

Bamboo Market Value-Chain Study Uganda

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Acronyms

AMSL	Above Mean Sea Level	NTSC	National Forestry Tree Seed Centre
Bn	Billion	NWFP	Non Wood Forest Produce
BINP	Bwindi Impenetrable National Park	OSB	Oriented Strand Board
CFR	Central Forest Reserve	PEFC	Programme for the Endorsement of Forest Certification
CFM	Collaborative Forest management	SACCO	Savings and Credit Cooperative Organisations
COMESA	Common Market for Eastern and Southern Africa	SGR	Standard Gauge Railway
EU	European Union	SME	Small and Medium Enterprise
FSC	Forest Stewardship Council	SNV	The Netherlands Development Agency
INBAR	International Bamboo and Rattan Organisation	SWOT	Strength, Weaknesses, Opportunities, and Threats
IPR	Intellectual Property Rights	UIRI	Uganda Industrial Research Institute
KM	Kilometres	UFA	Uganda Forestry Association
LG	Local Governments	UNBS	Uganda National Bureau of Standards
MDF	Medium Density Fibre	USA	The United States of America
Mn	Million	USD	United States Dollars
M	Meters	UGX	Ugandan Shillings
MGNP	Mgahinga Gorilla National Park	USD	Unites States Dollar
MSMEs	Micro Small and Medium Enterprises	UWA	Uganda Wildlife Authority
Mt	Mount	UWEP	Uganda Women Entrepreneurship Programme
MWE	Ministry of Water and Environment	YLP	Youth Livelihood Programme (YLP)
NFA	National Forestry Authority		

Foreword

Bamboo is a fast-growing, renewable and versatile resource, which is found across the Global South and is interlinked with the lives and livelihoods of numerous communities. It is well accepted that bamboo development could contribute directly to at least seven of the UN Sustainable Development Goals, including poverty alleviation, affordable and clean energy, affordable and resilient housing, sustainable consumption, climate change mitigation, and terrestrial ecosystem protection.

Bamboo is one of the important indigenous plant resources in Uganda. A large number of communities depend on bamboo for day-to-day use, such as housing, food ('malewa'), agriculture and household utility products, and support structures for crops. Though widely used by communities, bamboo is not a focus for policy support or investment by the government and development agencies. There is clearly potential for Uganda's bamboo sector to thrive, as shown by the many existing bamboo businesses that do not receive support.

This market study was conducted by SNV Uganda as part of INBAR's Dutch-Sino East Africa Bamboo Development Programme, supported by: the Ministry of Foreign Affairs, the Netherlands; China's State Forestry Administration; Wageningen University; Moso Bamboo BV; the Netherlands and Uganda's National Forestry Authority. The study is an attempt to identify existing value chains and market opportunities for bamboo products in Uganda, to understand the opportunities and bottlenecks, and to shortlist suitable value chains for development.

As this study shows, Uganda has a number of bamboo value chains which are worth developing, in areas as varied as construction and renewable energy. The information provided in this report should help various organisations and institutions transform the bamboo value chain in Uganda into a great success story.

Dr. Hans Friederich

Director General, International Bamboo and
Rattan Organisation (INBAR)

Executive Summary

This report presents the findings of Uganda's bamboo value chain study. Specifically, this report provides an overview of bamboo value chain in Uganda: existing bamboo resources, existing value-chain, value chain actors and their roles, value-chain map, existing and potential domestic and international markets. Also, strength, weaknesses, opportunities and threats (SWOT) and constraints analysis, intervention matrix was developed to shortlist products / value-chains for upscaling and to provide recommendations towards advancing bamboo value chain development in Uganda.

The following were the objectives of the Bamboo value chain analysis:

- Assess the bamboo value chain within Uganda, identifying key opportunities and bottlenecks
- Map these and other existing bamboo products and explore potential products that have value in the domestic marketplace.
- Identify bamboo products (existing as well as potential) that have the potential to be exported regionally, as well as to Europe.
- Provide concrete recommendations for up scaling the existing; as well as potential bamboo products.

The study was undertaken within the overall framework of value chain analysis. The consultant adopted a participatory methodology which entailed the involvement of major stakeholders; and the value chain analysis was conducted in very close interaction with a number of consultants, INBAR staff and other key stakeholders.

As regards to methodology, study inception report was presented to the INBAR technical team for comments, focus group discussions were held with selected bamboo value chain actors; Key informant interviews were held with officials from NFA, UWA, MWE, commercial plantation owners and district technical staff; preliminary findings were presented to bamboo value chain influencers for review and inputs and final study results were presented to key stakeholders during an interactive validation workshop.

The consultant collected both primary and secondary data. Primary data was collected through in-depth interviews with key informants, focus group discussions especially with communities' adjacent protected areas and observation. Secondary data was collected through document review and analysis. This was mainly qualitative data and was analysed using content analysis techniques.

The study's geographical target area was national; however, a particular focus was placed on bamboo production/processing areas in/ around Kapchorwa, Bukwo, Sironko, Mbale, Bududa, Manafwa, Kabale, Kisoro, Adjumani, Moyo and regional marketplaces in/around Kabale, Kisoro and Kampala.

In Uganda bamboo belonging to two indigenous species *Yushania alpina* and *Oxytenanthera abyssinica* are found in protected areas of Mt. Elgon, Rwenzori, Mgahinga, Bwindi Impenetrable National Park, Otzi West and East, Ayipe, Atiya, Agoro-Agu and Echuya.

In addition, a number of bamboo species are introduced and are naturalised in Uganda, grown mostly as small pockets in private land. It is important to note that wild / natural forest bamboo stocks are dwindling due to a number of natural and man- induced factors including illegal harvests, displacement by other species, and life cycles.

Little information is available on the number of people involved in the cultivation of bamboo. However, information gained through

interviews with key informants but also through focus group discussions indicated that, the number is very limited.

Information gained through interviews with key informants but also through focus group discussions indicated that people have not taken up commercial bamboo growing because of shortage of land, proximity to the park thereby free access, long gestation period (maturity and harvesting starts from approximately 5 years) and limited awareness about the bamboo.

Existing bamboo value chains in Uganda include (a) nursery; (b) bamboo pole; (c) bamboo shoot; (d) bamboo furniture; (e) bamboo handicrafts and ornaments; (f) bamboo charcoal and (g) industrial products.

The bamboo value chain actors mainly consist of (a) resource producers; (b) collectors or harvesters; (c) processors; (d) traders and (e) consumers. Total number of actors involved and/or associated with bamboo are difficult to estimate nationally, our interactions in the field with different stakeholders puts the current number of bamboo stakeholders at close to 1,000,000 with a vast majority of these actors found in the Mbale, Sironko districts of Uganda.

Industrial processing of bamboo as a material is very limited. There is low level processing activity related to bamboo shoots, handicrafts, household goods and, to a lesser extent, bamboo poles for construction. However, Uganda Industrial Research Institute (UIRI) has established two bamboo processing plants (in Kampala and Kabale) but the output is still limited.

In Uganda, production, consumption and export data specific to bamboo material is difficult to determine. Much of the bamboo used in households is not transacted in the formal economy and exports of raw bamboo and edible bamboo shoots cross borders are unrecorded. However, the leading global exporter of bamboo products is China and there is growing demand for sustainable products in Europe and the United States.

The global bamboo economy is now valued at \$60 billion, and is a potential income generator for rural communities. The largest markets are handicraft (USD 3 billion), bamboo shoots (USD 1.5 billion) and traditional furniture (USD 1.1 billion), (Greijmans, Oudomvilay & Banzon 2007). Traditional markets cover handicrafts, blinds, bamboo shoots, chopsticks and traditional bamboo furniture, which count for 95% of the market. Emerging bamboo markets are wood substitutes such as flooring, panels and non-traditional furniture.

In selecting key bamboo value chains for Uganda, a five step value chain selection matrix including the following key areas: (1) high and sustainable market and/or growth potential, (2) potential to contribute to increased employment especially for women and youth, (3) growing market demand over the next decade, (4) potential to attract additional investments from both the public and private sector and (5) linkages to other key sectors of the economy was developed.

Based on the analysis of the existing bamboo value-chains, five bamboo value-chains that could be selected for short-term intervention are as follows (a) bamboo shoots; (b) bamboo furniture; (c) bamboo handicrafts; (d) bamboo construction and (e) bamboo energy products.

The overall management of bamboo as a natural resource falls under the jurisdiction of National Forestry Authority (NFA) and Uganda Wildlife Authority (UWA), Ministry of Water and Environment (MWE). Bamboo value-addition and enterprise development activities are managed by the Uganda Industrial Research Institute (UIRI); investment promotion is handled by Uganda Investment Authority (UIA).

There are a number of institutions and policies that are relevant to bamboo. However, there is no concerted among all the stakeholders. Since, bamboo is a minor sector, most policies, agencies and departments, does not have specific bamboo related policies, guidelines and/or activities.

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Based on the SWOT analysis of value-chains, policy analysis, constraint analysis and intervention matrix, a number of recommendations are proposed;

- a. Value-Chain:** There is virtually no bamboo in Uganda highly suitable for industrial value addition (both quality and quantity), a phased approach for bamboo value chain development is recommended.

Short term interventions include upgrading and/or strengthening the existing value chains, which include (a) bamboo shoots; (b) bamboo furniture; (c) bamboo handicrafts; (d) bamboo construction and (e) bamboo energy products.

In the medium term, focus on mid to high quality products of the existing product lines and in addition strengthen industrial production of product lines having domestic demand such as (a) bamboo stick based products (curtains, table mats, tooth picks, etc.); and (b) slat based furniture.

In the long run, focus on high end industrial product line such lines such as (a) bamboo timber, (flooring tiles), (c) boards, (d) power; solid and liquid fuels; and (e) textile fibres targeting both the domestic and export markets.

- b. Undertake Rapid Resource Development** both in public and private land. This would entail strengthening of nurseries, technology transfer and capacity building on planting material production; facilitate establishment of large scale plantation in public and private land, enabling smallholder plantation aimed at increasing the resource base and to reduce pressure on natural forests.

Enable sustainable management of bamboo forests both in public and private land through demonstration, technology transfer and capacity building.

- c. Market Development:** Build a communication programme; undertake awareness and sensitisation activities among the policy makers, institutional markets and general public on the potential of bamboo products. In the short and medium term, target domestic and regional markets.

To provide market push during initial growth periods, enable opening up of government and institutional markets such as education (school construction, furniture); housing; fishery sector (baskets, drying mats, biofuel); apiculture (bee hives); coffee and tea (baskets, drying mats, etc.); energy markets (charcoal, briquettes, and biomass power (cogeneration)).

In the long run, target domestic and export market. Undertake activities towards market positioning of bamboo within and outside Uganda which could include marketing campaign, participation in domestic and international trade fairs and exhibition.

- d. Policy intervention:** Build the institutional and legal architecture to support the bamboo economy: Advocate for development of bamboo policy, inclusion of bamboo in National Development Plan, MSME policies, forest development plans; agricultural policies; industrial policies; Investment promotion and trade; census, etc.

This would enable allocation of additional government's budget towards development of the sector.

Advocate for fiscal and non-fiscal incentives such as tax incentives, import duties for entrepreneurs and investors.

- e. Institutions:** Establish and/or strengthen community forest management groups, groups, producer cooperatives at location level for strengthening the supply-chain.

Develop a national level bamboo multi-stakeholder platform with participation of regional and local stakeholders for advocacy on policy, link the demand and supply, and to develop markets.

The successful model of Uganda edible oil seed platform (OSSUP), which serves as a central meeting point for all edible oil seed value chain actors in Uganda can be adopted for bamboo.

- f. Partnership and Leveraging:** Develop partnership with government and non-government agencies to upscale the interventions which could include Uganda youth livelihood fund, the Netherlands embassy, Uganda industrial research institute (UIRI) and the Chinese Embassy.

Advocate inclusion of bamboo into different government agencies development plans such as National Development Plan, MSME development plan, forestry development plan, agriculture development plans, tourism development plans; and support implementation of the activities.

- g. Enabling Environment:** Set up a bamboo impact investment fund aimed at attracting investors into Uganda with the knowhow and equipment that they can use to process raw bamboo into flooring boards and other bamboo products that have a high demand globally.

This innovation fund will target investors that are willing to enter into inclusive business arrangements with bamboo growers in Uganda.

- Collaborate with Uganda Investment authority to develop business models to attract small, medium and large scale private sector investments into bamboo sector.
- Build capacities of Uganda National Bureau of standards on product test, standardisation, and certification.
- Enable Sustainable production certification mechanisms FSC/PEFC or similar certification will raise value and market acceptance in case of targeted bamboo forests and other public and private plantations; Chain of Custody (CoC) in case of bamboo grown in farms, and in homesteads.

1. Background Context

Bamboo originated from Southeast Asia, where it is a natural component of the forest ecosystem (Dannenmann et al., 2007). Bamboo generally known as “poor man’s timber” refers to a group of perennial evergreen plants belonging to the Poaceae family, subfamily Bambusoideae (Seethalakshmi and Kumar, 1998).

Based on the recent INBAR-ICBR-Kew Botanical Gardens research a total of 1,642 bamboo species including 1, 521 woody bamboo species belonging to a single evolutionary radiation are documented (Vorontsova et al, 2016).

With a wide species range, different bamboo species have considerable variation in their habitat, and they occupy a wide range of agro-ecological environments spread between 46° N and 47° S latitudes. However, they are commonly available in many tropical, sub-tropical and temperate regions of the world (Banik, 2000).

Bamboo grows in at least 37 million ha worldwide and covers 3.2 per cent of the forest areas of their host countries, or about 1 per cent of the global forest area (Lobovikov et al., 2007).

It is widely recognised as a plant of great cultural and practical importance in many Asian, African, and Central and Southern American countries (Banik, 2010; Widenoja, 2007).

Bamboo is one of the fastest growing plants in the world (Seethalakshmi and Kumar, 1998; Banik, 2000). Once established, bamboo plants produce new shoots every year. The new shoots can reach the height of mature bamboo (even 30 meters) within a period of 40 to 120 days (Banik, 2000; Tewari, 1992; Zhang et al., 2002).

The physical characteristics of different bamboo species are different: dwarf varieties can grow only few inches, mid-size bamboo can grow few meters and giant bamboo species can grow to about 30 meters in height and 30 centimetres in diameter (Lobovikov et al., 2007).

Bamboo can adopt itself to a wide range of agro-climatic conditions. It can grow from sea level to 3700 meters above sea level (Seethalakshmi and Kumar, 1998). It requires a minimum rainfall of 600 mm per annum, but the optimal rainfall ranges from 1200 mm to 4000 mm; bamboos is also found in zones with rainfall over 6500 mm (Tewari, 1992; Banik, 2000). It grows as mixed forests, under-story and as complete bamboo breaks or forests.

Bamboo prefers well-drained sandy loam soil: the most suitable soil pH ranges from 5.0 to 6.5, but it can grow even in soils which have pH as low as 3.5 and it is known to neutralise acidic soils. It requires a minimum soil depth of 1 to 1.5 ft. (Banik, 2000).

1.1 Bamboo Products and Uses Globally

There are 1,500 recorded utilities of bamboo, with annual commercial utilisation of 20 million metric tons in use by 2.5 billion people (Scurlock et al., 2000). Bamboo has traditionally been used by rural and forest dependent communities for day to day use in the form of food, firewood, fencing and construction material; and for making utility, furniture and handicraft products that provide livelihood and additional income.

Being an annual yielding crop with a wide range of product possibilities, bamboo offers opportunities for household, small scale, and

medium scale enterprises.

China has effectively used bamboo as a tool for poverty reduction in rural areas, and presently the Chinese bamboo sector generates revenues of around USD 20 billion annually and provides employment for over 8 million people (INBAR, 2012).

With technological innovations in bamboo utilisation as well as an increased need for eco-friendly materials, bamboo is presently a value added high quality durable material.

In the past two decades, numerous value added products in the form of wood substitutes, bamboo panels and flooring, pulp and paper, automotive industry products, sports and recreation industry products, food and beverages, textile products, artefact's, bio-energy products, bio-plastics and composites, pharmaceutical applications, bamboo furniture, etc. have been developed.

China alone produces around 1 million cubic meters of boards and 17.5 million square meters of bamboo flooring (Liese, 2009).

Table 1: Bamboo utilities and product lines

Construction and scaffolding	Medicinal uses	Electronic industry products: iPhone cases, mouse, laptop cases
Residential fencing	Panel products – MDF, OSB, ply boards, lumber, mat boards, roofing sheets	Bio-plastics and composites
Utility handicrafts and furniture	Pulp and paper- news print, toilet tissue, card boards	Stick based products: incense sticks, skewers, barbecue sticks, curtains/ blinds
Bamboo shoots as a delicacy	Textile products - clothing, underwear, towels, mattresses	Bows and arrows
Toothpicks	Bio-energy: wood fuel , charcoal, pellets, gasification	Toys, Jewellery and Ornaments
Forage for cattle/ animals	Food and Beverage: bamboo shoot, tea, wine, beer, vinegar	Life style products
Mats	Automotive industry: plastic composite body parts	Musical instruments
Utility basketry products	Sports and recreation: bicycles, stake boards, surfboards, fishing rods	Chemical processing – activated carbon and sewage treatment

The highlighted items in Table 1 represent the bamboo products that are being produced and used in Uganda. Bamboo products and uses in Uganda may be categorised into two segments namely, (1) traditional bamboo products: traditional house construction, bamboo shoot / malewa, utility baskets, ornaments, furniture, furniture, mats and shopping bags (2) Emerging bamboo product/uses: Construction, furniture, toothpicks, and charcoal/biomass. Furniture appears in both categories because it can be sold as different items made out of unprocessed bamboo or it may also be sold as an expensive furniture item made out processed bamboo.

1.2 Global Bamboo Industry

The global (domestic and traded) bamboo economy is now valued at USD 60 billion, and is a potential income generator for rural communities (Africa Renewal Magazine, April 2016). China's and India's bamboo national production value is estimated at USD 19.5 Bn and USD 13.5 Bn in 2012 and 2010 respectively (INBAR, 2012).

The leading producer and exporter of bamboo products is China and there is growing demand for sustainable products in Europe and the United States. Currently, the largest markets are handicraft (USD 3 Bn), bamboo shoots (USD 1.5 Bn) and traditional furniture (USD 1.1 Bn).

Traditional markets cover handicrafts, blinds, bamboo shoots, chopsticks and traditional bamboo furniture, which count for 95% of the market. Emerging bamboo markets are wood substitutes such as flooring, panels and non-traditional furniture.

In 2012, total export value of bamboo and rattan products was about USD 1,881 Mn. Out of which industrial bamboo products, bamboo woven products, bamboo shoots and raw material constitute about 29, 25, 15 and 5 per cent of the export value respectively (INBAR, 2012).

China is the largest exporter contributing to over 60 per cent of the exports, followed by the EU (11%). EU, USA and Japan are the largest importers contributing to 38, 18 and 16 per cent respectively. Other significant importers include Canada, Australia, Singapore, Russia and Korea (Refer Table 2).



Figure 1: Baskets made from bamboo on sale in Kisoro

Table 2: Products, value of trade, major import and export values.

Products	Value (mn USD)	% traded value	Major Exporter (Country: Traded value and % of the trade Value)	Major Importer (Country: Traded value and % of the trade Value)
Bamboo - raw material	69.4	5	China (\$ 48.2 Mn; 70%), EU (\$ 10.9 Mn; 16%). África (\$ 1.1M)	EU (\$ 53.4 Mn, 77%); Africa (\$ 4.7 Mn, 6.77%)
Bamboo shoots	276	15	China (\$ 240.9 Mn; 87%); EU (\$ 20.6; 8%); Thailand (\$ 12 Mn; 4%)	Japan (\$ 160.4 Mn; 59%); EU (\$ 55.2 Mn; 20%), USA (\$ 40.4 Mn; 15%)
Bamboo woven products	476.3	25	Asia: (\$ 438.2 Mn; 92%); Africa (\$ 0.9 Mn, 0.18%)	EU (\$ 126.3 Mn; 42%); North America (\$ 80.6 Mn; 27%), Asia: (\$ 68.8 Mn; 23%); Africa (\$ 3.6 Mn; 0.75%)
Bamboo basket work	285.4			
Mats and screens	119.6			
Bamboo plaits and plaiting material	71.3			
Industrial bamboo products	538.5	29	China (\$ 412.6 Mn; 77%); EU (\$ 65 Mn, 12 %), North America (\$ 20.2 Mn; 4%)	EU (\$ 159.2 Mn; 46%), Asia (\$ 80.2 Mn; 23%), North America (\$ 64.3 Mn; 19%); South Africa (\$ 4.3 Mn; 0.80%)
Bamboo flooring	366.4	(68%)	China (\$ 333 Mn; 91%);	EU (\$ 150.6 Mn; 44%), USA (\$ 37.9 Mn; 10.3%)
Bamboo plywood	114.6	(21%).	China (\$ 65 Mn; 57%), EU (\$ 30 Mn; 26 %)	EU (\$ 41 Mn; 30 %), Singapore and USA (17% each)
Bamboo charcoal	43	2	China (\$ 12 Mn; 28 %) EU (\$ 10 Mn; 23 %), Nigeria (\$ 10 Mn; 23%)	EU (\$ 9 Mn; 38%), Japan (\$ 5 Mn; 20%), Korea (\$ 4 Mn; 17%)
Bamboo pulp and paper	38	2	China	EU (\$ 33 Mn, 87%)
Bamboo and rattan furniture	290.4	16	Asia (\$ 210.3 Mn; 72%); Europe (\$ 71.4 Mn; 25%) Africa (\$ 0.4 Mn)	Europe (\$ 178.9 Mn; 52% North America (\$ 86.6 Mn, 25%). Africa (\$ 8.7Mn, 3%)
Bamboo and rattan seats	136.9		Indonesia (\$ 75 Mn; 55%); EU (\$ 23Mn, 17%) China (\$ 15 Mn, 11%)	EU (\$ 79 Mn; 41%) USA (\$ 39 Mn; 19%)
Bamboo and rattan furniture	153.5			

Source: *International Trade of Bamboo and Rattan 2012* (INBAR, 2012)

Note: Data on the import and export values of bamboo products are shown as a reference.

1.3 Africa Region Bamboo Industry Picture

In Africa, bamboo is closely related to indigenous culture and is widely used for traditional applications such as housing, fencing, basketry, agricultural utilities, furniture, fuel wood, etc. Data gathered from six countries of Africa (Ethiopia, Kenya, Nigeria, Uganda, Tanzania, and Zimbabwe) shows that 2.7 million hectares of bamboo forests exist, accounting for about 4 per cent of Africa's total forest resources (Lobovikov et al, 2007).

