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UGANDA NATIONAL BAMBOO STRATEGY AND ACTION PLAN

Ministry of Water and Environment



Kingdom of the Netherlands



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Ministry of Water and Environment

Plot 21/28 Port Bell Road, Luzira, PO Box 20026,
Kampala, Uganda
Tel: +256414505942; Email: mwe@mwe.go.ug
www.mwe.go.ug

International Bamboo and Rattan Organisation

PO Box 100102-86, Beijing 100102, China
Tel: +86-10-6470 6161; Fax: +86-10-6470 2166;
Email: info@inbar.int
www.inbar.int

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ACRONYMS

ADB	African Development Bank
AMSL	Above Mean Sea Level
BMCT	Bwindi Mgahinga Conservation Trust
BTVET	Business, Technical and Vocational Education and Training
CBD	Convention on Biological Diversity
CEO	Chief Executive Officer
CFM	Community Forest Management
CFR	Central Forest Reserve
CM	Centimetre
CO ₂	Carbon Dioxide
CSO	Civil Society Organisation
DFS	District Forestry Services
DLG	District Local Government
ENR	Environment and Natural Resources
FAO	Food and Agriculture Organization of the United Nations
FIEFOC	Farm Income Enhancement and Forest Conservation
FMP	Forest Management Plan
FLR	Forest Landscape Restoration
FSSD	Forest Sector Support Department
FY	Fiscal Year
GEF	Global Environment Facility
GoU	Government of Uganda
Ha	Hectare
ICBR	International Centre for Bamboo and Rattan
ICT	Information and Communications Technologies
IEC	Information Education and Communication
INBAR	International Bamboo and Rattan Organisation
IRR	Internal Rate of Return
KDLG	Kisoro District Local Government
LG	Local Government
M	Metre
M ³	Cubic Metre
MAAIF	Ministry of Agriculture, Animal Industries and Fisheries
M&E	Monitoring and Evaluation
MD	Man Days
MEMD	Ministry of Energy and Mineral Development
MM	Millimetre
MoES	Ministry of Education and Sports
MoLG	Ministry of Local Government
MoFPED	Ministry of Finance, Planning and Economic Development
MWE	Ministry of Water and Environment
MTIC	Ministry of Trade, Industry and Cooperatives
NaFORRI	National Forestry Resources Research Institute
NARO	National Agriculture Research Organisation
NBP	National Bamboo Plan
NDP	National Development Plan

NFA	National Forestry Authority
NFP	National Forest Plan
NFGA	National Forestry and Grassland Administration of China
NGO	Non-Governmental Organisation
NP	National Park
NPV	Net Present Value
NTSC	National Tree Seed Centre
PA	Protected Area
PFO	Private Forest Owner
PPP	Public–Private Partnership
PV	Present Value
RET	Renewable Energy Technology
ROI	Return on Investment
SDG	Sustainable Development Goal
SME	Small and Medium Enterprises
SPGS	Sawlog Production Grand Scheme
UBOS	Uganda Bureau of Statistics
UGX	Ugandan Shillings
UIRI	Uganda Industrial Research Institute
UN	United Nations
UNBS	Uganda National Bureau of Standards
UNCCD	United Nations Convention to Combat Desertification
UNHCR	UN Refugee Agency
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
UWA	Uganda Wildlife Authority
VAT	Value-Added Tax
WMDP	Water Management and Development Project
Yr	Year
°C	Degree Celsius
%	Per Cent

FOREWORD

Bamboo grows naturally in Uganda, forming a significant component of the environment, which government is mandated to manage for sustainable development as provided for under Article 245(b) of the 1995 Constitution of the Republic of Uganda. Most of the bamboo resources are located in protected areas (PAs; mainly forest reserves and national parks), which are managed by government in trust for the people of Uganda as provided for under Article 237(2)(b) of the Constitution. Bamboo is a significant non-timber forest resource for the rural communities that depend on it for food, construction and craft materials, fuel wood, fodder and other uses. Bamboo also contributes to the national economy through taxes on bamboo industries and products, tourist attractions, soil and water conservation, biodiversity conservation, mitigation of climate change and other environmental services. However, the bamboo resources of the country have long been neglected, resulting in depletion. There has been growing demand for bamboo and its products, and yet, minimal effort has been made to replenish the natural stocks and/or grow bamboo to complement the natural sources. This has adversely affected rural livelihoods, the environment and the national economy.

