to keep the capital outlay within the framework of the turnover to be expected, and every money spent on premises, equipment or materials must earn its keep if the business is to be successful.

Production workshop

Mass produced, i.e. quantity production, furniture is more the result of business expertise and engineering skill than the application of fine craftsmanship, although furniture is and probably always will be a craft-based industry whilst it continues to use natural and viable materials. The modern factory employs porters, kilners, machinist, assemblers and finishers. However most large concern keeps a nucleus of skilled craftsmen for prototype-work, whilst all learners and apprentices do, or should receive day release training in either wood machining or the basic hand- skills. In effect, therefore, a modern furniture factory which is efficient, well organized, and anxious to maintain standard of quality is the basic hand shop vastly extended, systemized and mechanized in which the skilled fingers which once held chisel, wielded planes have now learnt to use machines for precisely similar functions.

Hand workshops planning and equipment

Only general observations are possible for there are so many factors to be considered, number of personnel, type, variety and standard of work which is to be produced, the amount of fixed machinery which is to be employed. In factory production the work flow can be systematically planned from kiln drying units to the polishing shop through a system of intercommunicating units. For small hand shop which caters for specials, once off or contract furniture, with an occasional prototype for a large concern, short runs of smaller items, coffee tables, etc., and a certain amount of bread and butter repair work, most if not all of these activities must be carried on under one roof and compromises are inevitable. More immediate consideration is three phase electricity supply, good natural lighting, a dry shop and pleasant surroundings, for physiological effect in considerable with skilled craftsmen working to high standards. Window should be adequate to give a general flooding, for light from one side only can create dark shadows and dangerous twilight areas. Artificial lighting should be plentiful; but whilst fluorescent lighting is excellent for general flooding, it creates little if any shadow and it is then difficult to judge both depth and surface texture, therefore drop pendants over each bench are essential if there are much working after nightfall. In particular, all fixed machinery should be lit from every angle with no harsh shadows; but the quality of the lightning must be such that all moving parts are seen to be moving. If heavy machinery is included in the workshop some form of concrete raft is necessary, with the working areas round each machine heavily dressed with coarse carborundum powder in the surface screening; but the rest of the working

areas is better capped with wood if possible. Wooden floor should not be waxed or polished in any way for they become slippery and cause accident.

Woodworking and allied machines

In increasing value in furniture certain basic machines are indispensable to every workshop even where hand work predominates. These are circular table saw; radial arm-saw; band-saw; planers; spindle molder, shaper; mortise; horizontal borer; overhead table router; drill-press; bench-grinder; sanders and lathes.

Circular table saw

As a rough approximation it is usual to take one-third of the diameter of a circular saw as its effective cut, therefore a 381 mm saw giving a cut of about 127 mm would be about the minimum for general work. However, many large concerns do not use timber thicker than 38 mm building up for larger dimensions, and this greatly simplifies their stocks, while large-diameter saws are no longer necessary and most of the work is done on the 304 mm sliding-table panel-saw which is an excellent compromise if large boards of ply and chipboard are used to any great extent. Additionally, it is never advisable to fit small saws for ripping out stringers and bandings, etc. to large-diameter table saws, but they could be used in the smaller saws. (Where space permits it is advisable to double up with a small 8 or 9 inch diameter table saw for delicate cabinet work.) Whatever table saw is chosen it should be sturdy, adequately guarded, with an elevating spindle and tilting arbor, and with a minimum 3 Hp (2.237 kW) motor for 12 in (304 mm) or 15 in (381 mm) benches.

Band saw

The effectiveness of this machine is governed by the throat depth, i. e. distance from saw to body framework, and a 20 in (508 mm) band-saw will cut a width of 19 1/2 in (495 mm) and a depth or thickness of 13 in (330 mm). The smaller machines (12 in [304 mm] throat, etc.) have small-diameter wheels imposing greater strain on the band-saws, therefore here again it should be as large as possible. All machines have (or should have) a tilting table and ripping fence, the saw-pulleys, and positive adjustment to the ripping fence. For most hardwood cutting it is advisable to purchase skip teeth blades. These keep their edge so much longer and can be reground within the workshop on a fine grinding wheel.

Planers

A skilled machinist can accurately thickness a panel on an overhead surface planer/jointer but it requires practice and is dangerous. Ideally one should have a long bedded surface planer for the accurate truing of one surface and long edges, and a separate thicknesser/surfacer to reduce stock to a consistent thickness. Alternatively, where space and cost are crucial, a combination surface planer and thicknesser, often referred to as an over and under, would suffice. All these machines come in a variety of cutter widths from 9 in (228 mm) up to 36 in (914 mm) with the large thicknesser/surfacers.

Spindle moulder/shaper

The most versatile and yet the most dangerous machine in any workshop, the spindle moulder can, in the hands of the expert, almost perform miracles, but in the hands of the unexperienced it can be lethal. Instruction in its use is strongly recommended. Not only can this machine mould virtually any shape both on straight and curved surfaces, but it can also, with the aid of templates, produce any number of identically shaped components from chair legs and curved rails to drawer handles. It can tongue and groove faster than any other machine, and with the addition of a sliding table it can cut all manner of tenon and bridle joints, dovetail housings—the list is endless.

Mortiser

This is an essential item of equipment where any production work is involved. It is possible in one-off work to manage with a hollow chisel mortising attachment fitted to a drill press, but eventually the advantages of a separate mortiser will become only too apparent. There are two forms of mortiser: the hollow chisel type, and the chain mortiser, which works in a similar way to the chain saw. It is chiefly the former which is used in quality craft orientated workshops because it produces the perfect square edge and square bottomed mortises from 1/4 in (6 mm) width up to 1 in (25 mm) or more.