Most of the eastern and southern African countries have two indigenous predominant species namely *Yushania alpina* (Highland Bamboo) and *Oxytenanthera abyssinica* (low land bamboo), while the western African countries have only one indigenous species of woody bamboo (*Oxytenanthera abyssinica*).

Ethiopia has close to one million hectares of bamboo forests making it one of the countries in Africa that produces the most amounts of bamboo raw materials and processed products. Other countries with a woody bamboo stock in Africa include Benin, Burundi, Cameroon, Eritrea, Ethiopia, Ghana, Liberia, Kenya, Malawi, Madagascar, Mozambique, Nigeria, Rwanda, Senegal, Sierra Leone, Tanzania, Togo and Uganda.

In addition to indigenous species, two introduced species *Bambusa vulgaris* and *Dendrocalamus giganteus* are widely distributed in Africa. It is also important to note that Madagascar has 33 species of woody bamboo and two-thirds of these species are endemic (Bystriakova et al, 2004).

Trade (averaged import and export) data extracted from UN Commodity trade database (<https://comtrade.un.org/data/>) for reporting year 2014, 2015 and 2016 shows that the African continent as a whole imports bamboo products valued at USD 21 million and exports bamboo products valued at USD 18 million. This represents 1.6 per cent of the global imports and 1.2 per cent of the global exports.

Bamboo in Africa is mostly used to meet sustenance needs, and to cater to the demands of local markets. Ethiopia is the only country in Eastern and Southern Africa, which have comparatively well-developed bamboo industry producing bamboo panel, stick based and bio-energy products. South Africa is the most significant importer of bamboo products in Africa.

Domestic production, consumption and trade values of bamboo products are not available. Below table (Table 3) shows the import and export values of Uganda, COMESA block as well as Total Africa.

Table 3: Import and export of bamboo products for Uganda, COMESA & Africa

Code	Product	Uganda Trade Value (USD)		COMESA Trade Value (USD)		Total Africa Trade Value (USD)	
		Import	Export	Import	Export	Import	Export
140110	Bamboo	95,913	161,922	274,196	295,724	503,559	309,374
200591	Preserved bamboo shoot	4,048	0	163,796	58	261,908	89,441
460121	Bamboo mats / screens	18,294	997	119,370	549,399	348,834	593,133
460192	Bamboo plaits and plaiting material	1,101	0	48,707	6,609	297,887	23,610
460211	Bamboo basket work	7,331	0	221,668	15,136	1,126,872	197,967
440210	Bamboo charcoal	0	1,480	115,237	1,171,608	872,286	11,741,910
440921	Bamboo flooring	10,150	20,880	476,257	42,221	2,369,534	2,245,681

Code	Product	Uganda Trade Value (USD)		COMESA Trade Value (USD)		Total Africa Trade Value (USD)	
		Import	Export	Import	Export	Import	Export
441210	Bamboo plywood	49,902	18,180	2,886,041	35,232	5,485,052	555,286
470630	Bamboo pulp	0	0	12,727	164	24,813	1,783,986
482361	Bamboo paper based articles	994	213	1,149,320	69,992	1,466,245	259,896
940151	Bamboo and rattan seats	18,514	0	247,928	10,372	2,876,853	215,676
940381	Bamboo and rattan furniture	98,085	0	3,547,650	18,112	5,594,062	290,191
TOTAL		304,332	203,672	9,262,898	2,214,628	21,227,906	18,306,151

Source: UN COMTRADE Data base <https://comtrade.un.org/data/>

Note: Averaged values of 2014, 2015 and 2016

1.4 Uganda Bamboo Industry Picture

The bamboo industry in Uganda is largely underdeveloped. Bamboo utilisation and production is mostly confined to meet the sustenance needs, traditional and low value products. Bamboo is widely used by local communities located around Ruwenzori Mountains, Mount Elgon, Mafinga, Echuya forest reserve, and Bwindi for house construction and production of crafts. It is also used for production of granaries, production of basketry, bean-stakes and fuel wood. Additionally, communities surrounding Mount Elgon eat young bamboo shoot locally called as “Malewa”, whereas in other locations of Uganda, bamboo shoots are not eaten. Study by Bitariho (2015), illustrates that in Bwindi and Mgahinga locations, local communities live in bamboo houses and 84 per cent of the products used in homesteads are derived from bamboo. This shows the importance of bamboo for meeting the sustenance needs, income and employment needs of the local communities in Uganda.

This same study also points out that bamboo is the most important non-timber forest product locally used for making “handicrafts (baskets, beehives, granaries, mats, stretchers, trays and toys) and furniture (beds, chairs, tables, shelves and lamp sheds), construction (granaries, fences, ceilings, house gutters and wall panels, food (bamboo shoots), energy (firewood and charcoal). Other uses include stakes, tube-containers, drinking vessels, stands, medicines, fodder, musical instruments, cooking utensils and walking sticks”. Sale of bamboo poles for house construction, production of bamboo handicrafts and furniture and sale of bamboo shoots are the key value-chains generating income and employment for local communities in Uganda. Activities towards organising and mainstreaming bamboo sector in Uganda are in its initial phases. Industrial product production has not yet started in Uganda. It is important to note that in 2007, Uganda Industrial Research Institute (UIRI) with support of China bamboo Research Centre established training cum incubation centre for production of bamboo products (especially bamboo tooth pick production). Following this initial investment, a Ugandan investor is now engaged in the commercial production of bamboo tooth picks in Kabale District. Another key private sector player in Uganda called “Banapads”, a leading producer of affordable and eco-friendly sanitary pads is venturing into producing them using bamboo material. Though not in production, this initiative could be a game changer once it is fully operational.

In Uganda, production, consumption and export data specific to bamboo material is difficult to determine. Much of the bamboo used in households is not reflected in the formal economy and the data on exports of raw bamboo and edible bamboo shoots across borders remain largely undocumented. Based on the Government of Uganda’s report, the combined economic value of non-timber forests products especially rattan, bamboo and medicinal plants is valued at UGX 66 billion per year, accounting for 17 per cent of the Ugandan forestry sector’s contribution to GDP (GoU, 2002).

Uganda is a negligible player in international bamboo trade representing 0.023 and 0.014 per cent of global imports and exports respectively (Refer to Table 3).

2. Objectives of the Study

The objectives of this bamboo value-chain analysis study as contained in the Terms of Reference of the consultancy are as below:

1. Assess the key bamboo value chain within Uganda, identifying key opportunities and bottlenecks.
2. Map the existing bamboo products and explore potential products having potential in domestic market.
3. Identify bamboo products (existing as well as potential) that have the potential for exporting regionally.
4. Provide concrete recommendations for up scaling the existing; as well as potential bamboo products

2.1 Methodology

This section below provides details of the overall framework for conducting the study, the methodology, data collection tools and study area.

2.1.1 Overall framework

The study was undertaken within the overall framework of value chain analysis. Value chain analysis was used to identify the best entry points (points of leverage) in order to achieve maximum impact; map the key stakeholders (participants) for cluster selection, diagnosis and identification of market channels for analysis of strengths, weaknesses, opportunities and threats; vision building and action planning.

In conducting the Bamboo Market Value Chain Study within Uganda, the consultants adopted a positive approach which means that relatively most attention was devoted to the conditions / constraints that hinder the competitiveness of the bamboo value chain, opportunities for value chain support, leverage points, roles and functions of market actors, stakeholders and their linkages.

The consultants employed a participatory methodology which entailed the involvement of major stakeholders and the value chain analysis was conducted in very close interaction with INBAR staff and other key stakeholders.

2.1.2 Study sites

The study's geographical target area was national. However, particular focus was placed on bamboo production/processing areas in / around Kapchorwa, Bukwo, Sironko, Mbale, Bududa, Manafwa, Kabale, Kisoro, Adjumani, Moyo and regional market places in/around Kabale, Kisoro and Kampala.

2.1.3 Data sources

Data was collected both from primary and secondary sources. Primary data was collected through in-depth interviews with key informants, focus group discussions especially with communities' adjacent protected areas and participant observation. This was mainly qualitative data and was analysed using content analysis techniques. The type and number of people interviewed were: Artisans and processors (8), traders (3), key informants (42) and bamboo collectors (31). Total participants = 84. The details of the participants of the Focus Group Discussion and interviews are shown as **Annex 4**.

The secondary data was collected through document review and analysis of published and unpublished documents of government and development agencies working in bamboo sector.

Data on the Import and Exports of bamboo products were compiled from data extracted from UN Commodity data base (<https://comtrade.un.org/data/>).

Global bamboo trade (both import and export data) for the last three years (2014, 2015 and 2016) were downloaded for the following 12 bamboo commodities: (1) Bamboo poles (HS code: 140110), (2) Preserved Bamboo Shoot (HS code: 200591), (3) Bamboo Mats / Screens (HS code: 460121), (4) Bamboo Plaits and Plaiting material (HS code: 460192), (5) Bamboo Basket Work (HS code: 460211), (6) Bamboo charcoal (HS code: 440210), (7) Bamboo Flooring (HS code: 440921), (8) Bamboo plywood (HS code: 441210), (9) Bamboo pulp (HS code: 470630), (10) Bamboo Paper based articles (HS code: 482361), (11) Bamboo and Rattan seats (HS code: 940151), and (12) Bamboo and rattan furniture (HS code: 940381).

For the purpose of analysis, the data of Uganda, COMESA, entire Africa, China, EU, USA and China was compiled considering their importance in bamboo trade. In addition, to know the import and export scenario of products that could be alternated with bamboo, data of furniture (HS code 9403) and charcoal (HS code 4402) were downloaded and compiled. The data of three years (2014, 2015 and 2016) were downloaded from the website and compiled using the Microsoft Excel software.

2.1.4 Process of study

The Consultant undertook the value-chain analysis in a phased manner.

- Initially, the inception report of the study was prepared based on literature review. Presentation and discussion on the way-forward with discussed with INBAR team.
- Secondly, focus group discussions with selected bamboo value-chain actors were conducted to understand and document the overall scenario of the bamboo sector and to finalise the key value- chains to target.
- Thirdly, key informant interviews were conducted with relevant stakeholders (especially NFA, UWA, MWE, commercial plantation owners and district technical staff).
- Fourthly, based on the findings, a presentation of results was shared with INBAR technical team members and to key stakeholders for review and inputs;
- Finally, the value-chain report was submitted.

3. Status of Bamboo Resource in Uganda

Uganda has an estimated bamboo growing area of about 18,000 hectares (World bamboo resources, 2005), covering close to 545.87 km² of area. Based on the recent GIS based study conducted by Zhao et al (2017), Uganda has a total bamboo growing area of about 545.87 km² – this includes pure bamboo stands, mosaic of bamboo and trees.

Bamboos in Uganda are mainly found in protected areas and national parks (under government control) such as Mt. Elgon, Rwenzori, Mgahinga, Bwindi Impenetrable National Park, Otzi West and East, Ayipe, Atiya, Agoro-Agu and Echuya forests (Zhao et al, 2017).

There are two predominant indigenous species of bamboo available in Uganda. They are (a) *Yushania alpina* or highland bamboo; and (b) *Oxytenanthera abyssinica* or low land bamboo.

These two indigenous bamboo species are mostly confined to natural forests under government control. However, farmers on national park boundaries of Mgahinga and Bwindi have started bamboo cultivation in their farms, though the scale of farm plantations are small.

In addition, two introduced species (a) *Bambusa vulgaris* and (b) *Dendrocalamus giganteus* have adapted well to Ugandan conditions and could be seen in farms and in households across Uganda. Other species such as *Bambusa balcooa*, *Dendrocalamus asper*, *Gigantochloa aspara* also planted by few private farmers. In addition, *Phyllostachys aurea* bamboo species are widely used for landscaping in urban centres.

According to National Forestry Authority (NFA), specified bamboo growing area in Uganda is about 20,000 hectares, growing in an area of about 69,000 hectares (See Table 4). The location and species details of indigenous bamboo resources in government managed forests are as in Table 4.

Table 4: Estimated quantity of bamboo available in protected areas

Name of the protected areas	Location	Bamboo species found in the forest	Area of forests (hectares)	Area covered by bamboo in the specified forest (hectares)
Otzi West	Moyo	<i>Oxytenanthera abyssinica</i>	18,757	5,627
Otzi East	Moyo	<i>Oxytenanthera abyssinica</i>	425	85
Ayipe	Moyo	<i>Oxytenanthera abyssinica</i>	894	268
Atiya	Moyo	<i>Oxytenanthera abyssinica</i>	194	38
Agoro-Agu	Lamwo	<i>Oxytenanthera abyssinica</i>	26,508	7952
Mt Elgon	Kapchorwa	<i>Yushania alpina</i>	16,916	3,552
Echuya	Kabale and Kisoro	<i>Yushania alpina</i>	3,403	442
Mgahinga National park	Kisoro	<i>Yushania alpina</i>	1950	1131
Bwindi impenetrable forest	Kanungu	<i>Yushania alpina</i>		520
Total (ha)			69, 047	19, 615

Source: NFA, 2017

3.1 Bamboo in Private Land

Little information is available on the number of people involved in the cultivation of bamboo. However, information gained through interviews with key informants and through focus group discussions indicated that, the number is very limited (8-10 bamboo plantation owners in Uganda). Farmers around Mhaginga and Bwindi have started growing bamboo in their households and in farms on a small scale to meet their household needs.

The reasons for lack of interest among farmers to grow bamboo are (a) shortage of land, (b) proximity to the park (bamboo is a common property resource), (c) maturity of bamboo (takes up to 5 years for first harvest) and (d) limited awareness about the bamboo.

The locational details of bamboo growing in private farms are attached as **Annex 5**.

3.2 Types and Technical Specification of Bamboo in Uganda

3.2.1 *Yushania alpina*

Yushania alpina or African highland bamboo is found growing between altitudinal ranges of 2200 – 4000M AMSL across highlands of tropical Africa.

Y alpina is a tufted, sympodial bamboo with erect green culms ranging from 2 to 19.5 meters in height; 5- 12.5 cm in diameter; intermodal length ranging from 30 – 70 cm; and wall thickness ranging from 2 cm in bottom to 0.3 cm in the top of the culm (UNIDO, 2009).

Bamboo clumps in common are sustained by a rhizome system, which annually produces new bamboo shoots. Due to fast growing nature, new bamboo shoots grow to their full and become bamboo culms within a period of about 3 months; and with annual harvesting of 20-25 per cent of standing culms, *Y. alpina* can yield 10 tons/ha/year (Endalamaw, 2015).

Culms of *Y. alpina* are fully mature 3 years after they emerge and thereafter old culms, starts deteriorating, eventually dies and rots (UNIDO, 2009). Study by Seyoum et al (2014), shows that *Y alpina* culms need about 3 years for maturation and are suitable for industrial application. Thus it provides opportunity for selective annual harvesting providing annual income for farmers or collectors, sustained raw material for enterprises and industries; and with live intact bamboo culms and rhizome system protecting the soil and performing ecosystem functions.

Studies on *Y alpina* properties based on the bamboo samples collected from Ethiopia validated that this bamboo fulfils the ISO standards for industrial products such as bamboo ply boards, oriental standard boards, medium density fibre boards, bamboo lumber, pulp and paper, charcoal, furniture and bamboo shoots (Endalamaw, 2015; Starke, 2014).

In recent years, *Y alpina* bamboo has been used for manufacturing industrial products such as flooring tiles, blinds and curtains, stick based products and as a bio-energy (UNIDO, 2009)

The technical specification of physical properties of *Yushania alpina* is shown in **Annex 1A**.

3.2.2 *Oxytenanthera abyssinica*

Oxytenanthera abyssinica or commonly called as lowland bamboo is a dense clump forming bamboo growing in dry to semi-humid low land savannah forests.

In Ethiopia, this species is found between 500 – 2100 M AMSL (Mulatu and Kindu, 2010). The length of the bamboo culms / height of clumps range from 3– 10 meters; and the diameter as base ranges from 5 to 10 cm (Mulatu and Kindu, 2010). In Ethiopia, under natural

conditions, it produces 8000 culms/ ha semi-solid to solid bamboo poles.

The stems are widely used for construction, fencing, furniture and fish traps. It is also widely used as fuel wood for household cooking and charcoal production. *Oxytenanthera abyssinica* is also used for production of bamboo juice/ wine in Tanzania, and leaves are extensively used as feed and fodder in Ethiopia. Yield estimates of this species under natural conditions in Senegal ranges from 10-33 ha/yr; 14-28 tons/ha in case of Kenya (Mulatu and Kindu, 2010). This species can adopt itself to very dry regions even with a minimum rainfall of 600 mm per year.

Adam et al (2013), studied the properties of *O. abyssinica* and found that the species has suitable mechanical properties required for prosthetic materials and even proves to be better than some of the conventional prosthetic pylon materials.

Tolessa (2015), studied the suitability of *O. abyssinica* for pulping and paper industry, and found that suitable bamboo pulp and paper can be produced with more environmentally friendly pulping process. It is also eaten as bamboo shoots and production of bamboo charcoal and other bio-energy products

The technical specification of physical properties of *Oxytenanthera abyssinica* is shown in **Annex 1B**. In addition, physical properties of *Bambusa vulgaris*, a naturalised bamboo in Uganda is also shown in **Annex 1 B**

3.3 Condition of Bamboo Forests in Government Forests and Private Land

The overall state of bamboo forests in Uganda is degraded and unhealthy owing to the lack of unsustainable harvesting practices, over-exploitation, and forest disturbances such as wild fires, animal disturbances, pest and insect attack. The extraction level of bamboo poles and bamboo shoots (Mount Elgon) for sustenance use, and product production is high compared to the sustainable regeneration capacity of bamboo clumps. In the case of *Yushania alpina* or high land bamboo predominantly growing in Echuya forest reserve, Bwindi impenetrable forests, Mhaginga national park and Mount Elgon the bamboo forests are severely degraded and unsustainably managed.

Wild bamboo stocks are dwindling due to a number of natural and man-induced factors including illegal harvests, displacement by other species, and life cycles. In Echuya Forest, for example, which is located in Kabale and Kisoro Districts, the portion of land under pure bamboo cover has diminished from 20.5% in the 1950s to 12.5% in the 1990s; and the bamboo-to-tree ratio has decreased, from 48.2% to 26.2% over the same period (Banana and Tweheyo, 2001).

In Mt Elgon, it is estimated that bamboo covers 21% of the national Park. In Otzi West and East, Ayipe, Atiya, Agoro- Agu, bamboo is estimated to cover about 30% of each Central Forest Reserve (CFR). In most of the cases, bamboo resources are dwindling.

The clump composition (age class of bamboo in standing clumps), number of bamboo poles per hectare for healthy growth and optimal productivity is disturbed. Under ideal growing conditions, *Yushania alpina* can grow up to 19.5 meters in height; and over 10 cm in diameter (UNIDO, 2009).

In Ethiopian natural conditions, bamboo forests of *Y. alpina* has a density of 6000 – 14000 culms / ha with an above ground biomass of 51 tons/ha and old to new shoot ratio of 5: 1 (Mulatu and Kindu, 2010). Study by Bitariho (2015) at Echuya and Bwindi impenetrable forests, shows that the height of bamboo culms is around 7-8 meters and average diameter of bamboo poles is around 5 cm. In the case of homogenous bamboo forests, the number of bamboo culms per hectare ranges from 1135 to 41,020 culms and in the case of mixed forests the number of bamboo poles ranges from 0 - 34, 475 standing bamboo poles (Ssali and Bitariho (2013); Bitariho, 2015).

In Bwindi Impenetrable National Park (BINP), most bamboo poles have diameter ranging from 3.25 to 4.05 cm, and a smaller number of bamboo poles have diameter class of 4.85 to 5.65 cm. Considering this the average diameter of bamboo is around 5 cm. Inter-nodal length of the bamboo clumps in BINP is in the range of 63.5 to 72.5 cm (Bitariho, 2015). The sizes of bamboo poles produced is comparatively low, the number of bamboo poles per hectare is high, due to over sprouting; indicating unhealthy state of bamboo forests.

There is an extensive human disturbance, over extraction, sustainable harvesting practices and lack of management. In addition to human disturbances, there are considerable ecological disturbances documented by Bitariho (2015), they are damages caused by animals (eating of fresh shoots): mountain gorillas, elephants, golden monkeys (*Cercopithecus mitis kandti*) and blue monkeys (*Cercopithecus mitis spp.*) extensively feed on young bamboo shoots; borers and insect attack, and climbers (creating abnormal growth) are widely observed. On an average 43 – 92 per cent of the emerging bamboo shoots are consumed or disturbed in BINP and MGNP.

In the case of *Oxytenanthera abyssinica*, low land bamboo widely growing in north-eastern parts of Uganda (Otzi-west, Otzi-east, Aiye and Agoro-Agu: Moyo, Lamwo and its surrounding localities), the state of bamboo forests is highly degraded due to over-exploitation, frequent forest fire and lack of management. In addition, bamboo flowering is also reported. In addition to the local demand, with the increasing demand of bamboo to meet the housing demand of refugees the bamboo resources are indiscriminately harvested. Uganda is now home to close to 1.6 million refugees fleeing the war in South Sudan. This has put an enormous strain on the available resources in Northern Uganda. Bidi Bidi camp alone is host to close to 300,000 refugees.

A number of refugee agencies providing services to refugee communities now prioritize funding for refugee shelters using bamboo poles. This has increased the demand and the price for bamboo from this region.

Majority of bamboo poles in forests are of “poor quality” due to the lack of management. Majority of the bamboo culms are not suitable for high value utilisation, due to the lower size, borer attacks and eaten tops (Bitariho and Mosango, 2005). Comparatively bamboo poles extracted from bamboo clumps grown in homesteads are of better quality due to regular management – thinning, regular harvesting and other management practices

3.4 Bamboo Harvesting / Production Scenario

It is difficult to estimate the number of bamboo poles harvested due to the unorganized nature of sector as well as lack of records. Bamboo harvesting and processing is mainly in locations surrounding Mount Elgon (Mbale district, Eastern Uganda), Rwenzori in the western part; Bwindi, Mhaginga, and Echuya (Kabale district, South-western Uganda). The predominant species is *Yushania alpina*. In the north eastern parts of Uganda areas such as Bbajo (Mukono district), Metu and Otzi in Moyo district bamboo is mainly used for rural house construction in Moyo and Arua (West Nile, North Eastern Uganda). The demand for bamboo is high across Uganda. Bamboo harvesting as well as processing / value addition activities are concentrated in Mbale – Mount Elgon and Kabale (Mhaginga, Echuya and Bwindi).

Mbale:

In Mount Elgon, INBAR's bamboo production to consumption study estimates (Esegu et al, 2000), harvesting and consumption of 700 bundles (10 pcs of bamboo) per village. There are an estimated 14 parishes surrounding Mount Elgon depending on bamboo with an average household size of 500 per parish (7,000 households). Scott (1998) estimates that on an average 10 mn bamboo shoots (580 shoots per hectare) and 1 million bamboo poles (178 poles per hectare) are extracted annually from Mount Elgon bamboo Forests.