The lack of a vibrant bamboo industry has been primarily attributed to the absence of a strategy to guide development of the industry. Therefore, the present strategy has been developed to address the challenges and boost growth of the industry. The main focus of the bamboo strategy in Uganda is on the management of bamboo resources for economic, social and environmental benefits for all the people of the country. The vision, goal, guiding principles, strategic objectives and strategies are all tailored towards achieving a viable and sustainable bamboo industry in Uganda. The strategy is in line with international obligations to which Uganda is a signatory, national policies and planning frameworks. The important ones are the Sustainable Development Goals, Uganda Vision 2040, Uganda Forestry Policy 2001, National Forest Plan 2012, National Land Use Policy 2013 and National Energy Policy 2002, among others. The bamboo strategy recognises the fact that a number of players have to be involved to ensure the success of the bamboo industry. Thus, it identifies key support sector policies/plans and services for the implementation of the bamboo strategy. The different key actors are also identified and their roles clearly stipulated. It is anticipated that, once well implemented, this strategy should go a long way in redeeming the bamboo industry in the country. To address emerging developments and challenges in the industry, the strategy will be subjected to regular updates.

I take this opportunity to call upon all Ugandans to actively participate in the development of the bamboo industry as guided by this strategy, for the good of the present and future generations of our motherland, Uganda.

For God and my country.



Hon. Dr. Goretti Kitutu Kimono
Minister of State for Environment

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Alfred Okot Okidi
PERMANENT SECRETARY

1 INTRODUCTION

1.1 Background

1. Bamboo is a woody plant and a perennial species belonging to the grass family Poaceae, subfamily Bambusoideae. There are over 1600 species of bamboo growing in different agro-climatic locations of the world. It is amongst the fastest growing woody plants in the world. Bamboo is mostly found in the tropical and sub-tropical regions, thriving in diverse agro-ecological zones, from as low as sea level to 4000 m above sea level. Bamboo is a significant non-timber forest resource for most developing countries in Asia, Latin America and Africa. Based on the Food and Agriculture Organization of the United Nations (FAO)–International Bamboo and Rattan Organisation (INBAR) bamboo resource assessment in 2005 (Lobovikov et al, 2007), five countries in Africa reported 2.8 million ha.
2. According to the INBAR–Tsinghua University remote sensing study, bamboo grows in an area of 54,533 ha in protected areas (PAs) of Uganda (INBAR, 2018). At least 13 bamboo species had been identified in Uganda by 2013, of which only two were native, with the rest of the species introduced from elsewhere (National Forestry Authority [NFA], 2017). Of the introduced species, *Bambusa vulgaris* and *Dendrocalamus giganteus* are the most successfully cultivated bamboo species in Uganda.
3. Common places where bamboo forest can be found include the following: Northern Uganda (Otzi Mountain, Agoro-Agu Central Forest Reserve [CFR] and private/communal lands) for lowland bamboo (*Oxytenanthera abyssinica*) and Mt. Elgon, the Rwenzori Mountains, Mgahinga Gorilla National Park (NP), Bwindi NP and Echuya CFR highland bamboo (*Oldeania alpina*, synonym *Yushania alpina*).
4. Bamboo is widely used by communities for sustenance and local uses. Shoots of highland bamboo are eaten by people around Mt. Elgon, and they locally call it ‘Malewa’. Bamboo poles have been used for construction of huts, fencing materials, props for crops and local-use products (granaries, basketry for household and agricultural uses), especially in bamboo growing areas.
5. The demand for bamboo is high in Uganda, but only a few farmers are engaged in bamboo management and plantation development. So far, little attention has been paid to the development, management and trade in bamboo in Uganda. According to the United Nations (UN) Comtrade database of 2014–16, the annual trade value of bamboo from Uganda stood at United States dollars (USD) 304,000 for import and USD 203,672 for export. This indicates that there is a huge potential that bamboo can offer for the production of timber substitute products, energy products, fibre products, furniture and crafts, in addition to environmental management (bamboo forests contribute to soil and water conservation) and climate change mitigation and adaptation.
6. The bamboo strategy is designed to improve the livelihoods of Ugandans, especially those living in rural areas, through raising the incomes of the poor people, increasing the number of jobs and enhancing the contribution of bamboo forests to Uganda’s economic development. It is aimed at propelling green economy development, achieving the domestic and international development targets and commitments of the Government of Uganda.

1.2 Historical context

7. During the colonial period, large areas of the country's indigenous forests, including indigenous bamboo forests, were cleared for growing planted (monoculture) tree species, such as cypress, eucalyptus, pines and mahogany in the form of large-scale plantations. In the post-independence period, the government allocated large areas of indigenous forest (including those with bamboo) to communities for establishing agricultural and horticultural farms. In addition, with illegal excisions, a large area of bamboo forest and water catchment and wildlife habitat were destroyed.