Horizontal borer

The mortise and tenon joint will always be preferable in quality work to dowelling, but where economy of time is vital, the horizontal borer is an obvious alternative to the mortiser. It usually has two drilling heads side by side and an adjustable table for height. With the table set at the right height and pushed forward by the pre-set distance against the revolving bit it gave very accurate borings, and such machines, either independent or as accessories coupled to other machines, are invaluable for accurate dowel-work. Both the mortiser and the horizontal borers have the advantage of operating at very slow speeds and quietly, in contrast to the overhead and portable routers which can be used in some shallow mortising operations.

Bench-grinder

The bench-grinder is virtually indispensable for the rapid grinding of cutting edges, moulding blanks, etc., and the various abrasive wheels

Sanders

The most useful sander for the cabinet-maker, if space permits, is the pad belt sander. This often includes a built-in sanding disc with table, and also a finishing table for sanding smaller objects. Pad sanders come in a variety of lengths and increase considerably in price with each extra foot. The belts are normally 6 in (152 mm) wide and can be made up to order to any length in a variety of grits and either cloth- or paperbacked. Adequate and separate dust collection is usually essential, since the fans that are built into many machines for this purpose are rarely adequate for full protection.

Woodturning lathes

Most furniture-makers require turned components from time to time, from chair legs to turned drawer knobs, so it makes sense, if space permits, to undertake this within the workshop. The woodturning lathe can also be a useful source of income, and

bowls and platters, often from the waste products of furniture making, can keep apprentices and trainees gainfully employed between orders. It is preferable to purchase as heavy a machine as one can afford, with a bed long enough to take dining or side table legs

Production and assembly

Wood preparation

Preliminaries to any sound furniture making of high value are as follows

- (1) A full cutting list of all the pieces required;
- (2) Good timber free from natural defects, accurately sawn and planed up flat, square and out of twist;
- (3) careful planning of the work ahead, including the choosing of appropriate jointing methods, the order in which they are to be cut and the order and method in which the various pieces and parts are to be assembled in the completed carcass.

Raw materials and components

The raw materials and components for furniture are metal, glass, rattan, wood products (including plywood, cut stock, and frames), padding, and coverings (leather, manmade leather, and upholstery). The materials and components used in furniture have their own value chain, each with their own dynamics. While oftentimes overlooked, most of the high technology content in the furniture value chain is a function of trends in the composition and manufacture of raw materials and components. Four particularly prominent examples are

- 1) Engineered wood products using special glues and finishes;
- 2) Composite resins, plastics, and metals to achieve a desired look or feel,
- 3) The use of nonwoven textiles for batting and fire-proofing foam,
- 4) The use of coatings on furniture covering to achieve an aesthetic or functional quality such as stain-proofing or durability.

Furniture assembly

Wood furniture can either be finished or then assembled, or the reverse. Furniture made of irregularly shaped components is usually assembled and then finished. The assembly process usually involves the use of adhesives (either synthetic or natural) in conjunction with other joining methods, such as nailing, followed by the application of veneers. Purchased veneers are trimmed to correct size and patterns, and bonded to purchased chipboard. After assembly, the furniture part is examined to ensure a smooth surface for finishing. After initial sanding, an even smoother surface is attained by spraying, sponging or dipping the furniture part with water to cause the wood fibers to swell and “raise”. After the surface has dried, a solution of glue or resin is applied and allowed to dry. The raised fibers are then sanded down to form a smooth surface. If the wood contains rosin, which can interfere with the effectiveness of certain finishes, it may be deracinated by applying a mixture of acetone and ammonia. The wood is then bleached by spraying, sponging or dipping the wood into a bleaching agent such as hydrogen peroxide. Surface finishing may involve the use of a large variety of coatings. These coatings are applied after the product is assembled or in a flat line operation before assembly. Coatings could normally include fillers, stains, glazes, sealers, lacquers, paints, varnishes and other finishes. The coatings

may be applied by spray, brush, pad, dip, roller or flow-coating machine. Coatings can be either solvent based or water based. Paints may contain a wide variety of pigments, depending on the desired color.

Furniture finishing

Furniture finishing process is utmost process in value addition and involve several methods as follows;

- 1) ***Surface coating*** are clear, built-up, highly durable finishes that are virtually maintenance-free. Examples of surface coatings are varnish, shellac and lacquer. Surface coating finishes will add depth and warmth to the appearance of the woodwork, while enhancing the color and grain.
- 2) ***Natural' Finishes*** are clear finishes that are used to add luster, warmth, and character to the wood while protecting it from wear and tear.
- 3) ***Pigmented finishes*** are not transparent, and basically resembles paint. Black lacquer is a pigmented finish, it offer finish in any color and sheen. An example of this would be a kitchen table with a 'natural' maple top and a forest green 'pigmented' base. Pigmented finishes can also be distressed and/or glazed.
- 4) ***Penetrating Finish***, as the name suggests, penetrates the wood grain rather than 'setting up' on the surface and leaves no appreciable surface coating or film. This is done with oil. Oil will impart a beautiful low luster finish, but requires more maintenance than the surface coating finish. Generally speaking, a penetrating finish is used when striving for a modern look.
- 5) ***Wax Polish*** is the ultimate rich-looking and labor intensive finish that seals and protects the wood. It is used to rejuvenate and old finish or can be used as a finish itself. Surprising to most, a professionally applied wax finish requires little maintenance. It can also be applied over a penetrating finish, to reduce the amount of maintenance that would typically be required.
- 6) ***Staining*** is used to enhance the true color of the woodwork or to achieve uniformity when the wood has an inconsistent appearance. It can also be used to change the natural color of the wood to a color more in keeping with the owner's tastes.
- 7) ***Glazing and Toning*** are techniques used to highlight the details in the woodwork or to unify and add depth to the color. These two techniques can also be used to give "age" to the finish. The process is one of applying transparent pigmented liquid over or between coats of finish.
- 8) ***Pickling and liming*** are traditional finishing processes used to accentuate the wood grain. The highlighting is achieved by using two contrasting colors: a base color and another color rubbed into the grain.
- 8) ***Bleaching*** is used to lighten the natural color of wood or to remove discoloration caused by moisture. Bleaching can also be used to achieve the

base color in preparation for pickling or liming. It is not used to remove stain or dyes.