Bamboo Poles: Bamboo processing and value addition involves harvesting of the bamboo from forests, primary processing it into

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graded poles, splits and/or slivers; and secondary processing it into baskets and furniture.

Bamboo Shoots: Bamboo shoots are harvested when the shoots reach around 1 meter from ground. They are consumed as well as traded directly to consumers. Processing involves smoking of fresh bamboo shoots on fire and drying in sun.

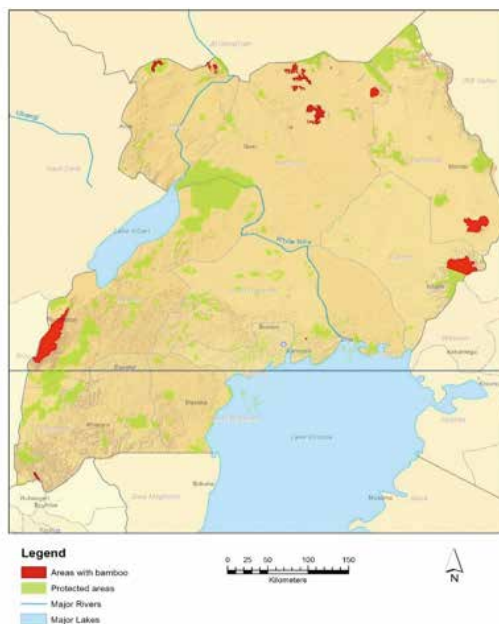


Figure 2: Map showing bamboo growing areas in Uganda (NFA, 2017)

Kabale:

Bamboo harvested from forests is mainly used for construction of rural houses, bean stakes, production of granary, basketry, handicrafts and furniture production. Quantum of bamboo harvested is difficult to determine. According to study (Bitariho and Mosango, 2005), each homesteads surrounding Bwindi impenetrable forest harvest a range of 120-360 bamboo culms each year, and while homesteads in Mgahinga harvests a range 360-900 bamboo culms each year. It is important to note that most of the bamboos harvested for sustenance use and value addition are harvested from forests. In Bwindi, 4 percent of the bamboo consumed are harvested from homesteads and in Mgahinga, 58 percent of the bamboo used are produced from homestead planting (Bitariho and Mosango, 2005)

In the case of Northern Uganda (Mayo and Arua), low land bamboo is harvested mainly for rural house construction and sale of bamboo poles for agricultural and horticultural stakes.

3.5 Access to Bamboo Resources

In Uganda, most of the bamboo resources are found within government controlled Central forest reserves (CFRs) or in National parks. The Constitution of Uganda vests the ownership of the forests and protected areas in the citizens of Uganda. Nevertheless, the responsibility for administration of forest reserves vests with the Central Government or local governments (LGs), on behalf of, and for the common good of all citizens of Uganda. In this respect, CFRs is not under the absolute ownership of the Central Government or responsible LGs, but they are managed in a trust relationship with the citizens of Uganda (Khaukha and Nsita, 2013).

The right to manage, maintain and control the CFRs is granted to the National Forestry Authority (NFA) (NFTPA 2003, Sections 5 and 54), while LGs are granted the same rights for Local Forest Reserves (LFFR) (NFTPA 2003, Section 5 and 9). To this end, NFA and LGs have powers to decide who can access and use resources in forest reserves. In this light, NFA and LGs grant licenses and also ensure that legally prohibited activities are monitored.

Members of local communities are granted subsistence rights to use forest resources such as dry wood and bamboo from forest reserves free of charge and within specified limits. Bamboos are important resources for economic as well as ecological protection. Bamboos have traditionally been used for producing variety of handicrafts, furniture items, housing and fencing; props for agriculture and horticulture application.

As mentioned before, there are two main sources of bamboo in Uganda; (i) from naturally existing forests and (ii) farm planted forests. Study by Bitariho and Mosango (2005), establishes that up to forty-six per cent of the respondents were sourcing bamboo from planted forests and the rest obtained it from naturally existing forests. One respondent making furniture in Nsambya in Kampala sourced bamboo poles from a planted forest in Mukono District.

The dependence of an industry on natural stocks for processing value-added products is unsustainable despite the fast growing rate of bamboo.

It was also apparent that across the locations there is a significant amount of deforested or degraded land requiring re-vegetation (although no known data exists on the exact scale). However, information gained through interactions with officials from Uganda Wildlife Authority (UWA) - Masaba office indicated that Mt Elgon National Park has over 1,000 hectares of open grassland land in Sebei region and UWA is willing to start the restoration process. However, UWA does not wish to deal with individuals fearing that they will claim ownership of land at one time. UWA is looking for an investor.

3.6 Accessibility of Bamboo Resources

A typical bamboo growing and/or harvesting site from a forest reserve is approximately 2-5 kilometres from any form of road. Bamboo resources are not directly accessed by road.

In the case of Mbale (Mt Elgon), for accessing the bamboo resources (bamboo shoots and bamboo poles), collectors have to penetrate the forest by foot and carry the harvested produce by human portage to the road point, which is about 5-7 kilometres. In case of Kabale, collectors carry the produce on head loads till road head, which is about 2-3 kilometres.

Bamboo collected (bamboo shoots and bamboo poles) collected for sustenance use and for processing by rural households, are usually carried in the form of head loads from the point of harvesting to their houses.

In the case of bamboo harvested for sale, bamboo harvested from forests are primary processed (cleaning branches and foliage), sized, bundled and brought to road point by head load. Then it is transported to market point by truck.

From information sourced from furniture makers in Kampala in Nsambya, bamboo is harvested in bulk and transported on order by specific furniture makers who buy it for their own work and also sell to other furniture and craft makers. As such they play double roles in the value chain retailing of bamboo raw material and producing and selling bamboo furniture.

Hired trucks are the commonly used form of transport, their cost can be high and in most cases, the traders often use the share truck to reduce the cost of transportation. To illustrate this, a 2.5 tons carrying capacity of truck from Mbale to Kampala (224 KMs) will cost UGX 900,000; and average of UGX 4,000 per kilometre. A truck can carry up to 1,440 bamboo stems; and this result in cost increment of

approximately UGX 1,000 per bamboo pole

4. Bamboo Value-Chain and Actors

Existing bamboo value chains in Uganda include (a) nursery; (b) bamboo pole; (c) bamboo shoot; (d) bamboo furniture; (e) bamboo handicrafts and ornaments; (f) bamboo charcoal and (g) industrial products.

The bamboo value chain actors mainly consist of (a) resource producers; (b) collectors or harvesters; (c) processors; (d) traders and (e) consumers.

Total number of actors involved and/or associated with bamboo are difficult to estimate nationally, our interactions in the field with different stakeholders puts the current number of bamboo stakeholders at close to 1,000,000 with a vast majority of these actors found in the Mbale, Sironko districts of Uganda.



Below mentioned table 5 shows their functions in the existing

value-chain

Figure 3. Malewa on sale in Mutuufu Market in Mbale District

Table 5: Bamboo Value-Chain actors and functions

Actors	Functions
Resource production: entrepreneurs producing bamboo plants for sale and farmers cultivating bamboo	
Nursery operators	Nursery operators across Uganda selling bamboo plantlets for home owners (landscape and decoration), plantation and to bamboo traders
Commercial plantations	This is an emerging model, with only a few players involved so far. There aims are to establish plantation to supply bamboo poles for industrial processing, demonstrate the benefit of bamboo as a substitute to timber.
Small scale bamboo farmers in integrated agro-forestry systems	Also an emerging area, with a number of undocumented small scale farmers across the country growing bamboo for their own use and for sale.
Collectors / harvesters: Community members harvesting bamboo from forest for sustenance use, handicrafts production and sale.	
Collaborative Forest Management (CFM) groups	1,020 households entered into an agreement with NFA in Echuya forests and have been allowed to access bamboo from the forest reserve as part suitable forest management mechanisms (Online: https://ww2.rspb.org.uk/our-work/conservation/projects/conserving-echuya-forest-uganda/)

Actors	Functions
Individual harvesters	Close to 5,000 individual bamboo harvesters or collectors enter government managed forestry areas to access bamboo. At present the majority of domestic demands are fulfilled through this system. For the case of Echuya, the 1,020 households are allowed to harvest bamboo twice a week. In the case of Mt Elgon, the Bagisu and Sabinu communities settled around the forest are allowed to harvest bamboo once a week. They are mainly allowed to harvest dry bamboo. In Otzi West Central Forest Reserve (CFR) in Moyo, harvesters / collectors enter the forest as and when they wish.
Bamboo shoot collectors	Bamboo shoot collectors enter Mt Elgon National Park both legally and illegally to harvest edible shoots. The edible shoots that are used for household consumption as well as for sales. Local communities collect bamboo shoots and sell to processors or direct to market (fresh), and may keep some for household consumption. However, one company AW Bamboo Enterprises located in Mbale on Mbale-Tororo road is processing and packaging bamboo shoots.
Processing: community members and farmers involved in production of bamboo crafts and furniture products	
Household enterprises	There are an estimated 5,000 individuals involved in bamboo collection from forests, bamboo shoot harvesting and processing, production of handicrafts and furniture products.
Industrial processing	Government research and training institution (Uganda Industrial Research Institute (UIRI) and private players involved in mechanised production of bamboo products
Trading: Trading of bamboo poles and products	
Traders	Involved in collection of bamboo poles, bamboo products from villages; logistics, transportation, trading towns and cities.
Consumers: Final Market for bamboo producers	
Consumers:	Purchase edible bamboo shoots (fresh, smoked and dried), bamboo poles for domestic use, bamboo poles for processing, bamboo baskets, bamboo furniture, bamboo for construction, bamboo for arts and crafts ornaments, and charcoal

4.1 Resource Producers

Actors involved in the bamboo resource production are nursery operators, large scale bamboo plantation owners and micro scale planters in their farms.

4.1.1 Bamboo nursery operators

Within the bamboo value chain, input suppliers mainly take the form of nursery operators. The bamboo nursery business is a recent development, as a result of demand created by development projects. Government agencies especially NFA has four nurseries in Kampala and other regions of the country producing bamboo plants for undertaking restoration activities and to distribute bamboo plants to farmers.

In addition, a number of private players are engaged in production of bamboo planting material for sale to development agencies and farmers. The exact number of private nurseries and the scale of planting material production are difficult to determine.

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Table 6 below shows the details of nursery operators and scale of production. It is important to note, most of the bamboo plants production are through vegetative propagation and the predominant species propagated is *Bambusa vulgaris*.

On average, the selling price of a single bamboo plantlet is UGX 5,000. This cost is very high in comparison to the cost of pine tree plantlets that are sold at UGX 500. Bamboo nursery in Najjera makes an estimated earning of UGX 18 million annually, making them one of the highest earning bamboo value chain actors in Uganda.

Table 6: Details of nursery operators and planting production capacity

No.	Name and owner of the nursery operator	Location	Estimated Capacity (# Seedlings)	Contact details
1	Nandagi Indigenous Tree and Bamboo Nursery	Nangagi, Mukono District	1,200	NFA: Ranger/Manager 0414286049 or 0777611671
2	Luzira Prisons	Luzira	500	Karugaba
3	Dr Nathan Nshakira	Kanungu	2,000	nnshakira@yahoo.co.uk
4	Engineer Fred Ijjo	Moyo	1,000	0772532159
5	NFA Tree Seed Centre	Banda	1000	0702371339
		Namanve	20,000	0774589300
		Nandagi	20,000	0777611671
6	Onvions Farms	Entebbe	1,000,000	0784 284 394; 0754 284 394 help@onvionfarms.com
7	Mr Armstrong Tinka	Wakiso	100,000	0772535878
8	Tree Trends Bamboo Nursery	Luwero	10,000	0704316744
9	Mr Ssali	Kasangati	10,000	0772400916
10	Talent Agro-Forestry Farm	Nakaseke	10,000	0772414047 (Andrew)
12	Divine Bamboo (INBAR supported)	Najjera	25,000	0702902233 (Divine)
13	Bamboo Eco Resort	Masaka	1,000	0752843590 (Lorna)
14	Mbale Nursery (NFA) (INBAR supported)	Mbale	25,000	0782417524 (Christine)
15	Muni University (INBAR supported)	Arua	25,000	0782717945 (Christine)

Source: Field study, 2017

Table 7 provides an overview of an average gross margin analysis for a bamboo nursery based in Kampala. The study team also interviewed respondents with nurseries in Kisoro, however, all the nurseries had just been started and had not yet made any sales. It is important to note, the nursery capacities are large, the sale of bamboo plants is limited.

Based on interviews and discussion with stakeholders, availability of quality planting material of required species is one of the major constraints. In addition, the cost of planting material is high inhibiting the bamboo planters and growers to venture into bamboo plantation.

Table 7: Annual Costs, Income and Margin for the Kampala Bamboo Nursery (5000 plants per year)

Item	Costs (UGX)
Labour - full time	1,800,000
Labour - part time	1,680,000

Item	Costs (UGX)
Water and fuel	1,680,000
Polythene	850,000
Soil	100,000
Total costs (UGX)	6,110,000
Income (5000 plants; UGX 5000 per plant)	25,000,000
Margin (UGX)	18,890,000

Source: Field study, 2017

4.2 Bamboo Nursery Value Chain

Bamboo cuttings and/or seeds are propagated directly in polybags and/or propagated in nursery beds and then transplanted into poly bags. The plants in polybags are maintained in nursery for a period of approximately 6 months and then sold in market (retail for planting / restoration and/ or as ornamental plants).



Figure 4: Bamboo nursery value chain

Table 8: SWOT (Strengths, Opportunities, Weaknesses and Threats) analysis of the Bamboo Nursery Value Chain

Strengths	Weaknesses
• Margins are high • Large landscape restoration targets by government and development agencies • Returns can be obtained in a short time span	• Market is not well developed, therefore, requires a lot of marketing efforts. • Requires a permanent water source
Opportunities	Threats
• Minimal Investments required • Can be established on a small piece of land or even at backyards	• Nursery operation require polybags; ban on polythene bags could soon take effect so alternative needs to be sought

Source: Field study, 2017

4.3 Bamboo Growers / Plantation

Most of the bamboo resources in Uganda are located in natural forest reserves. Open access and lack of stringent restrictions for

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bamboo harvesting from forests has led to the lack of interest and need for the farmers to plant bamboo in their farms. Focus group discussion and interviews with farmers at Metu sub-county in Moyo, Kisoro, Mbale and Kisoro revealed that farmers and community members perceive that sufficient bamboo resources are available in forests, and it regenerates itself; and there is no need for them to undertake bamboo plantation on their own. In addition, they are not aware that the bamboo forests are getting degraded due to unsustainable harvesting practices, wild fires, diseases, pest and insect attacks.

However, of late bamboo plantation in private farm lands have started in Uganda. Bamboo plantation in private farms can be categorised into two categories: smallholder plantation and large scale farmers/ companies.

Smallholder planting: Farmers surrounding Mhaginga national park, started bamboo planting in their homesteads and farm boundaries. It is difficult to estimate the number of households with bamboo resources in their farms but close to 100 households have received support from various development agencies to grow bamboo. The scale of bamboo plantation in farm land ranges from 1 clump to approximately 0.25 hectares. Bamboo plantation activities in private lands have started due to the restriction on harvesting of bamboo from national parks.

UWA and NFA are highly interested to promote bamboo plantation in farm lands, in order to reduce the pressure on natural forests. In the past, Mhaginga national park administration has allowed the farmers to collect bamboo rhizomes from the national park, and plant in their farms.

Large Scale Growers: The number of large scale growers in Uganda is limited. Most of the commercial bamboo producers that study team encountered have an average land holding size of over 25 acres. They are well aware of the commercial uses of bamboo. The biggest bamboo farm visited during our study was owned by Mr Steven Mawa with a total acreage of 60-100 acres of bamboo. Other commercial bamboo producers include Simba farms in Northern Uganda. Most of the commercial producers are located in the Eastern Uganda region, while few commercial bamboo producers are located in Western Uganda.

On average a mature bamboo stem is sold at an average price of UGX 2,000 for both species (*Yushania alpina* and *Oxytenanthera abyssinica*). Table 9 below gives an estimation of quantity of bamboo cultivated in private lands.

Table 9: Estimation of quantity of bamboo on private land

S.No	Name of Owner	Location	Size (Acres)
1	St Mathias Mulumba Shrine, Jinja Diocese, Mayuge district, Kyebando Parish	Kyebando, Mayuge District	4
2	Simba Group	Gulu	No access to information
3	Bamboo Eco-Resorts	Masaka-Rakai	No access to information
4	Talent Agro-forestry Farm	Nakaseke	No access to information
5	Mr. Stephen Kalema	Kikyusa Luwero	5
6	Mr. Armstrong	Wakiso	10
7	Jaguar	Bukomero	10
8	Mr. Steven Mawa	Moyo	60

Source: Field study, 2017

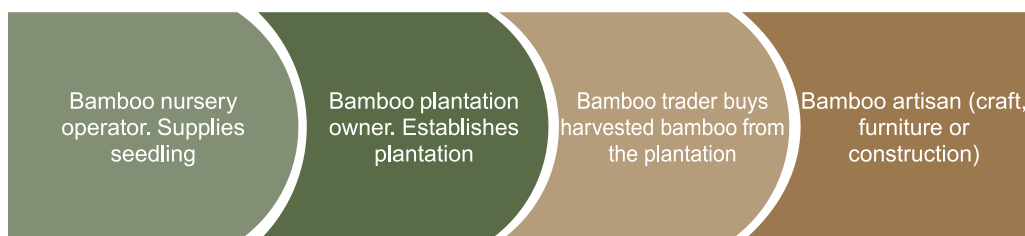


Figure 5: Bamboo Plantation Value Chain

Table 10 below illustrates the annual cost, benefit and profit margin of one acre of bamboo plantation.

Table 10: Annual Costs, Income and Margin for Bamboo Plantation Owners per acre

Item	Expenditure (UGX)	Revenue (UGX)
(a) Planting material (cost is spread over 5 years- for a typical harvest period scenario)	5,000 (per plantlet)	
(b) Plant population per acre	250	
(c) Labour costs (UGX 1,000,000 for 5 years)	1,000,000	
Total costs (a x b+c)	2,250,000	
Poles harvested per acre annually (on average)	1,000	
Income (1,000 poles per acre @ UGX 2,000 annually)		2,000,000

Source: Field study, 2017

NB. Initial cost of investment is high in year 1 but the returns for each subsequent year from year 1 of harvest (Year 5 / 6 of planting), with an annual return of about UGX 2 million per annum.

Table 11: SWOT (Strengths, Opportunities, Weaknesses and Threats) analysis for the bamboo plantation value chain

Strength	Weakness
Possibility of annual income returns after clump maturity	Delayed returns; bamboo plantation takes approximately 5 years to mature
Opportunities	Threat
- Possibility of inter-cropping during initial 3 years of planting - In addition to revenues, can provide intangible benefits such as soil erosion control, soil improvement, hydrology and carbon capture benefits.	Competition with bamboo harvesters from forests who obtain a free resource while the one from the plantation are investing their land and resources

Source: Field study, 2017

4.4 Bamboo Harvesters / Collectors

Bamboo harvesters and/or collectors are one of the key downstream actors in the bamboo value chain because they play the key role of harvesting bamboo resources and provide raw materials for value-adders, entrepreneurs and to end-users.

Harvesters / collectors participate in harvesting mainly two types of bamboo products namely (i) bamboo shoots aka malewa and (ii) bamboo poles.

4.4.1 Bamboo shoots Malewa (Edible bamboo shoots)

Bamboo shoots collection, processing and trading activities are mainly confined to locations around Mount Elgon (Mbale and Sironko district, Eastern region).

Young bamboo shoots are harvested from the forests during the rainy seasons. The main harvesting months are from April to July. It is estimated that about 5,000 community members are involved in collection, processing and trading of bamboo shoots. Bamboo shoot collectors harvest bamboo shoots which have grown to a height of approximately one meter from the ground.

Bamboo shoot harvesting is done using a simple knife. Up to 10-30 pieces of bamboo shoots are then bundled together and carried down the mountain to a collection centre as head loads, and then the bamboo shoots are redistributed into small baskets each carrying a bundle of 10 pieces of bamboo shoot.

Bamboo shoot harvesting, transport, primary processing and marketing activities are undertaken mainly by women. Women as a team of 7-10 persons climb the steep slopes for about 1-2 hours from the base of Mount Elgon to harvest the bamboo shoots.

It is important to note, NFA allocates specific locations in the overall Mount Elgon forest reserve for collection of bamboo shoots, to be collected free of charge.

The harvesters do not pay any official fees to access the bamboo shoots. Community members harvesting bamboo shoots are accompanied by the responsible officer / personnel recruited by the National Forestry Authority (NFA) for monitoring purposes.

The processing of bamboo shoots includes removing the outer sheath, drying and/or smoking of bamboo shoots for preserving or to improve the longevity of bamboo shoots.

The most common method of drying malewa is done using the sun while other malewa entrepreneurs use solar dryers to dry their malewa.

Bamboo shoots are a local delicacy (shoots are cooked along with groundnut sauce as a daily meal) for communities located surrounding Mount Elgon. Bamboo shoots are sold in market all-round the year. Bamboo shoots are mostly traded locally by women.

The markets for the bamboo shoots are located in Mbale main market. Depending on the seasons, the selling price of bamboo shoots ranges from UGX 1,000-3,500 for a batch of 3-10 pieces. Bamboo shoots (3-10 pcs depending on size) is sold for UGX1,000- 2,000 during rainy seasons, and during off-seasons (March to December), due to non-availability of shoots, it becomes expensive and it costs up to UGX 3,500.

In addition to local market, bamboo shoots are also sold in nearby towns such as Sironko and Bududa, the price of the bamboo shoot in towns and cities are approximately UGX 2000 per batch of 4 bamboo shoots.

Currently, one enterprise owned Ms. Irene Walimbwa is involved in processing, packaging and marketing of smoked bamboo shoots

in 100-gram plastic containers. Each container with smoked/dried bamboo shoots is sold at UGX 7,000 each mainly in super markets chains in Kampala and restaurants that serve malewa. She plans to set up an out grower scheme and export malewa to Europe and Asia. However, the business is in its infancy stage, and needs lot of capacity building support to scale up operations.

Based on the interview conducted with bamboo shoot harvesters, it is estimated that each family on an average earn up to UGX 2,000,000/year.

The demand and the supply of bamboo shoots are not organised, and this is an additional income generation activity for the families. It was observed there are over harvesting of bamboo shoots results in degradation of bamboo forests.

It is important to note that the bamboo shoot harvesters have not been given formal training on intensity and methods of sustainable shoot harvesting. They currently use the knowledge passed on to them by word of mouth from generation to generation.