1.3 Need for a bamboo strategy

8. Bamboo is an important natural substitute for a number of forest products and services. It is one of the fastest growing plants on the earth. It is a highly versatile material with possibilities of harvesting the crop annually.
9. Globally, the annual production and consumption of bamboo products are valued at USD 60 billion, and global import and export is valued at USD 3 billion. There is a large market opportunity for Uganda to tap into.
10. There has been a general lack of awareness, coupled with poor perception of bamboo as a poor man's timber and less durable product with no market opportunity. There are over 10,000 documented product utilities. A wide range of products ranging from household to micro-enterprise, small and medium enterprise (SME) and large-scale industrial products are possible from bamboo, which enables inclusive development.
11. A number of bamboo species can grow and perform well in different agro-ecological zones of Uganda.
12. Bamboo can contribute to environmental management (especially improving soil and water conservation), wildlife habitat and climate change mitigation. It can be used as a tool to achieve international obligations, including the Bonn Challenge, Convention on Biological Diversity (CBD), United Nations Framework Convention on Climate Change (UNFCCC) and United Nations Convention to Combat Desertification (UNCCD).
13. There has been minimal effort by government and the private sector to promote bamboo growing in the country. In contrast, there has been increasing pressure on natural bamboo forests due to bamboo's diverse uses, both domestically and internationally. This resultant imbalance between the production and utilisation of bamboo has led to the depletion of naturally growing bamboo stocks, and hence, scarcity of bamboo products. Bamboo is reportedly becoming extinct in areas where it used to be abundant, for example, in the public/communal lands in Northern Uganda.

2 BAMBOO: SITUATION ANALYSIS

2.1 Bamboo resources

14. Most natural bamboo is found in PAs (54,533 ha). However, there is little information available on bamboo resources found on private land or the quantity being produced. The NFA (2018) estimates its plantation of bamboo to stand at 200 ha. There are also several small holder farmers involved in bamboo cultivation around the Bwindi and Mgahinga NPs.
15. The predominant bamboo species in the PAs are indigenous, and they are as follows: (a) *Oldeania alpina*, or highland bamboo, and (b) *Oxytenanthera abyssinica*, or lowland bamboo. There are a few introduced bamboo species on private lands, and the important ones are as follows: (a) *Bambusa vulgaris* and (b) *Dendrocalamus giganteus*. They have adapted well to Ugandan conditions and are mainly found in farms and households across Uganda. Other species, such as *Bambusa balcooa*, *Dendrocalamus asper* and *Gigantochloa aspara* are also planted by a few private farmers. In addition, the *Phyllostachys aurea* bamboo species is common in urban centres and used for landscaping.

2.2 Bamboo value chain and actors

16. The bamboo industry in Uganda is largely underdeveloped. Bamboo utilisation and production is mostly confined to meeting the needs for sustenance, traditional and low-value products. Bamboo is widely used by local communities located around the Ruwenzori Mountains NP, Mt. Elgon NP, Mgahinga NP, Bwindi NP and Echuya CFR, for house construction and the production of granaries, baskets, bean stakes and fuel wood. In addition, people in the communities surrounding Mt. Elgon eat bamboo shoots called 'Malewa', whereas in other locations of Uganda, bamboo shoots are not eaten.
17. Industrial production of bamboo products is in its inception stage. It is important to note that, in 2007, the Uganda Industrial Research Institute (UIRI) with the support of the China Bamboo Research Center established a training-cum-incubation centre for the production of bamboo toothpicks and furniture. Following this initial investment, a Ugandan investor is now engaged in the commercial production of bamboo toothpicks in the Kabale District. However, both the productivity and quality are still low; yet, this sector has extremely high potential, which can be improved with investment in capacity development.
18. Existing bamboo value chains in Uganda include the following: (a) nurseries, (b) bamboo poles, (c) bamboo shoots, (d) bamboo furniture, (e) bamboo handicrafts and ornaments and (f) industrial products (at demonstration scale). The bamboo value-chain actors mainly consist of the following: (a) resource producers, (b) collectors or harvesters, (c) processors, (d) traders, (e) transporters and (f) consumers.
19. The total number of actors involved and/or associated with bamboo is difficult to estimate nationally. Studies put the current number of bamboo stakeholders at close to

1,000,000 (INBAR, 2018), with a vast majority of these actors found in the Mbale, Sironko, Kabale, Adjumani, Moyo, Rubanda and Kisoro districts of Uganda.

20. It is important to note that efforts are being made in Uganda to improve bamboo production and productivity. For example, efforts are being made by the Ministry of Water and Environment (MWE; Forest Sector Support Department, FSSD), INBAR, the NFA, the Uganda Wildlife Authority (UWA), the UN Refugee Agency (UNHCR), FAO/Sawlog Production Grand Scheme (SPGS) and Farm Income Enhancement and Forest Conservation (FIEFOC) to carry out development projects, including riverbank/watershed protection along the River Nile. Appendix 1 lists key actors involved in bamboo plantation development in Uganda (baseline). The initiatives support Forest Landscape Restoration (FLR), restoration of fragile ecosystems like riverbanks and steep slopes, bamboo poles for construction and energy for refugees, among other things.
21. Also important is the recognition of bamboo in relation to the influx of Sudanese refugees in Northern Uganda and the interventions government and development partners are putting in place to mitigate the destruction of natural trees. Of particular interest is biomass generation for fuel and building materials.