9) *Distressing* is a technique that can be used to give age and interest to the finish. This can be done any number of ways, including:

- *sanding* the finish away from areas that would have been worn over
- *rubbing* the finish away with a chemical
- *striking* the surface with a mix of objects that will randomly dent the finish

4.3 Wood Furniture's Business Environment

4.3.1 Actors

The carpentry and furniture sector is dominated by a huge number of micro, small and medium enterprises. They either offer their services directly to the consumers or work as sub-contractors for construction companies. The activities of these actors are closely related to the construction sector and its market dynamics. Another important market is public procurement of furniture. Many small and medium size enterprises in the wood sector are represented by the Tanzania Forest Industries Federation (*Shirikisho la Viwanda vya Mimitu Tanzania, SHIVIMITA*). Large construction contractors frequently run their own furniture and carpentry workshops, sourcing raw material from intermediary traders or (i.e. when treated timber is required) directly from the producers. The products produced are as numerous as the raw materials (plywood, sawn wood, MDF board, block board, etc.) and species (natural forest and plantation) used.

The carpentry and furniture sector in Tanzania still consumes significant volumes of natural forest timber. Prices for natural forest timber have significantly increased in recent years and availability is declining. This sector is strongly affected by frequently changing consumer preferences regarding styles and designs. Competition by imported furniture is of huge relevance. The average import price of wood furniture in 2015 was USD 1.2/kg (CIF), which indicates low quality furniture. If considering the local market prices for sawn hardwood furniture of around USD 0.9/kg to USD 1.3/kg, local producers are likely finding it difficult to compete. There is also an increasing trend in importing pre-fabricated carpentry and fittings for construction works, e.g. CNC worked MDF moldings. There are few Tanzania companies engaged in the production of such products, e.g. TANWAT has established processing lines for moldings and wood panel doors, and some other larger companies engaging are in carpentry as part of their value adding strategy. Plantation timber (softwoods) and wood based panels of any type are increasingly used for frames and doors, and in local furniture manufacturing. SMEs hardly participate in public tenders due to complex procedures. There is no established communication channel to articulate SMEs interests to policy actors and large-scale consumers. Frequently public tenders for furniture (schools, office) require native hardwoods in their specifications losing out on the potential cost reduction from using low cost plantation species (i.e. pine). Compliance with standards and quality requirements is rare in the sector, caused by lack of training and advanced processing technologies, but also difficult access to standard specifications (only available as hardcopies and in English).

4.3.2 Market trends

Overall market size is increasing alongside the growing construction sector. Other important changes are taking place in this market segment, offering possibilities, but also posing threats to Tanzanian producers and products. Plantation timber is increasingly accepted by the furniture market. However, a real substitute for natural hardwoods has not been identified so far. Eucalyptus and Teak are frequently discussed as options, but due to lack of quality sawn wood in the domestic market, the use and demand has not taken off yet. Eucalyptus products in particular would

require additional treatment to influence wood characteristics (e.g. darker colors are preferred by the market). There are signs of increased substitution of solid wood products with wood based panels of any kind (i.e. plywood, MDF and block board; imports have increased by 20% since 2011; in various applications (i.e. doors, fittings and furniture). Wooden window frames are increasingly replaced by aluminium, which is readily available and cheaper than timber. Further the aluminium frames show better work-match characteristics than wood frames. In the long run, wooden window frames will likely lose importance. Other wood and non-wood substitutes have also become increasingly important, import trends in the furniture sector show decreasing shares of wood furniture and an increase in plastic and metal furniture (import share of wood furniture in total furniture imports has decreased from 47% in 2011 to 37% in 2015).

The market volume of furniture and joinery was 590,000 m³ (rwe) in 2013, of which 12% were imported wooden furniture. Although plantation timber has entered the market (e.g. frames for upholstered furniture, beds or for doors), the majority of wood consumed were natural hardwoods. The demand forecast for carpentry and furniture predicts a volume increase by 250% between 2013 and 2035 with wood based material dominating sawn timber. The indirect effect of this substitution process can be a higher efficiency rate in terms of round wood use, provided that these wood based panels are produced in the country.

4.4 Wood Furniture's Supporting Functions

For the sustainability of furniture and wood industries, there is need for industry to realign itself to match with country's policy and adhering to the economic aspects as discussed below

4.4.1 Related policy in line with furniture industries

The National Forest Policy, 1998

The National Forest Policy emphasizes on the maintenance stability by preservation and restoration of the ecological balance that has been unfavorably disturbed by serious depletion of the country forests to increase their productivity sustainably by:

- (a) Ensured sustainable supply of forest products and services by maintaining enough forest area under effective management;
- (b) Increased employment and foreign exchange earnings through sustainable forest-Based industrial development and trade;
- (c) Ensured ecosystem stability through conservation of forest biodiversity, water Catchments and soil fertility; and
- (d) Enhanced national capacity to manage and develop the forest sector in collaboration with other stakeholders.