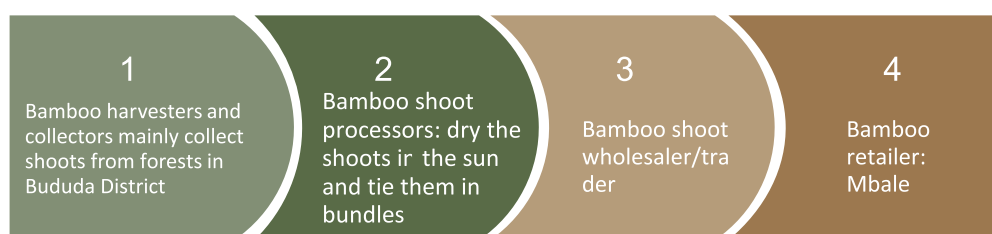


Figure 6: Bamboo shoots (*Yushania alpina*) value chain analysis in Mbale and Sironko districts of Eastern Uganda

Actor 1, 2 and 3 are mostly the same person but also different persons involved in some cases. Women are very active in segments 2, 3 and 4

Table 12 below shows the gross margin analysis of bamboo shoot enterprise producing packaged bamboo shoots

Table 12: Bamboo shoots Gross Margin

Production / Sale capacity: 100 containers per month

Costs	Input (Expenditure) in UGX	Output (Revenue) in UGX
Bamboo shoot (bundle of 3-5 shoot)	2000	
Transport	100	
Drying labour	100	
Packaging Labour	100	
Packaging box and sticker	1000	
Transport to market	500	
Total costs	3, 700	
Sale income		7,000
Profit Margin	3, 300	
Monthly turnover (Number of 100gram malewa containers sold per month)	100	
Potential monthlyIncome (UGX)	330,000	

Source: Field survey, 2017

Note: Gross margin analysis of production of 100 gm containerised dry bamboo shoot

Table 13: SWOT (Strengths, Opportunities, Weaknesses and Threats) analysis of the bamboo shoot/Malewa Value Chain

Strengths	Weaknesses
- Local delicacy and ready market available - Profit margins are high - Potential for engaging large number of women - Malewa is cooked in restaurants in Mbale, Sironko and Bududa Districts, hence the market exists beyond domestic consumption - Malewa is a highly nutritious food	- Enterprises and value addition is largely rudimentary - Trade is largely informal - Raw material supply (Bamboo shoot) harvesting depends on NFA. - Malewa is eaten by a very small proportion of the population of Uganda and has not been promoted as a national food
Opportunities	Threat
- Minimal Investments: possible to set up enterprises with small or no investment. - Possibility of value addition into numerous commoditized shoot products (fresh shoots, packaged shoots). - Export market for bamboo shoots is large. Possibility to set up an out grower scheme targeting smallholder farmers. - Malewa/bamboo shoot can be promoted by the government as a national and nutritious food and adopted in the diets of boarding school students	Unsustainable bamboo shoot harvesting from natural forests could lead to degradation of bamboo forests.

Source: Field survey, 2017

4.4.2 Bamboo poles for construction

Unlike bamboo shoot harvesting, which happens only in Mount Elgon; Bamboo pole harvesting activities are common in all the bamboo growing regions of the country. As earlier indicated, most of the bamboo in Uganda is found in protected areas and the harvesting is done by both women and men. However, access to the bamboo resources is limited to only the communities that live adjacent to the forest reserves. In addition, NFA staff restrict the quantity of bamboo that can be harvested by an individual at any point of time. This is done to ensure that each participating harvester gets an opportunity to earn a living through bamboo harvesting.

Communities around Echuya and Mt Elgon are only allowed to harvest dry bamboo once a week and the quantity is limited to one head load per individual.

In theory, designation of forests as a central forest reserves (CFR) or national parks implies that no commercial extraction of forest resources is allowed except for subsistence use under a framework of Collaborative Forest Management (CFM). However, in practice, the community accesses the resources for both subsistence and commercial purposes without the CFM framework in place.

For the purpose of bamboo harvesting, NFA and national park officials allocate specific areas or plots for harvesting bamboo, and the community member's needs to sign a MoU / agreements with the NFA or UWA.

In the case Otzi West and Otzi East CFRs in Moyo (Northern region), there are no restrictions for harvest, and the local community continues to freely access bamboo from the CFR.

Information gained through interviews with key bamboo harvesters in Metu Sub County, Moyo district indicates that NFA does not attach a lot of value to bamboo and hence communities freely access it. With no restriction, the location and intensity of harvest

depends on the demand of bamboo poles.

The type and quality of bamboo harvested depends on the demand. If the demand is for bamboo poles for construction, bamboo poles with bigger diameter and wall thickness is harvested. For supply to bee-keeping industry, bigger diameter hollow bamboos are harvested.

Harvesting of bamboo is done using a simple knife or locally called as "Panga". After cutting the bamboo poles at the base, the bamboo poles are separated from the clump, the branches along with attached foliage's are cut and discarded. Only the main stem or bamboo poles are collected and bundle the bamboo poles into heaps. Each heap consists of 20 poles, with each pole weighing approximately 3 kilograms. These heaps of bamboo poles are then transported to a road head / bulking point on head loads.

At the bulking point, the bamboo poles are graded according to size and bundled together (20 poles in each bundle) and sold off at rate of UGX 2,000-3,500 per bundle. The price depends on the size of bamboo poles. Prices are generally set by the traders and limited negotiation is possible. The bamboo harvesters do not have a clear indication on the final destination and final price of the bamboo poles. They speculate that most of their bamboo will be used for construction purposes.

From the interviews conducted at Moyo and Lamwo district, the study team estimate that a family or household that participates in bamboo harvesting can earn up to UGX 2,000,000/year from the harvesting, bundling and selling of bamboo stems.

4.5 Bamboo Traders

There are an estimated 250 bamboo traders who purchase the bamboo poles from the harvesters, transport and sell to the whole sellers in local towns, border locations and to Kampala. Close to 70 per cent of these traders are located in the North East and Echuya areas where most of bamboo for utilisation are harvested.

Overall 60 per cent of the wholesalers are also the bamboo traders who buy from the harvesters. The trader's places demand for specific quantifies, on collection the payment is made at the spot, and then the bamboo poles are transported to the destination of sale. Bamboo traders supply bamboo bundles to whole sellers at the cost of UGX 5,000 per bundle. There is a cost increment of 30 per cent.

For a 2.5 Metric tons' truck which can carry 50 bundles, an estimate of transportation cost from Metu sub- county, Moyo to Moyo town council, a distance of 15 KMs costs UGX 50,000; the transportation cost will be an additional UGX 1,000 per bundle; and trader earns a profit of UGX 150,000.

4.6 Bamboo Wholesalers

Bamboo wholesalers operate within a network of bamboo harvesters. A large number of bamboo wholesalers, approximately 150 are located mainly on the border towns such as the border with the Democratic Republic of Congo (DRC) and Rwanda in South-western Uganda, near Kisoro and the border with South Sudan around Moyo town. In Adjumani town (Northern Uganda), there are about 50 traders selling bamboo poles.

Unlike the harvesters, the bamboo wholesalers are more business savvy, have a good grasp of the market that they service and they offer product differentiation services. Bamboo wholesalers on receipt of the bamboo poles from traders grade the bamboo poles according to the variety or species as well as dimensions and supply them to the target market. For example, bamboo of *Oxytenanthera abyssinica* is supplied to construction and scaffolding industry; *Yushania alpina* bamboo variety to bamboo furniture and craft industry.

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The cost of bamboo bundles sold by whole seller's ranges from UGX 5,000-8,000. There is a profit margin of approximately UGX 3,000 per bundle.

Wholesalers also play a key role not only as quality controllers but also as exporters. They do this by supplying bulk produce to buyers from Kenya, Dr Congo and South Sudan. Export of bamboo poles to neighbouring countries are specific to wholesalers or bamboo traders who have outlets situated near or within border towns like Lamwo, Moyo, Bundibugyo, Adjumani and Kisoro.

4.6.1 Bamboo poles and construction materials value chain

The demand as well as the cost of bamboo poles is increasing day by day. Most of the households and processors located close to bamboo resources harvest and utilise the bamboo directly. However, limited trading of bamboo poles happens; the cost of bamboo poles varies across species and location.

Based on field observations we could see that bamboo gets more expensive as it moves away from the harvesters/wholesale point to the town centres or to the refugee camps. In Adjumani town (Northern Uganda), there are about 50 traders selling bamboo and each with average annual sales volume of 200 bundles of 20 poles each. In addition, bamboo poles are widely sold in towns across Uganda.

Information gained through interactions with commercial plantation owners indicated that commercial bamboo plantations are a lucrative business. For example, St. Mathias sells an average 700 bamboo poles monthly at UGX 2,000 each thus fetching UGX 1,400,000. St. Mathias Mulumba Shrine sells bamboo to different customers from Kampala, Iganga and Mayuge and they mostly use the bamboo for staking passion fruits, furniture, straws for ice cream, construction and fuel wood. However, they are faced with a number of challenges including: customers complaining that the price for bamboo poles is high (they would want to pay UGX 1,000), theft, forest fires, etc.

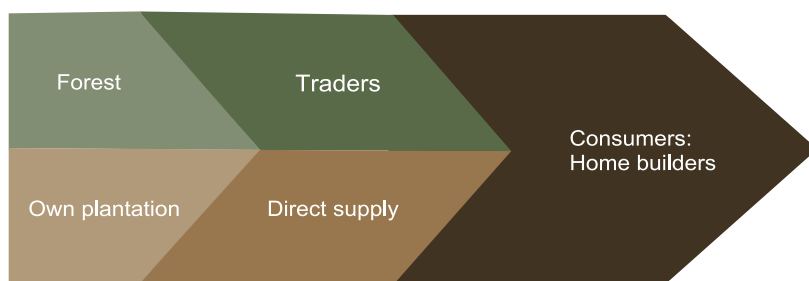


Figure 7: Bamboo poles for Construction value chain

Table 14 below shows the gross profit analysis of bamboo pole value-chain: cost increment of bamboo poles from the location of harvesting (farm gate) to retailer and the profit margin per bamboo pole.

Table 14: Bamboo Poles trading Gross Margin analysis

Location	Species	Farm Gate / Whole sale Price (UGX)	Retail price (UGX)	Minimum margin per pole (Transport and Labour (100 sh per pole) - UGX	Dimension
Mbale	<i>Yushania alpina</i>	200 - 300 per pole	500-1,000 per pole	200	Length: 10 feet; Diameter: 4-5 cm

Location	Species	Farm Gate / Whole sale Price (UGX)	Retail price (UGX)	Minimum margin per pole (Transport and Labour (100 sh per pole) - UGX	Dimension
Kabale	<i>Yushania alpina</i>	150 per pole	300 per pole	50	Length: 10 feet; Diameter: 4-5cm
Metu sub County, Moyo district.	<i>Oxytenanthera abyssinica</i>	150 per pole	300 per pole	50	Length: 18 feet; Diameter: 2-3 cm
Arua	<i>Oxytenanthera abyssinica</i>	150 per pole	300 per pole	50	Length: 18 feet; Diameter: 2-3 cm
Mathias Mulumba Shrine (KAMPALA)	<i>Yushania alpina</i>		500-2,000 per pole		Length: 10 feet; Diameter: 4-5 cm
Lamwo & Gulu Districts	<i>Yushania alpina</i>	150 – 200 per pole	300 per pole	50	Length: 10 feet; Diameter: 4-5 cm

Source: Field survey, 2017

Table15:SWOT analysis for the bamboo poles for construction

Strengths	Weaknesses
- Ready market is available for the bamboo poles because of the numerous applications and uses. - Big market exist for bamboo poles for construction around the growing refugee corridors in the West Nile and Northern Uganda regions in Uganda	- Less durability due to lack of preservation and treatment - Value addition of bamboo poles into products are minimal
Opportunities	Threats
Construction industry is fast growing	Any changes in the environment policies and laws can have a negative impact on bamboo harvesting activities from the forests

Source: Field study, 2017

Bamboo Construction:

A private player: Engineer Fred Ijjo based in Moyo district has established a dip-diffusion bamboo treatment tank and has a workshop for production of bamboo construction components. He has undertaken few construction projects: construction of eco-resorts; schools in refugee camps, etc. He is the only entrepreneur in Uganda who has bamboo treatment facility.

Table 16 below shows the SWOT analysis of the bamboo construction sub-sector.

Table 16: SWOT analysis of Bamboo Construction

Strengths	Weaknesses
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Traditional knowledge and culture associated with usage of bamboo as a construction material	- Bamboo as a construction material is perceived as less durable due to lack of preservation and treatment. - Bamboo is perceived as a poor-man's timber
Opportunities	Threats
- Bamboo as a construction material, furniture and crafts have huge potential in eco-tourism (resorts) as well as in rural housing. - Technology transfer and techniques for high-end application available	Alternative construction materials such as timber, and cement / steel based construction material – as they are perceived as a better material.

Source: Field study, 2017

4.7 Artisanal Products

Bamboo artisanal product productions are mostly concentrated in Mbale and Kabale localities. *Yushania alpina* or highland bamboo is commonly used for the production of artisanal products, which can be categorised into:

1. Bamboo basketry
2. Bamboo / rattan furniture
3. Ornaments and fashion accessories

Below mentioned table 17 shows the locational details of bamboo artisanal working communities in Uganda:

Table 17: Details of bamboo working communities in Uganda

Location	Activity	Number of Household / enterprises	Product	Source
Mbale (Mount Elgon) - Busiu, Bundesi, Bukayemba, Sipi, Lukusi and Gamani villages	Household enterprises	500 HH enterprises per parish (14 parishes)	Bamboo Shoots, Handicrafts, furniture and House construction	Esegu et al, 2000
Echuya Forest reserve (Kabale, Kisoro districts)	Household enterprises	80 HH	Bamboo basketry	Esegu et al, 2000
Kabale (South Western region) : Kalengyere, Bufundi, Ikamiro, Kasenkya and Muhindura villages	Harvesting of bamboo poles	100 HH	Bamboo poles collection, Bamboo basketry, furniture, house construction	Esegu et al, 2000
Bwindi (Nyamabale, Mushanje and Kitojo parishes)	Product producers	98 HH	Bamboo handicrafts and poles for housing	(Bitariho, 2015)
Mgahinga (Gisozi and Rukongi parishes)	Product producers	162 HH	Bamboo handicrafts and poles for housing	(Bitariho, 2015)

Location	Activity	Number of Household / enterprises	Product	Source
North East Uganda – Moyo and Arua	Bamboo collection	150 HH	Bamboo collection	Field observation
Adjumani town (Northern Uganda)	Bamboo Traders	50	Bamboo trading	Field observation

4.7.1 Bamboo basketry and furniture value chain

Bamboo basketry production is a traditional activity, which are mostly produced to cater to local household market. The basketry products include (a) Granary; (b) bee hives; (c) household and farm utility baskets and (d) trays.

Mbale: It is estimated that 15 parishes in Mbale (500 households per parish) are involved in some level of production of bamboo handicrafts and furniture such as stools, chairs and tables.

Kabale: There are an estimated 250 households surrounding Mgahinga national Park, Echuya CFR, and Bwindi involved in production of granaries, baskets, trays and bee hives.

The raw material for the production of handicrafts is collected from bamboo forests. The production of artisanal products is done on an individual and/or household basis. Basket production is a part-time job for most of the processors.

In Mbale, artisans spent about 50 per cent of their time in 5-12 months a year, and in case of Kabale, bamboo processing activities are undertaken for approximately 6 months in a year (Esagu et al, 2000)

All the bamboo products produced are traditional in nature. The equipment's used includes long knife (Panga), knives for slivering, measuring tapes, hand saws, hammer and sand papers. The input materials used for processing includes raw bamboo and nails.



Figure 8: Bamboo ceiling

Bamboo processing skills are transferred from family members and friends. There are no indications of any contemporary bamboo products. There is a larger scope for skill development, improvisation of tools and equipment, processing techniques and diversification of bamboo products.

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Market for Products: Kabale: Bamboo products such as granaries (both indoor and outdoor) are made on order, and the products are sold locally in the village.

Bamboo products such as baskets and trays are sold within the village. In addition, cross-border trade to Democratic Republic of Congo is happening. Weekly markets within Kabale location and Mpondwe border crossing in Kasese are the marketing / selling points

Table 18: Bamboo products in Kabale: Time and cost analysis

Products	Number of bamboo stems		Time taken to make bamboo products (hrs.)		Selling Price of bamboo products (UGX)
	Bwindi	Mgahinga	Bwindi	Mgahinga	
Baskets	5±0	4±2	18±9	15±9	4,000
Outdoor granaries	36+-18	71±41	52±34	50±29	7,000
Trays	4±1.2	3±2	20±7	16±11	2,500
Bee hives	8±4	7±3	18±10	12±6	60,000
Indoor granaries	15±8	16±15	25±7	20±11	13,000

Source: Bitariho and Mosango, 2005

Traders: There are no formal trading arrangements, the buyers come to the producer's home and place order for the products.

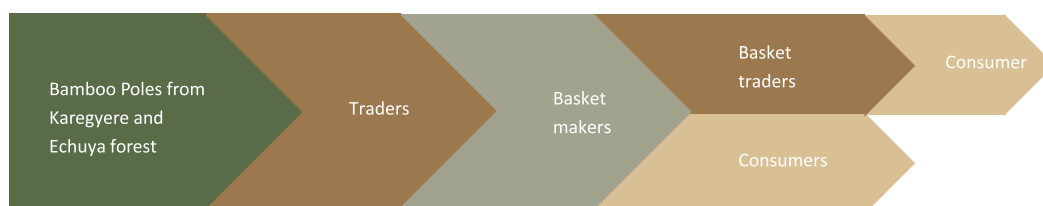


Figure 9: Bamboo Basketry Value Chain

Table 19: SWOT analysis of the Bamboo Basket Value Chain

Strengths	Weaknesses
- Household activity – an additional income source for women and men. - Enterprise possibility with no or minimal investment. - Good local demand and scale of production	- Lack of market information - Mainly focussed on traditional products - Lack of mechanism of input material supply-chain for higher value addition.
Opportunities	Threats
Huge potential for diversification into packaging products, wide range of handicrafts and souvenir products	Bamboo sourced from the forests and, therefore, uncertainty related to raw material supply;

Source: Field study, 2017

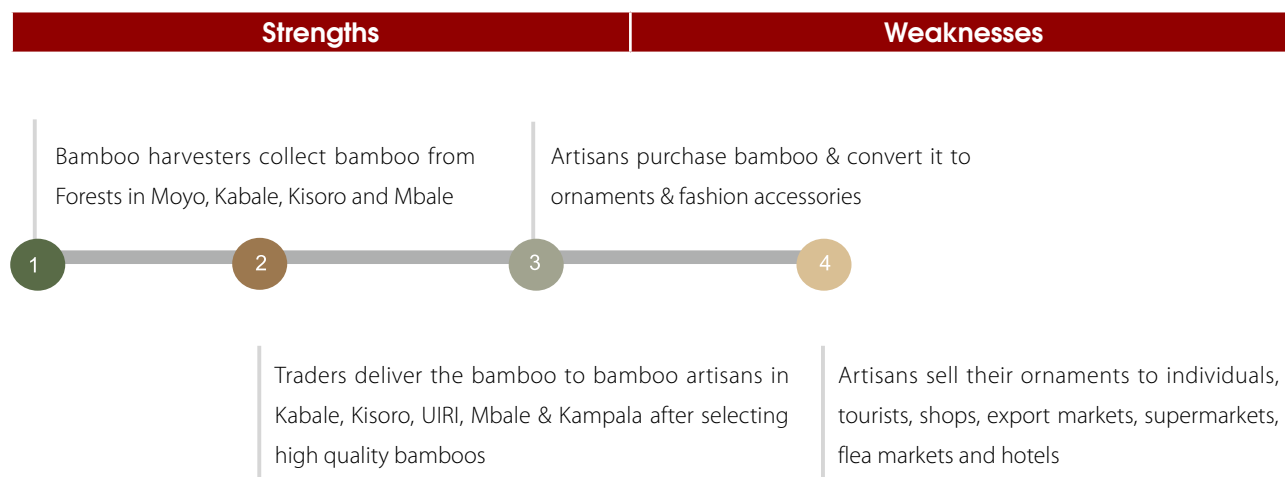


4.7.2 Cane / Bamboo Furniture Value-Chain:

In Uganda furniture products from cane and bamboo often utilise both of these products together on the same piece of furniture. The largest number of people engaged in production of this furniture are found on the outskirts of Kampala, in a place called Nsambya. They produce and sell their products by roadsides.

SWOT analysis of the cane/bamboo furniture value chain is shown in Table 20 below.

Table 20: SWOT analysis of the Cane/Bamboo Furniture Value Chain



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• Profit Margins are high • Cane / bamboo furniture is much stronger than a lot of the imported synthetic furniture on the market • The cane / bamboo furniture is very attractive	• Value addition is minimal (currently in Uganda all the bamboo furniture only has one colour (cream-light brown) = the colour of the cane / bamboo and yet some customers like colourful furniture • Designs of the products are limited and it is currently catering to household segment, not to other product segments.
Opportunities	Threats
• High demand for the cane / bamboo furniture locally and beyond • There is an existing association of cane / bamboo furniture makers with a number of members and there is an opportunity for scaling up and upgrading the value-chain.	• Alternative cheaper options from plastic and metal imported furniture • Over harvesting of cane or rattan can lead to depletion of cane resources.

Source: Field study, 2017

4.8 Ornaments, Fashion Accessories

Bamboo ornaments and fashion accessories producers are one of the most visible bamboo value-chain actors in Uganda. There are an estimated 95 enterprises / workers involved in production of bamboo fashion accessories. The range of products includes bamboo necklaces, ear rings, bangles, name tags, lady purses and bags. Bamboo fashion accessory enterprises are located around Kabale, Kisoro, Kasese, Masaka, Mbarara and Kampala (Nsambya, Kabalagala & national theatre). The artisans interviewed indicate that the investment for setting up the enterprise (tools and input material cost is about UGX 200,000), and the revenue generated by production of bamboo fashion accessories is about UGX 400,000 per month. Entrepreneurs purchase the bamboo and other input materials (paint, varnish, joinery and embellishment materials) from markets in Kampala.

Figure 11 below shows the value-chain map of bamboo ornaments value-chain.

Figure 10: Furniture made from Bamboo & rattan by artisans in Nsambya, Kampala

Figure 11: Bamboo ornaments Value Chain

Table 21: SWOT analysis for the Bamboo ornaments Value Chain

Strengths	Weaknesses
• Margins are very high • The bamboo ornaments are cheaper & stronger as compared to the imported ornaments on the market • The locally made ornaments can be custom made	• Lack of quality standards for locally made ornaments • Lack of quality consistency.
Opportunities	Threats
• Could be promoted as a local product for tourist and local market • Low investment required for this business • Existence of UIRI centre that offers training for artisans	• A lot of cheap imported ornaments from China and Kenya available at cheaper cost. • Lack of regular supplies of good quality bamboo for making ornaments

Source: Field study, 2017



4.9 Bamboo Charcoal Traders Value Chain



Charcoal production is an emerging node of bamboo industry that has attracted interest among many stakeholders. There are two bamboo charcoal traders (one in Kisoro and another in Kampala). This segment will have enormous potential for scaling up.

It is estimated that the annual contribution of firewood and charcoal to Uganda's GDP stood at UGX 120 billion and 67 billion respectively; and charcoal consumption was postulated to increase by 6 per cent in accordance to the annual rate of urban population growth (NBEDS, 2001).

It is important to note that close to 90% of the population in Uganda depend on some form of biomass (firewood or charcoal) as a source of energy for household or restaurant cooking and heating (Energypedia, 2017).

According to the National Forest Authority (NFA), more than 73,000 hectares of private forest and 7,000 ha of protected forest reserves are destroyed annually for production of timber and charcoal. It is clear that the country is headed towards an energy crisis unless an alternative and affordable source of energy is identified to replace wood fuel and charcoal.

Bamboo utilization for production of bamboo charcoal as well as other energy products such as pellets, briquettes represents an untapped market.

Bamboo, a woody biomass, is currently used as a fuelwood by rural communities especially in Northern regions of Uganda (Mayo and Arua). It has a number of desirable fuel characteristics (Scurlock et al., 2000). The calorific value of bamboo is in the range of 4600 – 5400 kcal/kg (Banik, 2000). Globally, bamboo is presently used as fuel for cooking, converted into charcoal, pellets, active carbon, and is suitable for electricity generation.

Bamboo charcoal and activated carbon are extensively used in Japan, Korea and Taiwan because of its high calorific value and absorption capacity (Lobovikov et al., 2007). Bamboo charcoal production is one of the important bamboo value chains globally.

The global trade of bamboo charcoal is estimated at USD 42.4 Mn, and the domestic consumption is multi-fold of the global trade value (INBAR, 2012). During the course of the study, the charcoal processors interviewed mentioned that they buy "yellow" bamboo (*Bambusa vulgaris*), which is dry and then converted into charcoal using kilns.

Figure 12: Image of a low cost, traditional bamboo charcoal kiln

Figure 13: Image of bamboo charcoal ready for the market

These bamboo charcoal processors buy bamboo stems (*Bambusa vulgaris*), at the cost of UGX 2,000 and the charcoal produced is valued at UGX 3,450 for bamboo charcoal, pellets or briquettes which have ready market in Uganda. Appropriate bamboo charcoalisation technology is available in Uganda.

There are different types of kilns introduced in Uganda to transform bamboo into charcoal and these include traditional brick kilns and metallic kilns imported from China.

Study team visited a fabricator who was trained to fabricate metal kilns for charcoal production. Though he has the capacity and facility to fabricate metal kilns, he has not received any order for production of kilns. This indicates the market for bamboo charcoal has not developed, and the production of bamboo charcoal and its enterprises are in infancy.

Table 22: Gross margin for the production of bamboo charcoal (per bundle)

Item	Input (Expenses) UGX	Output (Sale) UGX
Cost of bamboo including transport	2000	
Labor	200	
Drying	0	
Total costs	2200	
Sale income of charcoal		3450
Margin	1250	
Monthly turnover (Bundles)	100	
Potential monthly margin UGX	125,000	

Source: Field study, 2017

Table 23: SWOT analysis for the bamboo charcoal value chain

Strengths	Weaknesses
- Bamboo charcoal is a suitable bio-energy resource - Bamboo waste can be carbonized to produce bamboo charcoal or bio-char - It is a relatively simple process to build a kiln for carbonizing bamboo to charcoal	- Heavy reliance on bamboo stock from forest reserves - Lack of awareness of the potential for bamboo charcoal by the charcoal traders and charcoal consumers

Opportunities	Threats
• Availability of affordable technologies for carbonizing bamboo charcoal • Availability of abundant labour that can be trained on how to produce bamboo charcoal • A large population that is dependent on wood fuel and charcoal for energy (90%) • A sizeable market size to tap into valued at UGX 67 Bn	• Degradation and destruction of the bamboo forest and thereby environment to access raw material for the production of bamboo charcoal

Source: Field study, 2017

4.10 Industrial Products

Till date, industrial bamboo products are not commercially produced in Uganda. Uganda Industrial Research Institute (UIRI) in Nakawa and in Kabale are two bamboo processing centres established by Ugandan government in collaboration with China Bamboo Research Centre with the mandate of research and development, training and capacity building and business incubation. The government of China has invested close to USD 10 million to set up these two value addition factory. Both the centres have facilities, machinery and equipment's for value addition of bamboo into a number of products. They include:

1. Toothpicks
2. Floor panels
3. Mats
4. Vanished and/or polished bamboo poles
5. Bamboo furniture items
6. Tinned or packaged bamboo shoot/malewa
7. Bamboo charcoal

Though the machinery and equipment's are available, both the centres are not operating at full capacity.

5. SWOT Analysis of Bamboo Sector in Uganda

There are a number of strengths and opportunities that can be taken advantage of to advance bamboo value chain development. There are also weaknesses and threats that need to be addressed to promote the competitiveness of bamboo value chain. Table 24 below gives details of strengths, opportunities, weaknesses and threats of overall bamboo sector in Uganda.

Table 24: SWOT analysis of bamboo sector in Uganda

Strengths	Weaknesses
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• Uganda has indigenous bamboo resources and agro-climatic conditions suitable for introduction of commercially important species. • Big landholder farmers currently having bamboo plantation perceive it as a commercial crop. • The biggest cost in forestry is the time value of money. There is usually a time horizon mismatch. However, bamboo is one of the fastest growing plant that reaches maturity in about five years; on maturation selective annual harvesting is possible without deforestation. • Traditional bamboo value-chains such as (a) bamboo poles for construction; (b) bamboo shoot; (c) bamboo handicrafts / basketry and (d) bamboo furniture exist. • Traditional skill set on harvesting, production of bamboo handicrafts and furniture exist. • Bamboo enterprises are possible with investments of various scale: zero investment to millions of USD. • Current interest from investors for establishing bamboo enterprises • Markets for bamboo products exist: products made from other material similar to bamboo are widely sold in market. • Environment consciousness; and customs are interested in green products. • Big global, regional and local markets for bamboo; In Uganda about 1 Mn people use bamboo and its products. • Enormous environmental benefits – reversing degradation, soil and water conservation, climate change mitigation and adaptation tool.	• Cost of bamboo planting material is high. • Limited knowledge on bamboo propagation techniques • Lack of knowledge on quantity of bamboo stocks, scientific and sustainable management of bamboo forests. • Limited bamboo species (two indigenous bamboo species). • Bamboo resources in forests are unmanaged, and not currently suitable for industrial processing. • Inadequate farm plantation. Farmers have limited understanding on the potential of bamboo, and therefore less interest in planting bamboo in their farms. • Lack of market connectivity and absence of local trader's / market channels. • Limited capacities and skill set in bamboo shoot and bamboo pole harvesting, bamboo product production is limited to traditional products; • Lack of input and value addition materials for probable enterprises. • Poor quality of bamboo products; Consumers perceive bamboo as less durable material • Bamboo harvesters and well as bamboo processors are not organized, thereby limiting the bargaining power with traders. • Products produced are traditional in nature; quality is poor and processors lack understanding of market. • Higher cost of transportation due to poor infrastructure. • Industrial products are new, lack of capacity in production and management of value- chain.
Opportunities	Threats

- Huge opportunities for scaling up bamboo nurseries to cater to increasing demand of projects and private plantation.
- Significant land available to develop bamboo plantations in government land (vacant and degraded land, road reserves etc.)
- Huge scope of increasing the area of bamboo plantation in private farms; NFA and UWA encourage the growing of bamboo on private land and; are willing to provide the planting material
- Growing domestic demand from the construction sector, especially bamboo poles for scaffolding
- Bamboo harvesting and artisanal processing being a labour intensive work, can provide opportunities for poor households, youth and women
- Rapidly growing population coupled with high rate of urbanization creates high demand for furniture, household products, and for construction.
- Tourism market is growing, thereby opportunities for creating demand for bamboo products.
- Possibility of value-addition into high quality bamboo shoots, furniture, floor board, bio-energy products. Incomes as well as environmentally conscious consumers growing.
- Presence of support agencies targeting bamboo sector development: development agencies (INBAR, SNV; government NFA, UWA, UIRI, and UNBS)
- Carbon credits is an opportunity to explore
- Over-harvesting of bamboo, and competing objectives of government (conservation Vs. development).
- Growing demand, and threat of bamboo forest degradation.
- Forest degradation and de-forestation due poor enforcement and weak forest law (lack of staff)
- Competes with food production especially in areas with limited land availability.
- Bamboo faces threats from forests fires
- Import of cheaper products from bamboo as well as from other materials.
- Bamboo harvesting rights and tenure / access is uncertain, this depends on the NFA and UFA

6. Policies, Institutions and Enabling Environment

The overall management of bamboo as a natural resource falls under the jurisdiction of National Forestry Authority (NFA) and Uganda Wildlife Authority (UWA), Ministry of Water and Environment (MWE). Bamboo value-addition and enterprise development activities are managed by the Uganda Industrial Research Institute (UIRI); investment promotion is handled by Uganda Investment Authority (UIA). There are a number of institutions and policies that are relevant to bamboo. However, there is no coordination among all the stakeholders. Since, bamboo is a minor sector, most policies, agencies and departments, does not have specific bamboo related policies, guidelines and/or activities.

Below mentioned Table 25 provides the alignment of bamboo development to the overall policy and institutional frame work in Uganda.

Table 25: Table showing the alignment of bamboo development to the overall policy and institutional frame work in Uganda

Theme	Policy/ Institution	Mandate	Commitment / Objectives Alignment With Bamboo
Raw material and Resource development	Ministry of Water and Environment	NFA and UWA are the main regulators of bamboo harvesting in forest reserves, protected areas and national parks.	• Issue permission to traders and collect revenue in form of royalty. • Designates forests for community forest management (CFM)
	National Forestry Policy 2001	• Protection and sustainable management of government owned forests and private land. • Regulation of wood and non-wood processing industry.	• National forest policy does not have mention of bamboo, in particular. • Promotion of forest plantation business including developing collaborative partnerships with rural communities for the sustainable management of forests. • Supply of high quality tree seed and planting material. • Establish watershed protection forests.
	The National Forestry and Tree Planting Act, 2003	Provides guidelines for conservation, sustainable management and development of forest	Provide guidelines for establishment of community forests for sustainable management and welfare of local community; and issuance of license. Private natural forest: Owner need to register with district land board; produce belong to owner and can use in any manner; but mandates the owner to use in a professional and sustainable manner. Private plantation: Owner need to register with district land board; produce belong to owner and can use in any manner; but mandates the owner to use in a professional and sustainable manner. Planter has right to harvest, sell part or all of produce.
	National Forestry Business plan 2016 -2021	Plan for sustainable forest expansion, forest management and optimum utilisation of forest resources	NFA will be undertaking planting and activities towards popularizing bamboo and bamboo products, and developing alternative bio-fuels, or briquettes etc. in order to protect the Central Forest Reserves.
	National Forestry Tree Seed Centre (NTSC)	NTSC is working National Forestry Authority (NFA), mandated to provide adequate quantities of seed and plant materials with desired genetic and physiological quantities to meet the demand for tree planting activities in the Country.	• The services provided by the seed centre include seed and seedling sales, tree seed source development, training and advisory services. • NTSC hosts a number of agroforestry species including bamboo.

Theme	Policy/ Institution	Mandate	Commitment / Objectives Alignment With Bamboo
Micro small and medium scale enterprise	Micro Small and Medium Enterprise policy 2015	The policy aims to (a) provide an enabling environment; (b) promote research, product/ process development, innovation, value addition, (c) develop product standards; (d) provide market access and business information services. (e) increase access to credit and financial services, and (f) enhance capacity building entrepreneurship, vocational, business and Industrial development skills	• Priority sectors for policy implementation do not clearly specify bamboo as a sub sector. • However, bamboo can very well fit into the themes of manufacture of food and beverage; and production of wood product including furniture.
	NAFFORI and Universities	Research and development; Education and awareness	• Research and skill development of stakeholders; technology development. • Bamboo and bio-fuels are key sectors identified.
	Uganda Industrial Research Institute (UIRI)	Ugandan government's lead agency for industrialization and technological innovation under Ministry of Tourism, Trade and Industry (MTTI)	• UIRI provides entrepreneurship training, business advisory services, technology know-how and networking. • Two bamboo specific training and incubation center for Bamboo (Kampala and Kabale) • It has the required infrastructure, and provides entrepreneurship trainings, but lacks capacity in innovation, commercial production for ensuring self-sufficiency, marketing, and other BDS.
	China National Bamboo Research Center	Support UIRI in bamboo processing and training unit in Kabale and Kampala	Technology transfer and capacity building. Bamboo machine and infrastructure provision; about USD 10 million investment
Investment promotion	Uganda Investment Authority	Drive National Economic growth, through development of partnership with private sector	• Has one-stop centre (electronic and physical) to attract investors. • In its compendium of Investment & Business Opportunities Volume 2" had included bamboo" Making bamboo products" for production of bamboo basketry, partitions, candy sticks, and tray.

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Theme	Policy/ Institution	Mandate	Commitment / Objectives Alignment With Bamboo
National Vision and Development plans	Uganda Vision 2040	Develop Uganda into a high middle income country by 2040	- Aims to increase the forest cover from current 15 per cent (2010) to 24 per cent in 2040. This includes increasing forest cover both in public and private lands. - Agro-based industries will be given priority. - Develop five regional cities (Gulu, Mbale, Kampala, Mbarara, and Arua) and five strategic cities (Hoima, Nakasongola, Fort Portal, Moroto, and Jinja);
	National Development Plan II (2015- 20)	Plan for development of overall socio-economic development	- Implement activities for Farm Income Enhancement, Tourism Marketing and Product Development Skill development programs for women (UWEP) and youth Skills Development Project (YLP). - Increase afforestation, and reforestation activities
	Uganda Green Growth Development Strategy	Operationalize the objectives of Vision 2040 and National Development Plan II. Specifically support low emission economic growth pathways	- Upgradation of agriculture value-chain and sustainable energy - Create 4 million green jobs
Trade	Uganda National Bureau of Standards	To provide standards, measurement and conformity assessment	- Develop and harmonise standards, product testing, product certification and issuance of trade-marks, pre-export verification certificates. - Has standards for canned bamboo shoots: US CODEX STAN 241:2003
	Common Market for Eastern and Southern Africa (COMESA)	Provides common market for goods and services	Uganda is member of COMESA, consisting of 23 Eastern and Southern African countries with a population of over 400 million people.
	Economic Partnership Agreement	Preferential access to goods and service	Ugandan products enjoy preferential market access to the EU and the USA

Source: Field study, 2017

6.1 Other Business Enabling Conditions in Uganda

Other business enabling environment such as (1) support from Uganda Investment Authority (UIA) for investment, registration, access to land, etc; (2) ownership on investment and land; (3) electricity and its tariff; (4) potential human resources, labour rates and condition; (5) taxation provisions; and (6) intellectual property rights; (7) transport and shipping (roadways, railway transport and sea freight cost) are elaborated in Annex 2 A.

6.2 Policies and Institutional Constraints

There is no specific information on the contribution of the bamboo sector to the national economy or to forestry sector. Many of the policies of the government do not include bamboo as priority. This is an indicator of the importance provided to bamboo sector in Uganda. The most important weakness of the bamboo sector in Uganda is lack of dedicated agency as well as lack of coordination among different stakeholders of government.

Definition: The usual constraint is definition or classification of bamboo. Bamboo is classified as a “tree”. Application of this will create confusion – as per legal term, bamboo is classified as tree, and it is still considered as a “Non-Wood Forest Product”.

Clause 3: Interpretation of the “National forestry and tree planting act, 2003” states bamboo is classified as a “tree”. “Tree” includes palm, bamboo, cane, scrub, bush, climber, seedling, saplings and re-growth of all kinds, and any parts of them. “Non-wood forest produce” means that all forest produce that is not tree, timber, firewood, or any other products directly derived from them or a mineral under the mining act”

This creates ambiguity, bamboo is still considered as a tree and it is still an NWFP. Bamboo is ecologically not a tree. Unlike most of the tress, which requires clear cutting, bamboo produces new shoots and regrows every year without re-planting. This inhibits access of bamboo for domestic utilisation as well as commercialisation.

Domestic use and harvest from Forest reserves: Clause 33 of the “National Forest and Tree Planting Act, 2003” states that “(1) subject to management plan, a member of the local community, may in a forest reserve or community forest, cut or take free of any fee or charge, for personal domestic use in reasonable quantity, any dry wood or bamboo; and (2) no person may in a strict natural reserve or a site of specific scientific interest cut or take dry wood or bamboo”.

Bamboo produces new shoots every year which grows into a bamboo pole, and on maturation when the bamboo poles reaches age of 5 and beyond, it dies and deteriorates. Dead bamboo poles are not suitable for conversion of bamboo into a value-added product. Use of conversion will only be possible for fuel wood and /or bio-energy. If there is a need for value-addition it will be insufficient.

Registration of private natural forest and private plantation: The act stipulates that owner need to register any plantation with district land board. It also clarifies that the produce belongs to owner and can use in any manner; but mandates the owner to use in a professional and sustainable manner. Registration and getting license adds up another layer of administrative and bureaucratic work for the bamboo farmers. Though there are number of policies, legislations and plans have direct relevance to bamboo sector. The interventions are fragmented, unorganised, and no coordination among different government actors. Bamboo sector has not received its prominence in different plan – National Development Plant II, Vision 2040, Business plan; Micro small and medium enterprise policies and others.

The marginalisation of the bamboo into policy framework has created domino effects on government budgets for bamboo resource development, skill and enterprise development, research, standards development, technology transfer and innovation, development of markets, access to formal credit, private sector investment, trade, etc.

6.3 Steps Towards Creating Enabling Environment for Bamboo Value Chain Development

Information gained through focus group discussions but also interviews with different value chain stakeholders, the following were identified as critical steps towards creating enabling environment for bamboo value-chain development:

- Develop a separate classification / definition for bamboo – a national bamboo policy can be developed. The existing definitions in the National forest and tree planting act, National forestry and other associated legislations can be updated to include bamboo into forest definitions.

- A simplified separate fees, royalty and licensing arrangements needs to be put into place to enable the upcoming industry, smallholder farmers, and harvesters are able to comply with the harvesting, transporting and trading licenses.
- Undertake bamboo development activities in clustered approach different interventions of government agencies for bamboo resource management, Medium Small and Medium Scale enterprise development, National Development Plans, NFA business plans should be targeted to specific clusters for better impacts.
- Develop guidelines on standards and certification for processes and products – planting; harvesting and value added products such as bamboo shoots, construction materials and bio-energy.
- Encourage and provide incentives for smallholder farmers and private planters in establishing bamboo plantation.
- Strengthen UIRI and TVET's to establish model demonstration enterprises; provide business development services; input material as well as develop supply-chain to maximise the utilisation of bamboo.
- Include bamboo into national development plans, Vision 2040, Business and annual budget plans of line departments to upscale bamboo planting material production, plantation, sustainable management of degraded bamboo forests; training and capacity building of MSME; research and innovation, marketing linkages and information; micro finance, etc.
- Encourage private sector investment. Include bamboo as a theme under the National Development plan, Green growth strategy and MSME development plans.

7. Intervention Matrix

Based on key findings and SWOT analysis (table 24) and constraint analysis (table 33) of the study, below is the intervention Matrix

Table 26: Intervention Matrix based on key findings and SWOT analysis

Key Finding	Intervention
Harvesting of bamboo from Forest Reserves and National Parks is regulated by the National Forest Authority (NFA) and UWA and restricted to one head load once a week. NFA has continued to arrest illegal harvesters of bamboo in the forest. The trend suggests that stringent restrictions on entry into and amounts of bamboo harvested from the reserve will continue to toughen over time. This may also imply that illegal entries into Echuya forest and the resulting conflicts are likely to increase.	• Advance advocacy and lobby actions towards supporting communities to plant bamboo on their private land • Work with NFA to promote community / collaborative Forest Management
Many private entrepreneurs are interested to establish bamboo nurseries, and perceive this as the best entry point.	Although, this looks like the best entry point, there is need to produce quality planting material of desired species, rather than producing any species which is easy to propagate.
Community institutions such as associations, cooperatives and Savings and Credit Cooperative Organisations' (SACCO's) are vibrant in Uganda. However, till this year, there was no formal community based institution for bamboo in Uganda.	Engage the recently established Uganda Bamboo Association to develop community structures at various levels – groups or primary cooperatives at local level, secondary cooperatives at district level, which could then be linked up to the national level association or cooperative.
• Limited number of bamboo products available in the market. • The quality of products made by the local artisans (especially products finishing) is poor compared with imported products. Buyers are keen on quality, durability of products and price. • No specific standards for bamboo and bamboo products	• Enhance the competitiveness of the bamboo products sector through product development involving improved designs, quality improvement and product diversification to target different market segments. • Work towards diversification of product ranges in Uganda. Build capacity of master trainers as well as artisans to produce contemporary bamboo products. • Skill development activities should be coupled with provision of tools and equipment's, forward and backward linkages. • Establish demonstration or model production unit at suitable location and/or strengthen the capacities of UIRI. • Build capacities of Ugandan Bureau of Standards to develop standards for bamboo and its products to build customer confidence.