National Education Policy (NEP), 2014

The foundation of education and training will focus on building capacity to Tanzanian to be the best values for formation, ethics, skills, competence and enable self-reliance. The autonomous education will continue to facilitate education delivery and training to focus on changes in society, politics, economic, scientific and technological. The aim of the country is to reach the medium economy by 2025, where the education and training has been entrusted with

the preparation of sufficient resources to meet the world economy changes. The main objective of the NEP is to have qualified Tanzanians with knowledge and skills to be able to contribute rapidly to national development and withstand the competition. The specific objectives of the NEP are to have:

- (a) System, structural and structural processes enable Tanzanians develop in various ways in professional and professional speeds;
- (b) Education and training with quality standards internationally, regional and national;
- (c) Access to various educational opportunities and training in the country;
- (d) Increasing resources according to priorities of the nation;
- (e) Effective management and management of education and training in the country;
- (f) The sustainable system of education and education training in the country; and
- (g) Education and training system, focusing on issues crossing.

The National Sustainable Industries Development Policy, 1996

The policy framework for Tanzania's industrial development within short, medium and long-term perspective emphasizes on the following:

- (a) Establishment of capacities in areas with clear potential of gaining competitive advantage through the process of learning and application of efficient technology;
- (b) Promotion of light capacity goods and manufacturing industries;
- (c) Exploitation of Tanzania's iron ore deposit at Mchuchuma and Katewake;
- (d) Promotion of engineering industries that manufacture tools and appliances; and
- (e) Development of the education system with due emphasis on technical education.

The Sustainable Development Goals by 2016 to 2030

The sustainable Development Goals (SDGs), officially known as transforming our world: the 2030 Agenda for Sustainable Development, among others put emphasis the following:

- a) Energy – Ensure access to affordable, reliable, sustainable, and clean energy for all;
- b) Economic growth – promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all;
- c) Infrastructure and industrialization – build a resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation;
- d) Climate change – tackling climate change will only be possible if the SDGs are met.

The Tanzania Development Vision 2025

The major aspiration of Tanzania is to transform its economy from a low productivity agricultural economy to a semi-industrialized one led by modernized and highly productive agricultural activities. In realizing its aspiration, the Government is aiming

at improving the quality of education and health infrastructures, raising the proportion of the rural urban population. The nation, therefore, counts on transport to be one of the major vehicles for realization of these aspirations, since most of them depend on the ability of technical managers to adapt, improve and maintain technology and technological changes as a permanent ongoing process.

The National Environmental Policy, 1997

The policy for environmental extrapolated the objectives as follows:

- (a) To ensure sustainability, security and equitable use of resources for meeting the basic needs of the present and future generations without degrading the present and future generations without degrading the environment or risking health or safety;
- (b) To prevent and control degradation of land, water, vegetation and air, which constitute our life support systems;
- (c) To conserve and enhance our natural and man-made heritage, including the biological diversity of the unique ecosystems of Tanzania;
- (d) To improve the condition and productivity of degraded areas including rural and urban settlements in order that all Tanzanians may live safe, healthful, productive and aesthetically pleasing surroundings;
- (e) To raise public awareness and understanding of the essential linkages between environment and community participation in environmental action; and
- (f) To promote international cooperation on the environment agenda and expand our participation and contribution to relevant bilateral, sub-regional, regional and global organizations and programs including implementation of Treaties.

4.5 Product innovations

The control over manufacturing activities is not only fundamental in the customization of high-end products, but it is also important in fostering product innovation. Particularly in industries where product innovation is embedded in production processes, the marginalization of operations may severely affect firms' innovation capabilities. This is likely the case in the furniture industry, where product innovation often arises from close relationships between industrial designers, skilled workers, and specialized suppliers.

4.5.1 Process innovations

Manufacturers typically do not like to maintain inventory of finished goods, and instead prefer to manufacture on demand or develop relationships with wholesalers to maintain inventory. The capability to manufacture on demand, particularly when customization is required. Some domestic manufacturers are moving to the manufacturing on demand model, most manufacturing, in which continual process improvements are made throughout the manufacturing supply chain, are being adopted by some leading manufacturers. In addition, one novel process innovation we have seen recently is furniture assembler to have suppliers near the production location in order to be able to manufacture on demand. Consequentially, input and component suppliers hold materials and supplies inventory rather than the furniture manufacturer and assembler.

4.5.2 Technology and expertise improvement on furniture industry

According to Geneva (2005), advanced technology on globally imported furniture is seen as important factor in availability of varieties of furniture, where technology plays a central role in the process of economic development, in contrast to the 36 traditional economic growth of countries where technological level is very less, also the economic growth is less and dynamic, technology brought furniture easy, quickly and at acceptable quality and innovativeness, the review highlighted the dependence of growth rates on the state of local furniture enterprise's technology relative to that of the rest of the world. Thus, growth rates in developing countries like Tanzania are, in part, explained by 'catch-up' process in the level of technology, the rate of economic growth of a backward country depends on the extent of adoption and implementation of new technologies that are already in use in leading countries. Considering foreign direct investment by multinational corporations (MNCs) on the access to advanced technologies by developing countries, they are among the most technologically advanced firms accounting for a substantial part of the world's research and development investment where recent work on economic growth has highlighted the role of foreign direct investment in the technological progress of developing countries. Foreign direct investment increases the rate of technical progress in the host country through a 'contagion' effect from the more advanced technology (Dunne, 2009). Imported products and foreign activities in host country is an important vehicle for the transfer of technology and contributing to economic growth of the host country. Moreover, there is a strong complementary effect between foreign products in host country on the contribution to economic growth enhanced by its interaction with the level of human capital in the host country (You, 2007). However, what is imported or transferred to Tanzania is furniture only but there is no technology transfer since the manufacturing process of that foreign/imported furniture is done at foreign country. Despite the fact that foreign furniture plays a cretin role in technology improvement at host country, but availability of imported furniture in Tanzania market have great negative impact on Tanzania economy and other sectors, since the demand of local furniture becomes very less compared to the imported ones.