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Key Finding	Intervention
Information gained through interviews with traders in Bamboo products indicates that currently, they are not exporting products due to limited quantities and buyers are mostly tourists and local people.	Provide non-monetary incentives (skills development, exchange visits, market linkages etc.) for increase production of bamboo products targeting export markets
Bamboo products are mainly sold in crafts markets targeting tourist (Buganda Road Craft village, National theatre, old Kampala next to Gadhafi Mosque which takes place every Friday of the week, Railway Grounds (3 times a year))	- Tourists usually buy authentic and natural products with high quality finishing. Bamboo souvenir product line will have excellent market (nearly 1 million tourist Uganda every year) and it needs to be developed. In addition to quality product, storage, packaging and branding activities needs to be undertaken. - Link bamboo product producers and traders to markets where their products are on high demand

Key Finding	Intervention
Policy and regulatory environment: there seems to be no government support for growing bamboo on private land	Advocacy towards creating awareness among government institutions on the value of bamboo and their potential role in growing the value chain. Advocate for inclusion of bamboo as a separate category in National census; Work with agencies dealing with trade (customs and excise); tax for unique codes for identification (example HS codes in case of international trade)
At present most bamboo product users operate on a small scale. Many are unable to produce for large scale orders.	Organize artisans into bamboo processor associations to facilitate training, technology transfer and contract negotiations
The price of Bamboo seedlings for communities/ individuals other than frontline communities are prohibitive. It ranges from UGX 5,000- 6,000.	There is need to support more nursery operators to come on board and this will eventually dampen (reduce) the cost of bamboo seedlings.
Transportation: Bamboo is very bulky and therefore, transporting it from the location of harvesting to processing remains a challenge.	Capacity building and pre-processing (value addition at farm level) should be considered
There have been attempts to grow bamboo on private land around Echuya, Mgahinga and Bwindi. However, due to the competition for space with other crops with shorter investment periods, the success of these schemes has been sub optimal. As compared to other crops like climbing beans and Irish potatoes, bamboo takes time to mature. Besides, the two are perceived to bring in quick returns .Hence, the reason as to why communities prefer to grow those two as opposed to bamboo.	Promote bamboo as an agro-forestry crop; planting in homesteads and farm boundaries; shelter belts which performs both economic and ecological functions. Scale can be attained with number of farmers. Explore options for intercropping bamboo with food crops

Key Finding	Intervention
Information gained through interviews with artisans indicated that there are still a number of challenges related to production of products from bamboo. These included: High prices for bamboo seedlings, limited access to and inadequate supply system of raw materials, fragmented, unstructured and individualised production systems, low levels of equipment application, low scale of production, lack of specialisation, minimum access to capital, inconsistent product standardisation, poor design and low quality and inadequate production, vocational and business development training and absence of model incubator projects along organised production systems.	• Develop a supply chain mechanism and market linkages. Develop a “Common production and training center” model which provides incubation and handholding support, input materials such as commoditized bamboo, value addition material and market support. • Product lines shall be targeted for catering the local demands initially where quality is not a constraint, and gradually move up the value chain.
Seasonal nature of edible bamboo shoots: Bamboo shoots are seasonal (April – August) and during the season, nearly all traders in markets in and around Mbale do sell “Malewa”. However, during off season, very few are selling the product.	• Conduct trainings on sustainable harvesting of bamboo shoots to maximise production; and on post harvesting management to minimize wastage. • Establishment of bulking /collection centres for bamboo shoots and dry bamboo harvested by the community

Source: Field study, 2017

8. Domestic and International Market Trends and Possibilities

8.1 Current Domestic and International Markets

Data on the domestic market is difficult to estimate. Based on the focus group discussions, interviews it is roughly estimated that out of the current population of 38 million, nearly 1 million people in Uganda use bamboo and its products in various forms. Most of the current market for Uganda is rural based meeting the subsistence needs of communities.

Table 27 below shows the global bamboo commodity wise data of imports and exports for 2014, 2015 and 2016. For the purpose of analysis, the import and export data of these three years are averaged.

Below table 27 shows that the average global export value is USD 1508 million and imported value is USD 1320 million. The variation in import and export value may be due codes used by different countries during import and export as well as due to the availability of data of the respective country.

The major bamboo commodity that are internationally traded are (a) bamboo poles (10 per cent); (b) bamboo shoots (20 per cent); (c) bamboo basketry (14 per cent); (d) bamboo flooring (20 per cent); (e) bamboo ply board (10 per cent); (f) bamboo and rattan seats (10 per cent); (g) bamboo and rattan furniture (14 per cent)

Table 28 and shows the comparison of traded value (import and export in USD; and percentage of trade) of bamboo products of Uganda along with other relevant trading blocs such as COMESA, EU, USA and China. Uganda is a very minor player in trading of bamboo products. It imported bamboo products worth USD 0.3 million and exported bamboo products worth USD 0.2 million representing 0.023 and 0.014 per cent of the globally traded value. COMESA block: 19 member states (eastern and Southern Africa open market) imported bamboo products worth USD 9.3 million and exported USD 2.2 million representing less than 1 per cent of the global trade.

Entire African continent imports and exports bamboo products worth USD 21.2 million (1.6 per cent) and USD 18.3 million (1.2 per cent) respectively.

South Africa is a major importer and Ethiopia is a major exporter among African Countries. Globally, European Union (EU) is the major importer of bamboo products, importing bamboo products worth USD 367 million and exporting bamboo products worth USD 143 million, representing 27 per cent and 10 per cent of the global imports and exports.

The United States of America is another major bamboo trading country, importing bamboo products worth USD 120 million and exporting bamboo products worth USD 24 million. It is important to note, that China is the major exporter, exporting bamboo products worth over USD 1 billion, contributing to 73 per cent of the global exports.

From the above, it is clear that Uganda as well as entire Africa has underdeveloped market – both imports and exports of bamboo.

Table 29 below illustrates the product and trading block wise trade of bamboo products in terms of percentage; EU consumes nearly 30 per cent of the following bamboo products exported globally: bamboo poles (39 per cent); bamboo mats and screens (37 per cent); bamboo paper articles (38 per cent), bamboo and rattan seats (31 per cent); bamboo and rattan furniture (33 per cent); bamboo flooring (27 per cent); bamboo plaiting material (24 per cent); bamboo basketry (27 per cent); bamboo pulp (29 per cent); bamboo charcoal (24 per cent).

Major bamboo products exported from / between EU are bamboo poles (13 per cent); bamboo plywood (11 per cent); bamboo pulp (20 per cent); bamboo paper based products (20 per cent); bamboo and rattan seats (17 per cent); bamboo and rattan furniture (28 per cent).

The United States of America represents 20 per cent of the global bamboo trade. Major products imported are bamboo basketry (32 per cent), bamboo and rattan seats (31 per cent); bamboo and rattan furniture (25 per cent); and bamboo ply board (29 per cent), bamboo poles (15 per cent), bamboo shoots (12 per cent) and bamboo plaits (13 per cent).

China is the major exporter contributing to over 70 per cent of global exports. Over 90 per cent of the bamboo shoots, bamboo mats and screens, bamboo plaits, bamboo flooring originate from China

Uganda can aim for the EU and the USA markets particularly focusing on following products (a) bamboo poles; (b) bamboo shoots; (c) bamboo plaits and plaiting material; (d) bamboo baskets; (e) bamboo furniture and seats and (f) bamboo charcoal. The above products do not require high technology and investment.

However, there is a need for high level of skill and diversified product design to suit the export market.

Export market should only be targeted in long run, as it has stringent quality requirements. In the short and medium term, the above mentioned short listed products have domestic market in Uganda, and that should be targeted.

Over time, with maturation of enterprise as well as with high level of skills and capacity to invest, export market can be reached. Uganda as well as entire Africa have good bamboo resources, labour rates are minimal compared to China, and Africa as a whole is geographically closer to the EU and the USA. In addition, most LDC countries have preferential market access to the EU and USA markets.

Table 27: Average traded value: Global Imports and Exports of Bamboo Products during 2014 – 2016

Commodity Code	Product	2014 (Trade Value (\$))		2015 (Trade Value (\$))		2016 (Trade Value (\$))		Average (Import) USD	Average (Exports) (USD)	Per cent (Import)	Per cent (Export)
		Import	Export	Import	Export	Import	Export				
140110	Bamboo	133,630,756	92,437,086	134,774,148	104,735,196	133,821,568	88,050,885	134,075,490	95,074,389	10.2	6.3
200591	Bamboo Shoot	240,246,164	285,014,065	226,656,368	313,283,405	224,989,845	325,707,931	230,630,792	30,8001,800	17.5	20.4
460121	Bamboo Mats / Screens	67,245,172	105,175,755	64,126,263	87,312,563	52,553,341	80,971,204	61,308,258	91,153,174	4.6	6.0
460192	Bamboo Plaits and Plaiting material	47,179,220	67,262,952	28,002,152	63,202,737	21,841,639	44,018,492	32,341,003	58,161,393	2.5	3.9
460211	Bamboo Basket Work	181,324,314	239,885,226	173,773,620	232,045,599	160,872,671	171,925,518	171,990,201	214,618,781	13.0	14.2
440210	Bamboo charcoal	38,879,552	67,822,145	44,169,201	54,872,452	33,237,442	52,554,364	38,762,065	58,416,320	2.9	3.9

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Commodity Code	Product	2014 (Trade Value (\$))		2015 (Trade Value (\$))		2016 (Trade Value (\$))		Average (Import) USD	Average (Exports) (USD)	Per cent (Import)	Per cent (Export)
		Import	Export	Import	Export	Import	Export				
440921	Bamboo Flooring	99,920,895	326,271,508	89,358,693	280,675,617	76,194,291	271,276,066	88,491,293	292,741,063	6.7	19.4
441210	Bamboo plywood	171,180,615	109,529,691	146,825,414	95,464,204	166,344,595	94,207,012	161,450,208	99,733,635	12.2	6.6
470630	Bamboo pulp	6,438,204	9,642,695	5,598,859	5,827,708	4,128,852	4,218,025	5,388,638	6,562,809	0.4	0.4
482361	Bamboo Paper based articles	41,191,837	32,866,853	35,131,633	32,837,957	35,641,651	27,514,118	37,321,707	31,072,976	2.8	2.1
940151	Bamboo and Rattan seats	184,198,846	105,908,836	166,796,950	91,876,646	160,059,676	93,116,007	170,351,824	96,967,163	12.9	6.4
940381	Bamboo and rattan furniture	185,218,699	154,613,416	186,117,360	155,206,866	190,428,846	156,222,675	187,254,968	15,5347,652	14.2	10.3
140110	Bamboo	133,630,756	92,437,086	134,774,148	104,735,196	133,821,568	88,050,885	134,075,490	95,074,389	10.2	6.3
	Total (USD)	1,396,654,274	1,596,430,228	1,301,330,661	1,517,340,950	1,260,114,417	1,409,782,297	1,319,366,451	1,507,851,158	100	100

Source: UN COMTRADE Data base, 2017. Compiled from <https://comtrade.un.org/data/>

Table 28: Comparison of bamboo Imports and Exports among major trading blocks (Traded Value USD)

Product Code	Product	Trade Value (USD)													
		Uganda		COMESA		Total Africa		Total EU		USA		China		Global	
		Import	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export
140110	Bamboo	95,913	161,922	274,196	295,724	503,559	309,374	52,982,330	12,311,210	20,117,378	427,327	1,663,015	67,611,593	134,075,491	95,074,389
200591	Bamboo Shoot	4,048	0	163,796	58	261,908	89,441	36,276,330	18,601,725	29,621,677	221,648	131,979	274,725,989	230,630,792	308,001,800
460121	Bamboo Mats / Screens	18,294	997	119,370	549,399	348,834	593,133	22,740,742	5,880,534	4,237,098	454,586	52,937	81,525,800	61,308,259	91,153,174
460192	Bamboo Plait material	1,101	0	48,707	6,609	297,887	23,610	7,714,951	1,929,503	4,199,688	309,650	105,516	54,100,125	32,341,004	58,161,394
460211	Bamboo Basket Work	7,331	0	221,668	15,136	1,126,872	197,967	46,347,637	13,691,972	53,920,248	1,815,118	576,919	149,036,258	171,990,202	214,618,781
440210	Bamboo charcoal	0	1,480	115,237	1,171,608	872,286	11,741,910	9,585,305	5,056,054	2,975,879	349,901	314,134	31,974,073	38,762,065	58,416,320
440921	Bamboo Flooring	10,150	20,880	476,257	42,221	2,369,534	2,245,681	24,237,144	7,475,305	3,164,373	6,389,588	60,894	271,484,623	88,491,293	292,741,064
441210	Bamboo plywood	49,902	18,180	2,886,041	35,232	5,485,052	555,286	37,005,125	10,527,382	46,079,657	6,503,300	223,281	75,739,897	161,450,208	99,733,636
470630	Bamboo pulp	0	0	12,727	164	24,813	1,783,986	1,573,715	1,318,873	861,692	61,248	396,999	2,760,426	5,388,638	6,562,809
482361	Bamboo Paper based articles	994	213	1,149,320	69,992	1,466,245	259,896	14,195,668	6,218,069	4,627,576	1,264,255	20,530	9,430,144	37,321,707	31,072,976
940151	Bamboo and Rattan seats	18,514	0	247,928	10,372	2,876,853	215,676	51,230,523	16,311,612	52,184,363	2,371,787	1,954,507	10,928,384	170,351,824	96,967,163

940381	Bamboo and rattan furniture	98,085	0	3,547,650	18,112	5,594,062	290,191	62,772,934	43,092,511	47,411,598	4,036,911	687,185	66,010,375	187,254,968	155,347,652
Total (USD)		304,332	203,672	9,262,898	2,214,628	21,227,906	18,306,151	366,662,405	142,414,751	269,401,226	24,205,318	6,187,895	1,095,327,687	1,319,366,451	1,507,851,158
Per cent (%)		0.023	0.014	0.702	0.147	1.609	1.214	27.791	9.445	20.419	1.605	0.469	72.642		

Source: UN COMTRADE Data base, 2017. Compiled from <https://comtrade.un.org/data/>

Table 29: Percentage comparison of import and exports among major trading blocks

Product Code	Product	Percentage of Trade Value (%)											
		Uganda		COMESA		Total Africa		Total EU		USA		China	
		Import	Export	IMPORT	EXPORT	IMPORT	EXPORT	IMPORT	EXPORT	IMPORT	EXPORT	IMPORT	EXPORT
140110	Bamboo	0.072	0.170	0.20	0.31	0.38	0.33	39.52	12.95	15.00	0.45	1.24	21.95
200591	Preserved Bamboo Shoot	0.002	0.000	0.12	0.00	0.11	0.03	15.73	6.04	12.84	0.07	0.06	89.20
460121	Bamboo Mats / Screens	0.030	0.001	0.09	0.58	0.57	0.65	37.09	6.45	6.91	0.50	0.09	89.44
460192	Bamboo Plaits and Plaiting material	0.003	0.000	0.04	0.01	0.92	0.04	23.86	3.32	12.99	0.53	0.33	93.02
460211	Bamboo Basket Work	0.004	0.000	0.17	0.02	0.66	0.09	26.95	6.38	31.35	0.85	0.34	69.44
440210	Bamboo charcoal	0.000	0.003	0.09	1.23	2.25	20.10	24.73	8.66	7.68	0.60	0.81	54.73
440921	Bamboo Flooring	0.011	0.007	0.36	0.04	2.68	0.77	27.39	2.55	3.58	2.18	0.07	92.74
441210	Bamboo plywood	0.031	0.018	2.15	0.04	3.40	0.56	22.92	10.56	28.54	6.52	0.14	75.94
470630	Bamboo pulp	0.000	0.000	0.01	0.00	0.46	27.18	29.20	20.10	15.99	0.93	7.37	42.06
482361	Bamboo Paper based articles	0.003	0.001	0.86	0.07	3.93	0.84	38.04	20.01	12.40	4.07	0.06	30.35
940151	Bamboo and Rattan seats	0.011	0.000	0.18	0.01	1.69	0.22	30.07	16.82	30.63	2.45	1.15	11.27
940381	Bamboo and rattan furniture	0.052	0.000	2.65	0.02	2.99	0.19	33.52	27.74	25.32	2.60	0.37	42.49

Source: UN COMTRADE Data base, 2017. Compiled from <https://comtrade.un.org/data/>

Note: Averaged values of 2014, 2015 and 2016

9. Short listed Value-Chains for Uganda

In selecting key bamboo value chains for Uganda, a five step value chain selection matrix including the following key areas: (1) high and sustainable market and/or growth potential, (2) potential to contribute to increased employment especially for women and youth, (3) growing market demand over the next decade, (4) potential to attract additional investments from both the public and private sector and (5) linkages to other key sectors of the economy was developed. Scores between (1-10 (1 being lowest and 10 being highest)) were used to arrive at the final scores and select the value-chain.

Table 30: Value chain selection criteria for key bamboo value chains in Uganda

Value chain	Market / growth potential	Employment & gender	Growing demand	Scope for investment	Cross linkages	Total Score
Bamboo shoots	6	8	4	6	3	29
Bamboo poles for construction	5	6	7	6	7	31
Bamboo crafts	4	7	4	5	4	24
Bamboo furniture	5	7	7	7	5	31
Bamboo energy products	7	8	8	8	8	39

Source: Field study, 2017

a. Bamboo shoots

Bamboo shoots are an important food for the Gisu communities living around Mount Elgon. Nutrient content analysis of different bamboo shoots across the globe have proven itself as a suitable food material. With Uganda having ready market for bamboo shoots; especially for communities around Mount Elgon, there is a wider scope for promotion of bamboo shoots across the country. It can be an important tool for income and employment generation as well as strategically important for food and nutrition security.

Based on the above table 27, it is evident that bamboo shoots are one of the largest traded bamboo commodity, annual export of bamboo shoots is valued at USD 308 million. In the short term, bamboo shoot value- chain can be developed to suit the local market, and in long term export markets can be tapped.

b. Bamboo poles and construction:

Harvesting and trading of bamboo poles for construction, scaffolding and for use as props for agriculture and horticulture industry is one of the existing prominent value-chains in Uganda. The market is growing and there is scarcity of bamboo poles. Harvesters sell one bundle of *Oxytenanthera abyssinica* poles for UGX 2,000-3,000; and *Yushania alpina* for UGX 2,000-5,000; In urban areas bamboo poles are each sold for prices ranging from UGX 2,000 – 5,000. This provides immediate opportunities for bamboo growers, harvesters and traders. Organized supply chain for bamboo poles will be critical for success of all other value-chains in the bamboo sector.

Population growth and pressure: Faced with an average population growth rate of 3 per cent annually, Uganda is one of the fastest growing nations in the world. Additionally, Uganda is home to over 1 million refugees fleeing the war from South Sudan. This rapid rise in population coupled with the refugee crisis has increased the demand for affordable housing and shelter. In the West Nile region, the home to the largest number of refugees in Uganda, the price of bamboo has more than doubled due to the increased demand for bamboo stems that are used to build shelters and to manufacture beds for refugees. From the above Table 27, it is evident that trading

of bamboo pole and its components represent 10 per cent of the global trade valued at USD 130 million. Structured bamboo poles trading will open up new market opportunities for the farmers and other stakeholders involved in the value chain.

c. Bamboo crafts:

Majority of the households in bamboo growing regions use bamboo products as household and farm utility products. Currently the markets are confined to rural markets. Therefore, the basic skills sets are available with the community. It will be easy to upscale the bamboo crafts production to cater to the low value large consumption products such as basketry for households, agriculture and horticulture industry and life style products for the urban markets.

Uganda has a robust coffee and tea sector, a number of bamboo products such as tea picking baskets, coffee collection, mats for drying coffee; baskets for agriculture produce packaging and collection; household utility items; bee hives have enormous market. In addition, bamboo souvenir products will have a huge market. Ugandan tourist sector is flourishing, with about 1.3 million tourist arrivals in 2013.

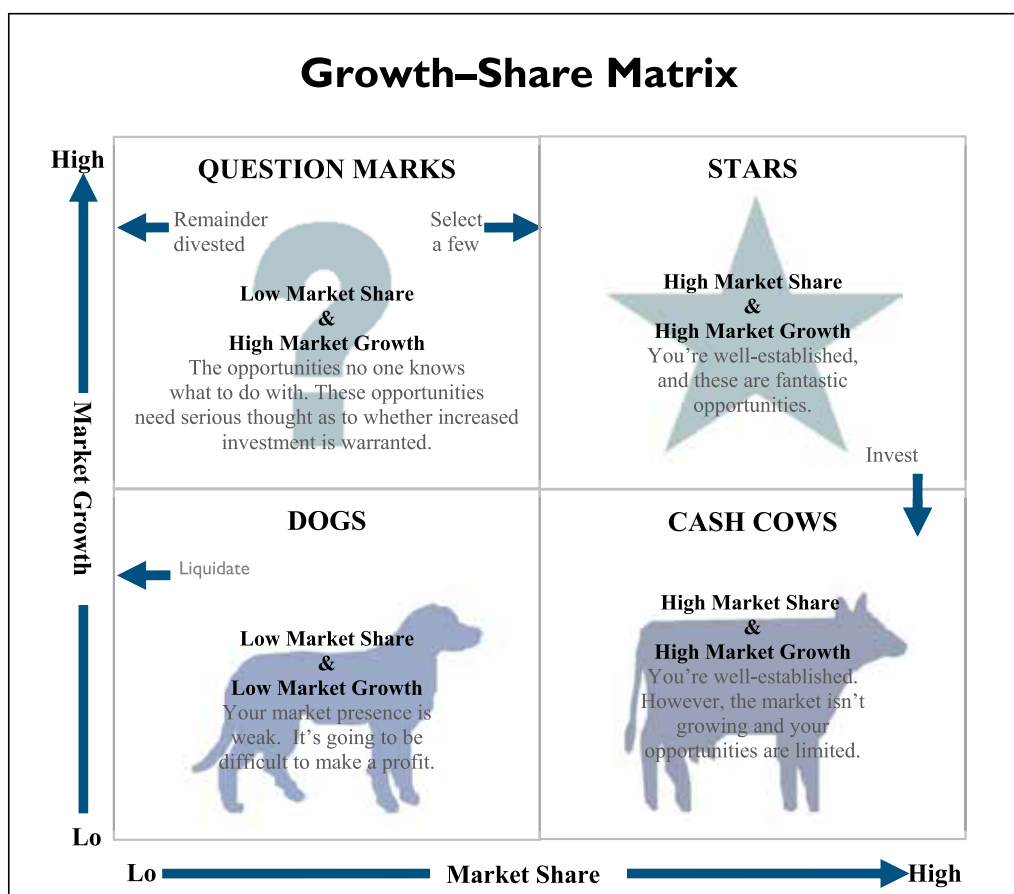
Based on the above table 27, bamboo basketry and wicker works represents around 14 per cent of the global trade valued at USD171 million. With the upgraded value-chain, including the quality of product Ugandan bamboo products have potential to reach international market. It is also important to note that nearly 60 per cent of the population in Uganda is below the age of 25 years, and there is large scale unemployment. Bamboo value-chains especially basketry and handicrafts is known to create large scale local employment.

d. Bamboo furniture:

As mentioned earlier about 60 per cent of the population in Uganda is below the age of 25 years. There is a huge demand for furniture; bamboo could fill in the gap. Wood furniture industry in Uganda is flourishing, literally wood working enterprises can be found along road sides all over the cities, towns and in villages. In addition to domestic production, Uganda imports large quantities of furniture made of wood, steel and plastic. During the year 2015, Uganda imported furniture worth USD 14.5 million out of which the value of metal furniture's, wood furniture and plastic + other furniture are USD 1.9, USD 9.8, and USD 1.4 million respectively. In addition, it is interesting to note that Uganda also imported bamboo and rattan furniture and seats valued at USD 0.11 million. Uganda also exported / re-exported furniture of USD 1.4 million (Refer to Table 31 below).

Table 31: Furniture imports and export in Uganda 2014 and 2015

HS Code	Product	2014		2015	
		Weight	Value (USD)	Weight	Value (USD)
Import					
9403	Furniture and parts	14,359,865	15,732,092	15,603,025	14,422,504



940310	Metal furniture for office use	371,473	528,374	551,128	779,849
940320	Other metal furniture	1,246,269	2,686,904	1,017,968	1,144,730
940330	Wooden furniture for office	2,882,645	3,195,129	3,500,192	3,512,452
940340	Wooden furniture for kitchen	1,182,042	822,050	1,302,840	711,850
940350	Wooden furniture for bedroom	1,517,018	1,327,483	1,369,367	1,141,748
940360	Other wooden furniture	5,397,048	4,613,091	5,686,480	4,431,811
940370	Plastic furniture	681,341	1,071,071	835,160	1,082,394
940381	Bamboo or rattan furniture	27,581	90,473	13,580	105,696
940389	Other	924,827	1,245,413	972,995	1,321,138

940151	Bamboo and Rattan Seats		32,010		5,018
Export and Re-Export					
9403	Furniture and parts	1,014,711	1,881,076	769,084	1,462,162
940310	Metal furniture for office use	32,308	30,455	14,069	45,167
940320	Other metal furniture	25,290	47,385	25,880	65,766
940330	Wooden furniture for office	85,482	127,307	52,160	68,371
940340	Wooden furniture for kitchen	11,407	94,328	18,373	97,888
940350	Wood furniture for bed room	79,801	102,024	35,207	44,801
940360	Other wooden furniture	208,556	458,983	166,415	187,946
940370	Plastic furniture	494,643	948,895	395,581	833,804
940381	Bamboo or rattan furniture	0	0	0	0
940389	Other	17,808	53,951	12,352	96,934

Source: UN COMTRADE Data base, 2017. Compiled from <https://comtrade.un.org/data/>

With large local demand, bamboo furniture value-chain can be targeted to develop bamboo furniture to cater to local demand. In addition, bamboo and rattan seats + furniture have a large international market which is valued at USD 357 million.

e. Bamboo energy products:

According to Uganda National Household Surveys (UNHS, 2016), the nominal value of household firewood and charcoal is valued at UGX 409.1 billion in 2009/10. Over 90 per cent of the household in Uganda use fuel wood and charcoal for cooking and heating. Fuel wood is the predominant energy source in rural areas and charcoal is the primary cooking fuel in urban areas. About 20.2 million tons of biomass is consumed annually, 16 million tons for household, industrial and commercial purposes and about 3 million tons of biomass are used for charcoal production (NBEDS, 2001).

In addition to large scale domestic production, small quantities of wood and bamboo charcoal are also imported and exported / re-exported in Uganda. Table 32 below provided the details.

Table 32: Import and Export of Wood and Charcoal in Uganda

HS Code	Product	2014		2015		2016	
		Weight	Value (USD)	Weight	Value (USD)	Weight	Value (USD)
Import							
4402	Charcoal: Wood, nut charcoal and bamboo	4535	2624	7653	2950	NA	NA
440290	Wood charcoal including nut charcoal	4535	2624	1653	2884	NA	NA

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440210	Bamboo charcoal			6000	66	NA	NA
Export and Re-Export							
4402	Charcoal: Wood, nut charcoal and bamboo	37,706	13,444	1679	321	NA	NA
440290	Wood charcoal including nut charcoal	35,466	11,964	1679	321	NA	NA
440210	Bamboo charcoal	2240	1480	0	0	NA	NA

Source: UN COMTRADE Data base, 2017. Compiled from <https://comtrade.un.org/data/>

Bamboo charcoal production and further value-addition to briquettes and pellets can be a good option, as it does not have market entry barrier and the demand for energy is growing rapidly.

9.1 Constraints Analysis Matrix

Based on the analysis of the existing bamboo value-chains, five bamboo value-chains that could be selected for intervention are as follows (a) bamboo shoots; (b) bamboo furniture; (c) bamboo handicrafts; (d) bamboo construction and (e) bamboo energy products. The existing constraints and the root cause that are holding back the identified bamboo value-chains are analysed; and the proposed interventions for mitigating the constraints are recommended.

Table 33 below; shows the constraints, root cause and recommended interventions:

Table 33: Constraints; root causes and proposed interventions:

Constraint	Root cause	Proposed intervention
Bamboo shoots - Bamboo shoots as food is limited to Gisu culture. Other tribes in Uganda don't eat bamboo shoots, due to cultural influence. - Lack of awareness about the nutritional value of bamboo shoots. - Not all species of bamboo are edible. - Crude processing methods employed hence poor quality products; poor preservation. - Seasonality of the shoots (available May – August). - Limited or no value addition. Poor and unattractive packaging. - Communities still depend on government managed forests for bamboo shoot harvesting.	- Limited knowledge and technical capacities on sustainable harvesting methods to maximize the bamboo shoot emergence. - Bamboo shoot processing, and preservation and treatment for improving the quality as well as longevity of shoots. - Diversification of bamboo shoot based product ranges. - Lack of infrastructure facilities and equipment's. - Poor or lack of packaging and branding. - Lack of support for communities for establishing bamboo plantations for shoot production.	- Create awareness on the nutritional values of bamboo shoot, and its health benefits. - Conduct capacity building / trainings for NFA, UWA staff, bamboo shoot harvesters on sustainable management. - Support establishment of a sustainable bamboo shoot supply-chain; including private enterprises. - Capacity building of bamboo shoots processors on primary processing, preservation and value-addition, packaging and branding. - Facilitate establishment of standards and certification mechanism to enable bamboo trading.
Furniture - Bamboo products are perceived as a low quality and are considered non-durable (attack by insects, borer, fungi and moulds). - Product ranges are limited: catering to local / rural demand. - No technical skills on bamboo preservation and treatment. - Lack of appropriate and affordable tools / equipment for making furniture. - Limited availability and quality of raw material. - Multiple alternative furniture (plastic, timber, and metals) available.	- Most of the bamboo in protected forests are unmanaged. - Lack of awareness / exposure to new product possibility. - Lack of skill in diversification of contemporary products. - Lack of capital, investment capacity for purchase of tools and equipment and input materials. - Institutional failure to promote bamboo (although, there are a number of policies to promote sustainable natural resources management but also promote tree planting, none is specific to bamboo planting). - High end bamboo furniture produced by few entrepreneurs are expensive. - Lack of market promotion and supply-chain.	- Training and capacity building of bamboo forest managers (NFA, UWA), bamboo collectors on sustainable management and harvesting. - Encourage bamboo plantation in private farms to enable availability of quality bamboo poles (desired species, sizes and age of poles). - Capacity building of artisans on new product lines, tools and equipment's. - Develop supply-chain and foster market linkages. - Advocate for preferential purchase of bamboo in government purchases (government schools, hospitals, offices, etc.)

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Constraint	Root cause	Proposed intervention
Construction • Perception of bamboo as a non-durable and low quality construction material. • Lack of preservation and treatment infrastructure, techniques as well as chemicals. • Availability of commoditized bamboo poles or components for construction. • Lack of skills and appropriate technology in construction: construction techniques and designs. • Lack of standards for bamboo structures but also usage of bamboo as a construction component.	• Bamboo grown in forests is unmanaged. Desirable bamboo poles of required species, dimensions and quality cannot be attained. • Institutional capacity for developing standards and certification are poor. • Existing bamboo construction are traditional, contemporary designs, techniques and skills not exist.	• Introduce and capacitate stakeholders on sustainable management and harvesting practices. • Develop preservation and treatment infrastructure; including linkages to supply of input chemicals. • Build capacities of engineers, architects, builders and youth on modern bamboo construction techniques. • Collaborate with Ugandan Bureau of Standards to develop standards and certification for bamboo construction. • Introduce appropriate bamboo species suitable for construction.
Bamboo Handicrafts • Competition from China and Kenya (most of the products on the market come from China and Kenya). • Products are limited confined to rural markets (baskets, trays). • Product qualities are poor. • Limited skills in bamboo handicraft making and especially product finishing. • Lack of appropriate tools and equipment for making bamboo handicrafts. • Lack of innovativeness by the artisans.	• Lack of intervention by national government on capacity building and skill development. • Limitation in skill set, product design, market development and linkages. • Lack of industry standards and regulation.	• Conduct training and capacity building of artisans on new project designs. • Undertake market development and linkage efforts.
Energy production • Lack of large scale raw materials supply. • Negative perception about the quality of charcoal from bamboo. • Limited technical capacities on bamboo charcoal production, pelleting and briquetting. • Limited institutional support for upcoming entrepreneurs.	• Alternate source for charcoal production exist. • Lack of awareness and sensitization on potential of bamboo as an energy source. • Limited technology deployment and demonstration on a wider scale.	• South-South Knowledge transfer: technology and enterprise models. • Advocacy for development of suitable policy regime for promotion of bamboo charcoal. • Develop standards and certification mechanism to enhance customer confidence.

Source: Field study, 2017

The root causes of the above constraints can be broadly categorized as follows:

1. Policy issues that are not specific and supportive to bamboo growing and lack of institutional support;
2. Government has not prioritized bamboo growing and does not value bamboo as it does with timber trees.

3. This is worsened by lack of skills in bamboo growing (propagation, management, processing and marketing).

10. Recommendations

10.1 Bamboo Growth Share Matrix

Figure 14: A growth share matrix adopted from NetMBA

Cash cow: From the bamboo market study in Uganda, a clear cash cow and low hanging fruit that has emerged is the bamboo charcoal value chain. This is mainly because it has a low entry barrier, low competition but with very high economic, social and environmental returns.

Star: Bamboo shoots/malewa has exhibited a high return on investment but they are currently serving a limited market. Significant investment is required to turn this product into an exportable product to tap into this lucrative market. China currently earns USD 275 million annually from the bamboo shoots industry while Taiwan consumes close to 80,000 tons of bamboo shoots annually. The question is, do we have the right amount and quality of bamboo shoot in order to tap into at least 10 per cent of this global market? Do we have adequate all year round supplies?

DOG: Bamboo furniture and baskets have a low market growth rate and faces stiff competition from countries like Ethiopia and China that export cheaper bamboo and plastic furniture to Uganda.

Question Marks: Bamboo industrial products such as tooth picks, flooring boards and others. Do we have the required technology, enabling environment, right species and quality of bamboo raw material to compete with cheaper imported bamboo products from China.

10.2 Recommendations Towards Advancing Bamboo Value Chain Development

Based on the SWOT analysis, policy analysis, constraint analysis, growth share matrix, a number of recommendations have been made. Recommendation proposed is a combination of short term, medium term and long term. It is not possible to segregate the intervention into different classes, as the activities are inter-dependent and builds on each other.

10.2.1 Proposed interventions

Rapid Resource Development:

- Support establishment of government, private and community nurseries for production of quality planting material of desired species in quantities.
- Undertake technology transfer and capacity building of nursery operators to ease the existing difficulties in planting material production, thereby reducing the cost of planting material.
- Conduct awareness and sensitisation of farmers and growers on the potentials and possibilities of bamboo.
- Along with NFA, UWA and other stakeholders, incentivise and facilitate smallholders and private large scale plantation in farms to reduce the pressure on natural forests, and to improve the raw material access.

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- Bamboo production could be enhanced by promoting new plantations on degraded forest lands, waste lands, along riverbanks, reservoirs and ponds.
- Undertake capacity building of NFA, UWA, harvesters and bamboo users on bamboo plantation establishment, maintenance, and sustainable harvesting and management.
- Provide technical support for NFA and UWA on scientific and sustainable management of bamboo forests in forest reserves and national parks to improve the productivity and quality of bamboo.
- Participatory development of community forest management plans, planting and harvesting guidelines, and planting models.

Value-chain Development:

- In the short term, focus on the existing value-chain such as (a) bamboo shoot; (b) bamboo crafts; (c) bamboo furniture; (d) bamboo energy products and (e) bamboo poles and construction. In the medium term, focus on high quality products of the existing product lines and in addition strengthen industrial production of product lines having domestic demand such as (a) bamboo stick based products (curtains, table mats, tooth picks, etc.); and (b) slat based furniture. In the long run, focus on high end industrial product line such as (a) bamboo timber, (flooring tiles), (b) boards, (c) power; solid and liquid fuels; and (d) textile fibres targeting both the domestic and export markets.
- Strengthen existing bamboo enterprises and support new micro and small enterprises catering to the domestic markets; Activities include (a) small and micro-enterprise promotion (b) research on bamboo based product development (c) improvement on traditional skills/skill upgradation (d) eco-labelling and certifications (e) extension support and (f) incubation.
- Establish a model demonstration production unit which will operate in a “for profit mode” with linkages to growers, value addition entrepreneurs and traders which will provide commoditised raw materials for producers, value addition input materials, capacity building, marketing and business incubation support.
- Focus on skill development and entrepreneurship: To facilitate business development in bamboo value chain (production to consumption). Plantations, processing and manufacturing of value added products are some areas where efforts can be made to create a cadre of budding entrepreneur through skill development, design inputs and business tie-ups.
- Coordinate south-south knowledge and technology transfer activities such as (a) exchange tours to China and Ethiopia; and (b) targeted training on the proposed value-chain.
- Plan and develop bamboo clusters and develop value-chains: Currently, bamboo entrepreneurs must handle the entire supply chain since it is non-existent. Efficient supply-chain development requires a high concentration of bamboo growing/plantation and value addition activities in relatively close geographical clusters rather than dispersing the interventions all across the country.

Market Development:

- Build a communication programme; undertake awareness and sensitisation activities among the policy makers, institutional markets and general public on the potential of bamboo products. This includes increasing awareness on bamboo's viability as a versatile timber-replacement material among different stakeholder groups, including farmers, traders, artisans, industries and buyers.
- In the short and medium term, target domestic and regional markets. To provide market push during initial growth periods,

enable opening up of government and institutional markets such as education (school construction, furniture); housing; fishery sector (baskets, drying mats, biofuel); apiculture (bee hives); coffee and tea (baskets, drying mats, etc.); energy markets (charcoal, briquettes, and biomass power (cogeneration).

- In the long run, target domestic and export market. Undertake activities towards market positioning of bamboo within and outside Uganda which could include marketing campaign, participation in domestic and international trade fairs and exhibition.

Policy intervention:

- Build the institutional and legal architecture to support the bamboo economy: Advocate for development of bamboo policy, inclusion of bamboo in National Development Plan, MSME policies, forest development plans; agricultural policies; industrial policies; Investment promotion and trade; census, etc. This would enable allocation of additional government's budget towards development of the sector.
- The availability of data on the bamboo sector is one the major constraint. Develop linkages with National Census agency to include bamboo as a separate sub-sector; and collect data especially in key bamboo production areas Kapchorwa, Bukwo, Sironko, Mbale, Bududa, Manafwa, Kabale, Kisoro, Ntungamo, Rukungiri, Bushenyi, Kibale, Kisoro, Mbarara, Kampala, Tororo, Lira, Arua, gulu and Masindi.
- Advocate for fiscal and non-fiscal incentives such as tax incentives, import duties for entrepreneurs and investors.

Institutions:

- In the short term, establish community forest management groups, groups, producer cooperatives at local level for strengthening the supply-chain.
- Develop a national level bamboo multi-stakeholder platform with participation of regional and local stakeholders for advocacy on policy, link the demand and supply, and to develop markets. The successful model of Uganda edible oil seed platform (OSSUP), which serves as a central meeting point for all edible oil seed value chain actors in Uganda can be adopted for bamboo.

Partnership and Leveraging:

- Develop partnership with government and non-government agencies to upscale the interventions which could include Uganda youth livelihood fund, the Netherlands embassy, Uganda industrial research institute (UIRI) and the Chinese Embassy. This is important considering that a number of the bamboo artisans in Uganda do not have access to high technology capacity building services that they can leverage to design and create high quality bamboo products for the market.
- Advocate inclusion of bamboo into different government agencies development plans such as National Development Plan, MSME development plan, forestry development plan, agriculture development plans, tourism development plans; and support implementation of the activities.
- Especially, sign a partnership with the tourism sector to promote bamboo products: Uganda has an impressive and vibrant tourism sector, with an annual tourist inflow of over 1 million tourists in 2015, and the sector is growing rapidly. A formal partnership between the Uganda Tourism Board (UTB) and the artisans would trigger increased sales for the artisans and lead to increased employment opportunities being unlocked.

Enabling Environment:

- Advocate for setting up bamboo impact investment fund aimed at attracting investors into Uganda with the know-how and equipment that they can use to process raw bamboo into flooring boards and other bamboo products that have a high demand globally. This will give Uganda an opportunity to tap into a growing global market of consumers that are conscious of buying products that promote our environment. This innovation fund will target investors that are willing to enter into inclusive business arrangements with bamboo growers in Uganda.
- Collaborate with Uganda Investment authority to develop business models to attract small, medium and large scale private sector investments into bamboo sector.
- Build capacities of Uganda National Bureau of Standards (UNBS) on product test, standardisation, and certification. Support development of bamboo standards for existing bamboo products in short term; and capacitate UNBS to develop standards on industrial product lines in long term.
- Enable sustainable production certification mechanisms FSC/PEFC or similar certification to raise value and market acceptance in case of targeted bamboo forests and other public and private plantations; Chain of Custody (CoC) in case of bamboo grown in farms, and in homesteads.

11. References

Adam, F.W., Essandoh, E.O., Tawiah, P.O. 2013. The suitability of *Oxytenanthera abyssinica* for development of prosthesis in developing countries. International Journal of Advances Research in Engineering and Technology (IJARET).Volume 4, Issue 5, July – August 2013, pp. 87-97

Banana, A.Y., and Tweheyo, M. 2001. The ecological changes of Echuyaa montane bamboo forest, Uganda. African Journal of Ecology. Volume 39, Issue 4, PP 366-373. DOI: 10.1046/j.1365-2028.2001.00327.x

Banik, R. L. 2000. Siviculture and field-guide to priority bamboos of Bangladesh and South-Asia. Chittagong, Bangladesh: Bangladesh Forest Research Institute.

Bitariho, R and Mosango, M. 2006. Abundance, Distribution, Utilisation and Conservation of *Sinarundinaria alpina* in Bwindi and Mgahinga Forest National Parks, South West Uganda. Ethnobotany Research and Applications. Accessed from <https://scholarspace.manoa.hawaii.edu/bitstream/handle/10125/170/11547-3465-03-191.pdf?sequence=4> on 29/09/2017.

Bitariho, R., Mosango, M., 2005. Abundance, distribution, utilisation and conservation of *Sinarundinaria alpina* in Bwindi and Mgahinga Forest National Parks, South West Uganda. Ethnobotany Research Applications 3, 191–200

Bystriakova, N., Kapos, V., & Lysenko, I. 2004. Bamboo Biodiversity.UNEP-WCMC/INBAR.

- Energypedia. 2017. Uganda Energy Situation. Accessed from https://energypedia.info/wiki/Uganda_Energy_Situation
- ERA (Electricity Regulatory Authority). 2017. Accessed from <http://www.era.or.ug/index.php/sector-overview/uganda-s-electricity-sector>
- Esegu, J.F., Ssentenza, J., Sekatuba, J. 2000. Rattan and Bamboo in Uganda: A study of the Production to Consumption System. INBAR. 2000.
- Gibson, C.C., McKean, M.A., and Ostrom, E (Editors). 2000. People and forests: Communities, Institutions and Governance. ISBN: 9780262072014. PP 87-98.
- Greijmans, M., Oudomvilay, B., & Banzon, J. 2007. Houaphanh Bamboo Value chain Analysis
- IEF (Index of Economic Freedom). 2017. Accessed from <http://www.heritage.org/index/country/uganda>
- Investment Guide. 2015. Investment Guide Uganda. African Legal Network. Accessed from <http://www.africalegalnetwork.com/wp-content/uploads/2015/12/Uganda-Investment-Guide-2015.pdf>
- Liese, W. (2009, September 16-18). Bamboo as Carbon-Sink - Fact or Fiction? Paper presented at the 8th World Bamboo Congress, September 16-18, 2009, Bangkok, Thailand: World Bamboo Organization. Vol. 3: 71-86.
- Lobovikov, M., Paudel, S., Piazza, M., Ren, H., & Wu, J. (2007). World Bamboo Resources: A thematic study prepared in the framework of the global forest resources assessment 2005 Non Wood Forest Products 18 (pp. 1, 11-33 & 55). Rome, Italy: Food and Agricultural Orga-

nization.

Louppe, D., Oteng-Amoako, A.A., Brink, M. Louppe, D., Oteng-Amoako, A.A., Brink, M. 2008. Plant resources of Tropical Africa 7(1). Timbers 1. PROTA foundation, Wageningen, The Netherlands.

Ministry of Water and Environment. 2016. State of Uganda's forests 2016. Accessed from www.mwe.go.ug/sites/default/files/State%20of%20Uganda%27s%20Forestry-2015.pdf

NBEDS. 2001. National Bioenergy demand strategy 2001-10. Ministry of Mines and Mineral Development. Republic of Uganda. Accessed from <http://energyandminerals.go.ug/downloads/BEDS-Contents.pdf> on 30/09/2017.

National Forestry Authority (NFA). 2016. Business Plan 2016/2017 – 2020/2021. Accessed from http://www.nfa.org.ug/images/NFA_Business_Plan_%202016.pdf on 28/9/17

Scott, P. 1998. From Conflict to Collaboration. People and Forest at Mt. Elgon, Uganda. IUCN. 1998.

SCEA (Shippers Council of East Africa). 2015. East Africa Logistics Performance Survey: Cost, time and complexity of the East African Logistics Chain. Accessed from file:///C:/Users/Durai%20Jayaraman/Downloads/2015%20East%20Africa%20Logistics%20Performance%20Survey.pdf on 19 November 2017.

Scurlock, J. M. O., Dayton, D. C., Hames, B. Hames, B. (2000). Bamboo: an overlooked biomass resource? (O. R. N. L. Environmental Sciences Division, Trans.). Tennessee, US.

Seethalakshmi, K. K., & Kumar, M. S. M. 1998. Bamboos of India—a compendium. New Delhi, India: Kerala Forest Research Institute and International Network for Bamboo and Rattan.

Ssali, F and Bitariho, B. 2013. Status and Distribution of Montane Bamboo in Echuya Central Forest Reserve- South West Uganda. Institute of Tropical Forest Conservation, Ruhija, Kabale. Accessed from <http://itfc.must.ac.ug/sites/default/files/publications/Echuya%20bamboo%20report%202013.pdf> on 28/9/2017

Stanbic Bank. 2017. An investment guide to Uganda-2017. Accessed from <https://www.stanbicbank.co.ug/standing/Uganda/file-Downloads/SBUInvestmentGuide2017.pdf>

Tewari, D. N. 1992. A monograph on bamboo. Dehradun, India: International Book Distributors.