4.5.3 Promotion and Advertisement of the Furniture

Promotion is an intricate part of market mix while others include product, price and place, with promotional activities, a firm communicates directly with potential customers, promotion is an attempt to influence, promotional activities are designed to inform, persuade, or remind the market of the firm and its products and ultimately to influence consumers feelings, beliefs and behavior (Wen-fei, 2004). The absence of promotion and advertisements on local furniture lead to less influence on customer's feelings, beliefs and behavior on preferring local furniture instead of imported ones. The Chartered Institute of Marketing (2009) described promotion mix as a term used to describe the set of tools that a business can use to communicate effectively the benefits of its products or services to its customers, the tools of the promotion mix include advertising, public relations, sales promotions, direct marketing and direct sales. The Chartered Institute of Marketing added that once the plan for the promotion mix have been completed then plan and undertake a certain promotion activity to make sure they meet objectives. The local furniture enterprises should consider promotion objectives that will lead to win local market so as to sell more than imported

furniture. For the local furniture to be preferred over imported ones, the local enterprises should choose the right promotion mix. The Chartered Institute of Marketing (2009) clarify the promotion mix that, advertising programs can be expensive and need to be planned ahead in order to meet publishing deadlines; public relation, a campaign will only be success if it has been planned, coordinated and measured against a desired set of results; sales promotion, these needs to be effectively managed by setting objectives for each promotion and evaluating the results after the event; direct marketing, weigh up the benefits of using enterprises own list against a bought-in list and whatever choice made the enterprise has to be prepared to follow up the activity to create sale; sales representative, a sales force needs to be motivated and managed to achieve sales targets. So the local furniture has to dedicate enough time and resources for training, motivation and personal development before the promotion and advertisements as well become full effective.

On the production side, evidence of this global trend can be observed in the growth of exports from transitional economies, in terms of production volume and added value in the overall manufacturing industry, starting from 1993. This growth was strongly displayed in the furniture and woodworking sector. Growth of manufacturing in developing areas, excluding transitional economies, was powered by production of radios, televisions, communications equipment, and automobiles (You, 2007). The challenge is to choose the right mix for promotion activities to suit a particular business (furniture business) at a particular time and to then use it correctly to achieve a result. The combination of tools to be used depend on the targeted audience (customers), the message that furniture enterprise (sellers) wish to communicate and available budget for promotion (Wen-fei, 2004). If customers don't know of what varieties, quality, price, appearance and availability of furniture the enterprise/business provides, then the business won't survive in today's competitive furniture market. Effective communication with customers is vital to ensure furniture business generates sales and profits. In mature markets, the growth of the furniture trade relies on shortening replacement cycles by stimulating consumers to buy new furniture before their existing furniture is worn out.

According to Geneva (2004) the media and television in particular, are playing a strong role as stimulator to furniture customers, TV specials are used, particularly in Europe, to prepare the market for new products by raising interest in home interior design and prompting more consumers to buy new furniture purely for design or fashion reasons. This has also increased demand for a wider variety of products than in the past. Actually the performance of the household furniture market is dependent on the general economy as a whole, the level of house building, household formation, and moving/renovation activity. Moving to a new house often triggers the purchase of replacement furniture, even from consumers who are not first-time buyers. Consumers setting up a home for the first time will usually purchase a wider range of household furniture than will movers. Spanish furniture manufacturers spend the biggest part of their promotional funds on participating in trade shows (about 50% of their budgets). Of the remaining amount, the largest expenses are for publicity in specialized magazines (about 30% of the total), followed by minor expenses (direct promotion, publicity in non-specialized magazines) (Geneva, 2004). The problem with local furniture enterprises is they don't set budget for promotions

and advertisements. There is opportunity for local furniture manufacturers to do even Internet based marketing such as through websites which seems to be less expensive than other means of advertisements such as Televisions and advantageous of this is the number of Tanzanians using internet services is large and it increase more day after day.

MODULE 5: MANAGING BUSINESS

5.1 Saving

Savings are money or other assets kept over a period of time, usually not to be consumed immediately but in the future. Savings can be kept in a bank or any other safe place for making profit or kept in places where the risk of loss or spending is low.

Savings can be done through

- Small but regular deposits – this happens when someone has decided to sacrifice current consumption (use of assets, e.g. of money and goods) in order to increase the availability of assets for future consumption. It, therefore, involves postponing expenditures in a view to accumulating a sizeable amount of resources for future use.
- Automatic deductions from salaries, wages or income - this type of saving is not voluntary. It is a system used by most employers under the labour law

5.2 Advantage of saving

- To meet needs in the future
- To have access to monetary or other assets whenever needed
- To ensure financial independence
- To make one's resources inaccessible for others without one's approval
- To safely store surplus
- To acquire skills for proper money management and self-discipline
- To qualify for certain types of loans

5.3 Forms of Saving

- Informal saving: Savings societies, village banking
- Traditional forms of saving: Buying assets (e.g. houses, animals, artworks), holding cash in pots, or mattresses.
- Formal savings: Bank savings account; savings account with microfinance institutions.

5.4 Advantages and Disadvantages of different forms of saving

At home

Advantages:

- You do not have to travel.
- Don't have to follow procedure to withdraw money
- Can be used at any point of time

Disadvantages:

- You are tempted to use the money;
- It may not be safe.

At the bank:

Advantages:

- The money is safe;
- You will get interest on the money.

Disadvantages:

- You may have to travel;
- Banks are formal institutions, which may discourage people.

With a savings group:

Advantages:

- You do not have to travel;
- You are encouraged by other group members to save.

Disadvantage:

- The money-collector may not always be reliable.

5.5 Managing Credit Buying and selling on credit are very popular

It can be rewarding, but it can also be very risky as people do not always remember who owes them money and to whom they owe money and how much. Some people may only pay after a long time or not pay at all. Understanding how to manage credit will help you control your business better.

Selling on credit

The main advantage of selling on credit is that it is a service to your customers, and will attract some customers. However, there are more disadvantages than advantages to selling on credit:

- Your clients may delay in repaying, or may not repay you at all;
- There may be quarrels over repayment;
- Selling small items on credit to people (1 bread, 2 bottles of soft drinks), easily adds to a lot of money, which makes it difficult for you to remember who should repay you and how much money;
- The money that your customers still have to repay cannot be used to buy materials or improve your business. Therefore, it is best not to sell on credit at all. However, if you have to sell on credit, keep the following rules:
- Only sell on credit to regular customers who you are sure will pay you back on time;
- Demand payment of part of the amount;
- Always keep sufficient cash to buy new stock;
- Maintain records of the people to whom you sell on credit.

Buying on credit:

Buying on credit may help you in your business in the following cases:

- To buy stock in a season when it is cheap (like local example), preserve and store it and sell it when the prices are high;
- To enable you to buy cheaper in bulk (like flour);
- To cover high seasonal expenses (like plowing).

In these cases, buying on credit may give you more profit.

The disadvantages of buying on credit are:

- There may be quarrels over repayment;

- You may forget about it;
- There is the tendency to buy unnecessary things;
- Sometimes you have to pay more when you buy on credit (interest).

If you decide to buy on credit, be sure that you will be able to repay your credit on time. Before buying on credit find out how much profit you will make with your business. The profit should be enough to repay your credit, and still leave some money for savings.

5.6 Importance of Credit book

The credit book keeps the record of all the money that customers have to repay you and all the money you have to repay to others. You can keep two credit books; one for the goods that you have sold on credit, and one of the goods that you bought on credit. Alternatively: you can use the first part of an exercise book for ‘sold on credit,’ and the second part for the “bought on credit.”

5.7 Loan

A loan is a type of debt. Like all debt instruments, a loan entails the redistribution of financial assets over time, between the lender and the borrower.

In a loan, the borrower initially receives or borrows a sum of money, called the principal, from the lender, and is obligated to pay back or repay an equal amount of money to the lender at a later time.

Typically, the money is paid off in regular instalments, or partial repayments; in an annuity, each installment is the same amount.

The loan is usually provided at a cost, referred to as interest on the debt, which provides an incentive for the lender to engage in the loan. In a legal loan, each of these obligations and restrictions is enforced by contract, which can also put the borrower under additional restrictions known as loan covenants. Although this article focuses on financial loans, in practice any material object might be lent. Acting as a provider of loans is one of the principal tasks for financial institutions. For other institutions, issuing of debt contracts such as bonds is a regular source of funding.

Advantages

- A bank loan can be secured quickly; in less than an hour, a qualified borrower can complete a bank loan transaction.
- A bank loan can be used in many ways; money can be borrowed for many large-ticket items, such as furniture, vehicles or home renovations.

Disadvantages

- Some loans carry a prepayment penalty, preventing the borrower from paying the note off early without incurring additional cost.
- There are a number of limitations on the transaction. Good credit is usually required to borrow money, and there are stipulations on how the money can be used.

5.8 Financial and Marketing Management

Introduction of Finance

Finance is the study of how investors allocate their assets over time under conditions of certainty and uncertainty. A key factor in finance, which affects decisions, is the time value of money, which states that a unit of currency today is worth more than a unit of currency tomorrow. Finance measures the risks vs. profits and gives an indication of whether the investment is good or not.

- Management control (as exercised in planning, performance evaluation, and coordination) of financial activities aims to achieve the desired return on investment.
- Managers use financial statements (a budget being the main one), operating ratios, and other financial tools to exercise financial control.

Financial controls and system

Financial controls are the means by which an organization's resources are directed, monitored, and measured. Financial controls play an important role in ensuring the accuracy of reporting, eliminating fraud and protecting the organization's resources, both physical and intangible. These internal control procedures reduce process variation, leading to more predictable outcomes. The types of financial controls in place differ with each organisation however following core areas can be covered:

- **Budgets:** By having a budget in place at the beginning of the year you can access performance and be able to identify overspends.
- **Bank Mandate:** You need effective controls over who has authority to make payments of the bank account, the level of authority and rules over cheque signatories.
- **Expenditure Authorisation:** You need to ensure that people have sufficient authorisation to spend the organisations resources.
- **Salaries:** This can be a significant area of fraud without strong financial controls in place over new staff, leavers, changes to salaries and who calculates and pays the salaries.
- **Petty Cash:** As this is physical cash it is easy for money to go missing, it is essential to maintain good records and ensure it is reconciled regularly.
- **Cash Income:** If you receive lots of cash there are risks that not all of it will be deposited in the bank therefore controls need to be put in place over who counts, banks and records it.
- **Bank Reconciliation:** This is an important process for any organisation to go through to ensure that the amount in the bank account agrees with what you expect there to be.
- **Confidential information:** You need to ensure you know what information is confidential, how long you are supposed to keep it and that it is fill away correctly.