Tolessa, A. 2015. Chemical pulping of *Oxytenanthera abyssinica* bamboo. Thesis. School of Chemical and Bio Engineering. Addis Ababa University. Accessed from <http://etd.aau.edu.et/bitstream/123456789/8437/1/Amsalu%20Tolessa.pdf> on 27/09/2017.

The National Forestry and Tree Planting Act (NFTPA). 2003. Accessed from http://www.nfa.org.ug/images/National_Forestry_and_Tree_Planting_Act_2003.pdf on 27/9/2017.

The Republic of Uganda (RoU), 2002. The National Forest Plan. Ministry of Water, Lands and Environment. October 2002. Accessed from http://www.nfa.org.ug/images/National_Forestry_Plan_2002.pdf on 27/9/2017.

The Republic of Uganda (ROU). 2013. Ecosystem based adaptation in Mountain Elgon Ecosystem: Vulnerability impact assessment (VIA) for the Mt Elgon Ecosystem. Accessed from http://www.adaptation-undp.org/sites/default/files/downloads/undp_ugandaunepunep-wcmc_2013_uganda_via_report.pdf on 27/09/2017.

UBS (Uganda Bureau of Statistics). 2017. Uganda National Household Survey 2016/17. Accessed from http://www.ubos.org/onlinefiles/uploads/ubos/pdf%20documents/UNHS_VI_2017_Version_I_%2027th_September_2017.pdf

Vorontsova, M.S., Clark, L.G., Dransfield, J., Govaerts, R., Baker, W.J. 2016. World Checklist of Bamboos and Rattans. International Network of Bamboo and Rattan & Royal Botanic Gardens, Kew.

Widenoja, R. 2007. MSc Thesis: Sub-optimal equilibriums in the carbon forestry game: Why bamboo should win but will not. Tufts University. Retrieved from <http://repository01.lib.tufts.edu:8080/fedora/get/tufts:UA015.012.073.00019/bdef:TuftsPDF/getPDF>.

WIPO (World Intellectual Property Organisation, 2017. Laws of Uganda. Accessed from <http://www.wipo.int/wipolex/en/profile.jsp?code=UG>

World Bank. 2017. https://data.worldbank.org/indicator/IC.EXP.COST.CD?locations=KE&name_desc=false. Accessed on 20 October 2017.

Zhao Y., Feng, D., Durai, J., Belay, D., Sebrala, H., Ngugi, J., Maina, E., Akombo, R., Otuoma, J., Mutyaba, J., Kissa, S., Qi, S., Assefa, F., Oduor, N., Ndawula, A., Li, Y., and Gong, P. 2017. Bamboo mapping of Ethiopia, Kenya and Uganda for the year 2016 using multi-temporal Landsat imagery. International Journal of Applied Earth Observation and Geoinformation. Issue 66(2018) 116-125.

Annexes

Annex 1A: *Yushania alpina*: Bamboo specification

Location: South Western Uganda

Size	Portion	Diameter	Thickness	Inter-nodal length
Large Total Height: 12 M	Bottom	8 cm	2 cm	40 cm
	+1.5 M	7.5 cm	1 cm	
	+ 3 M	7 cm	0.7 mm	65 cm
	+ 4.5 M	6.5 cm	0.6 cm	
	+ 6 M	5.7 cm	0.5 cm	
	+7.5 M	5.3 cm	0.4 cm	55 cm
	+ 8 m	4.5 cm	0.4 cm	
	+ 9.5 M – 11 M	3.3 cm	0.3 cm	
Medium Total Height: 10 M	Bottom	7 cm	1.5 cm	31 cm
	+1.5 M	6.3 cm	0.8 cm	46 cm
	+ 3 M	5.5 cm	0.6 cm	53 cm
	+4.5 M	5 cm	0.6 cm	55 cm
	+ 6 M	4.3 cm	0.5 cm	57 cm
	+ 7.5 M	3.5 cm	0.5 cm	52 cm
	+ 9 M	2.5 cm	0.4 cm	42 cm
Small Total Height: 8.5 M	Bottom	5.4 cm	1.4 cm	34 cm
	+ 1.5 M	4.3 cm	0.5 cm	56 cm
	+3 M	4 cm	0.4 cm	61 cm
	+4.5 M	3.7 cm	0.4 cm	53 cm
	+6 M	2.9 cm	0.35 cm	46 cm
	+7.5 M	1.8 cm	0.3	31 cm

Availability of Bamboo as per the size

Large	30 percent
Medium	50 percent

Small size	20 percent
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Annex 1B: *Oxytenanthera abyssinica*: Bamboo specification

Location: West Nile, Otzi central forest reserve, Northern Uganda, Central Uganda

Size	Portion	Diameter	Thickness	Inter-nodal length
Large (Total Height: 10 M)	Bottom	7 cm	1.5 cm	20 cm
	+1.5 M	6.3 cm	0.8 cm	20 cm
	+ 3 M	5.5 cm	0.6 cm	20 cm
	+4.5 M	5 cm	0.6 cm	20 cm
	+ 6 M	4.3 cm	0.5 cm	20 cm
	+ 7.5 M	3.5 cm	0.5 cm	20 cm
	+ 9 M	2.5 cm	0.4 cm	20 cm
Medium (Total Height: 8.5 M)	Bottom	5.4 cm	1.4 cm	15 cm
	+ 1.5 M	4.3 cm	0.5 cm	15 cm
	+3 M	4 cm	0.4 cm	15 cm
	+4.5 M	3.7 cm	0.4 cm	15 cm
	+6 M	2.9 cm	0.35 cm	15 cm
	+7.5 M	1.8 cm	0.3 cm	15 cm
Small (Total Height: 7 M)	Bottom	7.5 cm	1 cm	20 cm
	+1 M	7 cm	0.7 cm	20 cm
	+ 2 M	6.5 cm	0.6 cm	20 cm
	+ 3 M	5.7 cm	0.5 cm	20 cm
	+ 4 M	5.3 cm	0.4 cm	15 cm
	+5 M	4.5 cm	0.4 cm	15 cm
	+ 6 M	3.3 cm	0.3 cm	15 cm

Availability of Bamboo as per the size

Large	50 percent
Medium	40 percent
Small size	10 percent

Annex 1C: *Bambusa vulgaris*: Bamboo specification

Location: South Western Uganda

Size	Portion	Diameter	Thickness	Inter-nodal length
Average (Total Height 12 M)	Bottom	8 cm	1 cm	40 cm
	+1.5 M	7.5 cm	1 cm	
	+ 3 M	7 cm	0.7 mm	63 cm
	+ 4.5 M	6.5 cm	1 cm	
	+ 6 M	5.7 cm	0.5 cm	
	+7.5 M	5.3 cm	1 cm	55 cm
	+ 8 m	4.5 cm	1 cm	
	+ 9.5 M – 11 M	3.3 cm	1 cm	

Annex 2: Other Business Enabling conditions in Uganda

Uganda Investment Authority (UIA): One Stop Center

Uganda is actively engaged in promotion of domestic and foreign investment in various sector especially agriculture / agribusiness, tourism, mining, energy, oil and gas, manufacturing, infrastructure, etc. **Uganda Investment Authority (UIA)**, a semi-autonomous government agency established in 1991 is dedicated for attracting value-adding investors, and provide necessary support for investors (<https://www.ugandainvest.go.ug>). Uganda provides a suitable investment climate for foreign investors. According to 2017 Index of Economic Freedom, it ranked 9th among the 47 sub-Sahara African countries making it one of the open destinations for investment (IEF, 2017). More details related to investment promotion can be found in UIA website (<https://www.ugandainvest.go.ug>).

A foreign investor is required to get investment license. Company registration and Investment license and secondary licensing such as VAT and income tax registration will be facilitated by UIA. Investors / companies investment a capital exceeding USD 100,000 (Foreign firms) and USD 50,000 (Local firms) are eligible for Investment licence. The benefits related to import duty, duty drawbacks, and value-added tax can be negotiated between the UIA and investment license holders (Investment Guide, 2015).

Ownership on investment and land

100 per cent Foreign investments are allowed in all sectors except those related to national security. Land available for investment purpose can be majorly classified into four categories namely (a) leasehold tenure; (b) free hold land tenure, (c) mailo land tenure, and (d) customary tenure. Non-residents / investors are eligible for land lease for a maximum period of 99 years.

Electricity and its tariff

Electricity generation in Uganda is liberalised with several licensed electric power producers, distributors and transmission utilities. Uganda has a net electricity generation capacity of about 683 MW, with a legally grid connected consumer of 713, 756 (ERA, 2017). The consumer electricity tariffs are reviewed and fixed on a quarterly basis based on the (a) inflation rate, (b) fuel prices, (c) foreign exchange rate and (d) any changes in electricity generation mix. Uganda adopts a differential pricing system based on time of use as well as quantify of usage. Base rates are fixed during the beginning of the year and rates are revised on the above mentioned factors on a quarterly basis. The electricity tariff in Uganda is presented in **Table 34**.

Table 34: Energy tariff scheme in Uganda

Consumer Category	Supply volt	Time of Use	2017 Base rates (UGX)	2017 Quarter 4 resultant tariff (UGX)
Domestic consumer	240	< 15 kWh / month	150	150
		>15 kWh / month	696.6	685.6
Commercial Consumers	415; load < 100 Amp	Peak	815.9	806
		Shoulder	628.1	618.2
		Off-peak	391.5	381.6
		Average	629	619.1
Medium Industrial Consumer	415; max demand upto 500 kVA	Peak	747.9	738.1
		Shoulder	575.7	565.9
		Off-peak	355.6	345.8
		Average	577.8	568.0
Large Industrial Consumer	11,000 / 33,000 Max demand between 500 kVA to 1,500 kVA.	Peak	498.2	490.0
		Shoulder	383.5	375.3
		Off-peak	243.3	236.3
		Average	372.8	368.1
Extra-large industrial consumer	11,000 / 33,000 Max demand higher than 1,500 kVA.	Peak	493.1	484.9
		Shoulder	379.6	371.4
		Off-peak	243.3	235.1
		Average	372.8	364.6

Source: ERA 2017

Potential human resource, labour rates and condition

Uganda has about 19 million people between the working age (14- 64), out of which 15 million are working and remaining 4 million are unemployed (UBS, 2017). There is an estimated 14.2 million labour force in Uganda. Ugandan labour law does not require a contract of employment in writing for upto 12 weeks after the date of commencement of employment (Stanbic Bank, 2017). Growth of bamboo sector in Uganda can provide employment opportunity at rural and urban area. In discussion with the communities during field visit, it was revealed that labour wage is relatively cheap in rural Uganda. The median monthly wage in Uganda is about UGX 120,000 (USD ~ 30) in case of rural areas and UGX 220,000 (~ USD 60) in case of urban areas. Persons with education level of a degree

and above earned a monthly median income of UGX 780,000 or ~ USD 200 (UBS, 2017). This is an excellent opportunity for the industry to come up.

Labour: Normal working hours consist of a maximum of 48 hours per week with 30 minutes break per day. Employees are entitled for 21 days of annual leave. Female employees are entitled for 60 working days of maternity leave with full pay. Male employees are entitled to 4 working days of paternity leave.

Below **table 35** shows the median wages of labour force in Uganda published by Uganda Bureau of Statistics

Table 35: Median Wages of labour force in Uganda (2012/13 and 2016/17)

Background Characteristics	Survey Year					
	2012/13 (UGX)			2016/17 (UGX)		
	Male	Female	Average	Male	Female	Average
Residence						
Rural	110,000	66000	88000	150000	88000	120000
Urban	220000	150000	200000	300000	150000	220000
Technicians and Associate Professionals			300,000			450,000
Clerical Support Workers			300,000			370,000
Service and sales workers			155,000			150,000
Skilled agricultural, forestry and fishery workers			144,000			150,000
Craft and related trades workers			220,000			240,000
Plant and machine operators and assemble			220,000			300,000
Elementary occupations			66,000			90,000

Source: UBS, 2017

Markets

Uganda is part of free trade area with market access to Common Market for Eastern and Southern African (COMESA), East African Community (EAC) and South African Development Community (SADC) with market access to over 400 million people.

Uganda has market access to EU under Generalised Scheme of Preferences agreement; unrestricted entry into the USA market under African Growth and Opportunity Act (AGOA) for specified Ugandan products.

Investment protection and Taxation

Uganda has double taxation avoidance (DTA) tax treaties with fifteen countries including Denmark, Egypt, India, Mauritius, Netherlands, Norway, UAE (pending), South Africa, United Kingdom, Seychelles (pending) and Zambia. This ensures that the individual is not subjected to further taxation in Uganda on income that has already been taxed elsewhere.

Uganda has bilateral investment protection treaties with the following countries: BLEU (Belgium-Luxembourg Economic Union), China, Cuba, Denmark, Egypt, Eritrea, France, Germany, Italy, Netherlands, Nigeria, South Africa, Switzerland, United Kingdom and Zimbabwe.

Tax Holiday and incentives: 100% exemption of income derived from exportation of finished consumer and capital goods for the first ten years; 100% exemption from tax on income from agro-processing; In addition, exemption is possible which can be renewable annually.

If the cost of imported plant and machinery is above USD 22,500, the import duty is NIL and VAT is deferred.

Personal income tax: An individual present in Uganda for at least 183 days in any 12-month period is resident. A person with a permanent home in Uganda, or who has been present for an average of at least 122 days during three consecutive tax years, is

deemed to be tax resident (Stanbic, 2017)

There are five income tax slabs; Personal income tax is imposed on progressive rates ranging from 0- 40 percent (Stanbic, 2017)

Local Service Tax: This is collected by local authorities, where a tax payer resides for at least six months in a year. The maximum local service tax is about UGX 100,000.

Corporate tax: Standard corporate income tax is about 30 percent.

Value added tax: Standard rate of VAT is 18%. No VAT is applied for exported goods and services and specified import goods in agriculture, health and education.

Intellectual property rights

Uganda is a member of World Intellectual Property Organisation (WIPO), as well as Trade-Related Aspects of Intellectual Property Rights (TRIPS). It has a number of laws such as The intellectual property Act, 2014; the Geographical Indicator Act, 2013; The Trademarks Act, 2010; The trade secrets protection act 2009; and there is other intellectual property related legislation under penal, civil and criminal acts to protect the intellectual property rights (WIPO, 2017). Ugandan Registration services bureau is mandated to register the IPR. However, the enforcement remains weak.

Land rights: Investors have the right to own property. The Ugandan Land Act, 1998, allows foreigners to acquire a lease not exceeding 99 years.

Transport and shipping:

Road transport: Uganda has a very good road network and through road, bamboo products can be transported to neighbouring countries like Rwanda, DRC, South Sudan, Kenya, and Tanzania.

Railways: Rift Valley Railways Consortium (RVR) manages railways transport (cargo transportation) of Kenya and Uganda. A total of 818,520 tonnes was hauled in 2015 compared to 682,800 tonnes in 2014 representing an increase of 19.9 percent in overall cargo transport. However, the net tonnes ferried through Port Bell (Uganda) decreased by 66 percent in 2015.

Currently, Uganda does not have a functional railway network covering key bamboo growing areas. However, agreements had been signed with respective East African countries like Kenya resulting in the extension of the standard gauge fast track railway (SGR) service from Mombasa, Kenya to Uganda. In Uganda, the SGR network will comprise of three major routes with a total route length of 1,614 KM. The Eastern Route will start from Malaba to Kampala, the Northern Route will start from Tororo to Gulu to Nimule with a spur to Pakwach and the western Route will start from Kampala to Mpondwe (at the DRC border) through Mityana, Kamwenge and Kasese, and a line from Bihanga southwards to Mirama Hills (at the Uganda- Rwanda border) through Mbarara. The success of this project will be a game changer and is expected to halve the time spent transporting goods and is also expected to significantly reduce the cost of transport for goods flowing within Uganda or for goods coming in and out of Uganda.

Waterways: Though waterways could be an option for transportation of goods from Uganda to other neighbouring countries such as Kenya and Tanzania. The infrastructure is poorly developed.

Sea Port: Uganda is a land-locked country. Using sea ports from neighbouring countries for import and export is costly. Uganda currently uses Mombasa port in Kenya for imports and exports via sea. The distance from Kampala to Mombasa is about 1150 Kilometres.

Railway transport: Railway accounts for 4-6 per cent of cargo transported in and out of Port Mombasa (SCEA, 2015). Transportation of shipment from Mombassa port (Kenya) to Kampala (Uganda) inland be expensive compared to transporting goods from inland to port due to lesser movement of goods into Mombassa port. The cost of shipping a 20 feet and 40 feet container from Kampala to Mombassa is about USD 600 and 700 respectively. However, the cost of shipment of 20 feet and 40 feet container from Mombassa port to inland Kampala is much higher account for USD 1250 and 2200 respectively. The details are shown in below **table 36:**

Table 36: Cost of shipment from Mombassa to Kampala and vice versa

Size of container	From Mombasa (USD)		To Mombasa (USD)	
	Nairobi	Kampala	Nairobi	Kampala
20 Feet	500	1250	200	600
40 feet	1000	2200	400	700

Source: SCEA, 2015

Sea freight cost analysis: Table below shows the cost involved in export of goods in 20 feet container from Mombasa port to different destinations in the world. The cost of shipping a 20 feet container to North America, Europe, Middle East and Asia-Pacific is about USD 5500, USD 4500, USD 3500 and USD 4800 respectively in 2016.

Table 37: Sea Freight charges from Mombassa port to different parts of world

Year	North America (USD)	Europe (USD)	Middle East (USD)	Asia-Pacific (USD)
2012	4900	3400	2600	4200
2014	5000	4000	3000	NA
2016	5500	4500	3500	4800

Source: SCEA, 2015

Based on the world Bank ease of doing business data for shipment 20 feet container, the cost of handling shipments in East African Countries is much higher compared to China (~ 10 times), EU (~ 2 times), United States (~ 4 times) and approximately twice the cost of global average.

Please note: (1) The cost includes (a) fees levied, (b) cost involved in procedural compliances to export or import the goods, (c) costs for documents, (d) administrative fees for customs clearance and technical control, (e) customs broker fees, (f) terminal handling charges and (g) inland transport and (2) The cost measure does not include tariffs or trade taxes. Only official costs are recorded.

Table 38: Cost of shipment from Uganda to different countries in the world (20 feet container)

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Country Name	Country Code	Cost (USD)				
		2010	2011	2012	2013	2014
China	CHN	275	275	319	823	823
Ethiopia	ETH	2180	2180	2180	2180	2380
European Union	EUU	1034	1045	1039	1035	1042
Kenya	KEN	2055	2055	2255	2255	2255
North America	NAC	1145	1145	1157	1422	1452
Netherlands	NLD	925	925	925	925	915
Uganda	UGA	2780	2880	3050	2800	2800
United States	USA	630	630	654	1164	1224
World	WLD	1369	1389	1461	1530	1560

Source: World Bank, 2017

Annex 3A: Tools for conducting Bamboo Market Value Chain Study within Uganda

Bamboo Product Producers - Questionnaire for both individual interviews and FGDs

- I Malewa (Bamboo Shoots) – **Mbale Markets** – Start with Mbale Central Market and then visit 2 other markets,
- II Furniture – Kisoro and Kabale,
- III Construction materials – **Kisoro and Kabale**
- IV Charcoal – ask around – no clear location given

Name person conducting the Interview: _____

1. Location
 - a. Parish
 - b. Sub county
 - c. District
2. Date (dd/mm/yr)
3. Time
4. Name of Person being interviewed
5. Gender Female/Male
6. Age category (1 = 10 – 20, 2 = 21 – 30 years, 3 = 31 – 40 years, 4 = 41 – 50 years)
7. Mobile tel No. of person being interviewed
8. Where do you get the bamboo from?
9. Are there people who plant bamboo in this area or it is all harvested from forests?
10. Can you give us the location and contact details of the people who plant bamboo (if any)?
11. Which type of bamboo do you use and why?
12. Do you know any other types of bamboo that are found in your area?
13. If yes, which ones and what are their percentages in your area (Use the Table)
14. Are they used to make any product? Which ones? (Use the Table)

Bamboo types and simple description	Percentage in area	Products made from the type of bamboo

15. How much do you pay for a specified quantity (bundle, basket etc)?
16. Estimate the weight (Kg) of that specified amount

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17. How much they use (base this estimate on the specified amount above eg the whole bundle, 20% of the bundle, 1% of the bundle, 5 bundles etc) to make (Fill in Table)

Bamboo item	Unit of bamboo purchase	Proportion of that unit used in making the bamboo item
A standard single person chair		
A market bundle of Malewe		
A sack of charcoal		
Construction pieces		

18. How many of these products (Chairs, Malewe, Sacks of charcoal and Construction pieces) do you sell in a month?
19. How much do you sell this product?
20. What transport costs do you incur?
21. How many people do you employ, What is your payment arrangement for your employees and how much do you pay them (Fill in table below)?

Type of Labour	No. of people	Payment arrangement	Rate of payment (Ushs)
Full time			
Part time			
Type of Labour	No. of people	Payment arrangement	Rate of payment (Ushs)

22. Do you have to treat the bamboo in any way before making your product?
23. Besides labour, are there any other costs you incur in that treatment process?
24. Do you work alone or in a group?
25. If in group – how many are you in your group?
26. Do you know of other groups doing this kind of business?
27. If yes, how many and where do they operate from?
28. Do you know others doing a similar kind of business like yours working alone?
29. Where do they operate from?
30. Is this business profitable for you (Yes/No)? Why your response?
31. What are the 3 major challenges you face in your business?

32. What would your suggestions be for addressing these challenges?
33. What are major opportunities do see in this business? (maximum of 3)
34. Do you anyone else who makes something different from yours from bamboo?
35. If yes, what product and where can we find them?

Annex 3B: Questionnaire for bamboo Nurseries – Individual Interview

Name person conducting the Interview: _____

1. Location
 - a. Parish
 - b. Sub county
 - c. District
2. Date (dd/mm/yr)
3. Time
4. Name of Person being interviewed
5. Gender Female/Male
6. Age category (1 = 10 – 20, 2 = 21 - 30 years, 3 = 31 – 40 years, 4= 41 – 50 years)
7. Mobile tel No. of person being interviewed
8. What types of bamboo seedlings do you sell?
9. Which are the 3 major bamboo types that sell fastest? (Begin with one that sells fastest of the 3 and end with the one that sells least of the 3) – use Table
10. How many seedlings of these 3 do you sell in a month? – Use Table
11. At what price do you sell them? – Use Table

Bamboo type	No. of seedlings sold in a month (if a month is too short we use a year)	Price of a seedling