Sources of Finance

Own funds

Many starting entrepreneurs have saved money for quite a while to be able to start their business. Some sell assets such as land or livestock. Using their own funds creates independence. Entrepreneurs should cultivate a culture of saving money,

which will allow them to make future investments unassisted. One way of increasing one's own funds is to team up with one or more partners who can pump money into the business.

However, this requires careful consideration, as the business needs to generate enough profit to provide a return to all those who invested in it. Entrepreneurs investing their own funds in their business also send out a message to third parties. They show that they believe in the business and that they are ready to risk their own money to run it they show commitment. Showing this type of commitment can prove crucial when they decide to apply for funds from a financial institution like a microcredit Institute, a bank or moneylenders.

Microfinance institutions and NGOs providing grants for small businesses often demand a personal contribution of funds from the entrepreneur to supplement a loan or a grant.

Loans

Entrepreneurs with a convincing business idea and a good plan of activities illustrating its potential profitability may qualify for a loan from a financial institution. Often, however, loans are granted only if the entrepreneur has some collateral (e.g. is the owner of a house). Entrepreneurs who use loans to start their business must add the respective costs – i.e. interest payments and reimbursement of the principal – to all their calculations. For starting entrepreneurs with limited means and no collateral, loans are usually not accessible. Entrepreneurs who have a seasoned business and can illustrate their financial viability and profitability have a better chance of obtaining a loan. This is another reason for entrepreneurs to keep records and properly document the profitability of their business.

What is marketing?

Marketing is the effort to identify and satisfy customers' needs and wants. It involves finding out who your customers are, what they need and want, the prices, the level of competition. It involves the knowledge and all the processes you undertake to sell your product.

Marketing answers the following questions:

- Who are my customers?
- What are my customer's needs and wants?
- How can I satisfy my customers'?
- How do I make a profit as I satisfy my clients?

Who are your customers?

Your customers are the people or other businesses that want your products/services and are willing to pay for them. They include:

- People who are buying from you now.
- People you hope will buy from you in the future.
- People who stopped buying from you but you hope to get them back.

What are my customer's needs and wants?

An Important point to note is that customers want to look at different products so that they can choose what they like best. Some customers want a different design and others want high quality and are willing to pay extra for that

How can I satisfy my customers'?

You need to do everything to find out who your customers are and what they need and want in order to satisfy them improves your sales and makes a profit.

You need to find out:

- Products/services your customers want.
- Price your customers are willing to pay.
- Location of your business in order to reach your customers (Place).
- Promotion to use to inform your customers and attract them to buy your products or services.

Product: Product refers to goods/services produced for sale, the product /service should relate to the needs and wants of the customers. Some important questions you need to ask yourself include:

- What products/services do I sell?
- Why did I decide to sell these products?
- Do I have the products customers want?
- Do any of my products not sell well?
- Do I stock products that do not sell well?

Always listen to what your customers like and don't like. When their needs change, change your products and services to satisfy the new requirements. Do more market research in order to provide those goods and services and increase your sales. If your product is not selling well, think of new ideas like finding new customers.

Pricing: Pricing refers to the process of setting a price for a product/service. Your prices must be low enough to attract customers to buy and high enough to earn your business profit.

To set your price, you need to:

- Know your costs.
- Know how much customers are willing to pay.
- Know your competitor's price.
- Know how to make your prices more attractive

Place: Place means the different ways of getting your products or services to your customers. It is also referred to as distribution. If your business is not located near your clients, you must find ways to get your products/services to where it is easy for customers to buy. You can distribute your products to your customers through:

- Selling directly to the consumers of the products.
- Retail distribution and wholesale distribution.

Promotion: Promotion means informing your customers of your products and services and attracting them to buy them. Promotion includes advertising, sales promotion, publicity and personal selling. Use advertising to make customers more interested in buying your products or services. Some useful ways of advertising include signs, boards, posters, handouts, business cards, price lists, photos and newspapers. You can use sales promotion to make customers buy more when they come to your business, and you could also:

- Ensure you maintain attractive displays.
- Let customers try new products.
- Have competitions
- Give demonstrations
- Sell complementary products (products that go together)

Market research: Before starting a business, it is important to know the market conditions, in which the business will be operating:

- What are the customer needs?
- Who is the competition?
- What are the prices at which products and services are sold?

These are only some of the questions that need to be clarified before starting. So, after having come up with a brilliant idea, you need to check if it can work in the market. You need to carry out a market survey. The main focus of this activity is to find out as much as possible about your potential customer's buying habits and competition

- What do they buy?
- Where do they buy?
- Why do they buy from XY?
- When do they buy?
- How much do they buy?
- Which price do they pay?
- What are their preferences?
- Do they get any extras?

The Marketing Process: Market research is the gathering of information that ties a small enterprise to its customers. It provides the information that is necessary for companies to correctly position their product in the marketplace and offer the best combination of product, price, place/distribution, promotion, and person. Well-designed market research gives a person an edge on their competition, reduces their risk, and improves the effectiveness of their enterprise activities. Quality market research is the key to success for the small entrepreneur. If a person does not understand their customer and their needs they will likely fail in their enterprise.

Why Conduct Market Research?

- To develop product, price, promotion, place/distribution, and people plans
- To identify problems in their marketplace and discover new opportunities
- To learn about competitors and how they are marketing their products.

- To find out what consumers think about their product category
- To gauge the performance of existing products

Market research involves the systematic, objective collection and analysis of the above data. It is often conducted as the first step in identifying the feasibility of an enterprise idea. It always incorporates some form of data collection and is either secondary research (often referred to as desk research) or primary research (direct from an individual).

How to conduct market research?

Talk to potential competitors to find out:

- Their products or services (for example quality and design)
- What prices they charge
- What exactly they sell
- How their product/services differ from yours
- Where they get their inputs?
- Where do they sell?
- How they promote their product/ service
- Any particular approaches to customer care • How you can compete

REFERENCES

- Baksy, A. (2013). The Bamboo Industry in India: Supply Chain Structure, Challenges and Recommendations. Researching Reality Internship. Centre for Civil Society. 48pp
- Chihongo, A. W., Kishimbo, S. I., Kachwele, M. D. and Ngaga, Y. M. (2000). Bamboo Production-to-Consumption Systems in Tanzania. Tanzania Forestry Research Institute, Morogoro, Tanzania. 35pp.
- Clement, C. (2013), Factors leading imported furniture to be preferred over locally produced ones a case of Ilala and Temeke Municipal councils in Dar es salaam-Tanzania. A Dissertation Submitted in Partial Fulfillment of the Requirements for the Award of the Degree of Master of Business Administration (MBA - CM) of Mzumbe University
- Duke (2013), The furniture value chain in north Carolina. Pg 8 – 18.
- Dunne, N. (2009), International trends in the timber furniture industry and the implications for South African manufacturers, Durban, School of Development Studies, University of Natal.
- Ernest J. (1987),The technique of furniture making; Fourth edition, revised by Allan Peter (1987); BT Batsford Ltd London; Pg 129 – 140.
- Fakude, G. (2000), Export linkages, upgrading or downgrading furniture firms. Durban, School of Development Studies, University of Natal.
- FAO (2001). Global Forest Resources Assessment 2000. Rome.
- FAO (2007). World Bamboo Resources: A Thematic Study Prepared in the Frame Work of Global Forest Resources Assessment 2005. Food and Agriculture Organization of the United Nations, Rome, Italy. 73pp.
- Geneva (2004), International Wooden Furniture Markets, International Trade Centre UNCTAD/WTO and International Tropical Timber Organization, Volume I.
- Geneva (2005), International Wooden Furniture Markets, International Trade Centre UNCTAD/WTO and International Tropical Timber Organization, Volume II.
- Ishengoma, E. (2005), Firm's Resources as Determinants of Manufacturing Efficiency in Tanzania: Managerial and Econometric Approach. Hamburg: LIT Verlag
- Khan, Amir Ullah and Hazra, A. (2007). “Industrialisation of the Bamboo Sector: Challenges and Opportunities”. India Development Foundation, Publication 15. Published by Confederation of Indian Industry (CII).
- Lyimo, P.J., Malimbwi, R., Samora, A.M., Aloyce, E., Kitasho, N.M., Sirima, A.A., Emily, C.J., Munishi, P.K., Shirima, D.D., Mauya, E., Chidodo, S., Mwakalukwa, E.E., Silayo, D.S.A and Mlyuka, G.R. (2019). Bamboo: A Potential Resource for Contribution to Industrial Development of Tanzania. In: E.D. Karimuribo, N. Amuri, D. Ndosu, C.N. Nyaruhucha, A.B. Matondo, J.K. Urassa and S. Iddi. Proceedings of Scientific Conference on Transforming Agriculture and Natural Resources for Sustainable Development to Attain Industrial Economy in Tanzania. SUA, Morogoro, Tanzania 96-117 Pp.
- Murphy, T. (2006), the socio-spatial dynamics of creativity and production in Tanzanian industry: Urban furniture manufacturers in a liberalizing economy, Environment and Planning A, 38(10), -1863.
- Mwamakimbullah, R. (2016). Private forestry sector in Tanzania: status and potential. AFF Report. African Forest Forum, Nairobi.

- Nalioleta, N. and Elias, E. (2003), Introduction of industrial design engineering concepts to SMEs in Tanzania: difficulties and possible approaches, International Conference on Industrial design engineering, UDSM.
- Olomi, R. (2006), Opportunities and Challenges for Rural SMEs development in Tanzania, Policy Dialogue Seminar Paper, Economic and Social Research Foundation, Dar es Salaam.
- PFP, (2016) Value chain analysis of plantation wood from southern highlands of Tanzania.
- Ribeiro, N.S. and Alves, T. (2019). Gathering honey from wild and traditional hives in the Miombo woodlands of the Niassa National Reserve, Mozambique: What are the impacts on tree populations? *Global Ecology and Conservation*, (17), <https://doi.org/10.1016/j.gecco.2019.e00552>
- The Chartered Institute of Marketing (2009), How to achieve an effective promotional mix.
- The Sustainable Development Goals of 2016 to 2030.
- Tutuba, N. B., Msamula, J. S., and Tundui, H. P. (2019). Business Model Innovation for Sustainable Beekeeping in Tanzania: A Content Analysis Approach. *American Journal of Management*, 19(1). 74-88 <https://doi.org/10.33423/ajm.v19i1.1340>
- United Republic of Tanzania. (2014). Education and Training Policy. Dar es Salaam.
- URT (United Republic of Tanzania), (1996). The National Sustainable Industries Development Policy, Dar es Salaam.
- URT (United Republic of Tanzania), (1997). The National Environmental Policy, Dar es Salaam.
- URT (United Republic of Tanzania), (1998). The National Forest Policy, Dar es Salaam.
- URT (United Republic of Tanzania), (2000). The Tanzania Development Vision 2025, Dar es Salaam.
- Vorontsova, M. S., Clark, L. G., Dransfield, J. and Barker, J. (2017). World Checklist of Bamboo. Technical Report No. 37. International Network for Bamboo, Rattan. 466pp.
- Wen-fei Uva (2004), Develop a successful Promotion Program.
- You, Q. (2007), World furniture trade up to 100 billion US Dollar in 2007, *Furniture Market* 8, 55. United Nations, (2016).

FCG.