2.3 Institution and policy framework

22. The focus of the bamboo strategy in Uganda is on the management of bamboo resources for the economic, social and environmental benefits for all people of Uganda.
23. In its current form, Uganda has several legislative frameworks that can support the development and management of the bamboo industry. Fourteen laws were reviewed during the bamboo strategy development, including the following: a) The Constitution of the Republic of Uganda (1995) and Constitution Amendment Act (2005); b) National Environment Act, Chapter 153 (1995); c) Land Act, Chapter 227 (1998); d) Physical Planning Act (2010); e) National Agricultural Advisory Services Act (2001); f) National Forestry and Tree Planting Act (8/2003); g) Water Act, Cap. 152 (1997); h) Uganda Wildlife Act, Chapter 200 (1996); and i) Local Governments Act, Chapter 243 (1997).
24. The other legal frameworks are as follows: a) the National Environment (Hilly and Mountainous Area Management) Regulations (2000), No. 2; b) National Environment (Wetlands, Riverbanks and Lakeshores Management) Regulations (S.I. No. 153-5; 2000); c) Environmental Impact Assessment Regulation (S.I. No. 13; 1998); d) National Forestry and Tree Planting Regulations (2016); e) Land Regulations (2004); and f) National Physical Planning Standards and Guidelines (2011). The legal frameworks and sections/provisions relevant to bamboo are elaborated on in Appendix 2.
25. Several national policies (statements of intent, implemented as a procedure or protocol) that are relevant to the implementation of the bamboo strategy, were also reviewed. The aim of the review was to establish the linkages in policy formulating, cross-referencing the various policies and legal reforms. The pertinent policies reviewed included the following: the National Environment Management Policy (1994), National Wetland Policy (1995), Forestry Policy (2001), National Policy for Disaster Preparedness and Management (2010),

National Climate Change Policy (2012), National Land Policy (2013), National Agriculture Policy (2013) and Uganda National Water Policy (1999). Most of the policies have been supported by national planning frameworks. The relevance of the support sector policies/plans and services is illustrated in Appendix 3.

26. The main policies and planning frameworks that will support the bamboo strategy include the following:
- a) Uganda Vision 2040: Uganda Vision 2040 part 293 states, 'Over the Vision 2040 period efforts will be undertaken to attain a green and clean environment with no water and air pollution while conserving the flora and fauna and restoring and adding value to the ecosystems'.
 - b) National Development Plan II (NDPII, 2015): The Second NDP (2015/16–2019/20), section 1.2.11, aims at 'Promoting sustainable population and use of the environment and natural resources [ENR]'.
 - c) The Forestry Policy (2001): This policy aims to realise '[a]n integrated forest sector that achieves sustainable increases in the economic, social and environmental benefits from forests and trees by all the people of Uganda, especially the poor and vulnerable'.
 - d) The National Forest Plan (NFP; 2011/12–2021/22): Its vision is a 'sufficiently forested, ecologically stable and economically prosperous Uganda', and its goal is '[a]n integrated forest sector that achieves sustainable increases in economic, social and environmental benefits from forests and trees by all the people of Uganda, especially the poor and vulnerable'.
 - e) The National Energy Policy (2002): Strategy (f) under the biomass and other renewable energy subsector seeks to '[s]upport efforts to develop biomass resources in agreement with the Uganda Forestry Policy and the [NFP]'.
27. The Uganda bamboo strategy is also formulated to meet international obligations in which Uganda is a signatory. Some of the important international obligations in support of this strategy are as follows:
- a) The Sustainable Development Goals (SDGs): SDG 1 (End poverty), SDG 7 (Affordable and clean energy), SDG 11 (Sustainable cities and communities), SDG 12 (Sustainable consumption and production), SDG 13 (Climate change), SDG 15 (Life on land) and SDG 17 (South–south cooperation) are all relevant.
 - b) The UNFCCC: This is linked to stabilising the greenhouse gas concentration.
 - c) The UNCCD: This is linked to sustainable land management.
 - d) The CBD: This is linked to biodiversity conservation.

2.4 Bamboo industry development challenges

28. The development of the bamboo industry has been very slow in Uganda. Several factors have contributed to this. However, the most important ones are as follows:
- a) Difficulty in obtaining bamboo, that is, the limited bamboo supply. People have destroyed a lot of bamboo forest, and this has resulted in a scarcity of bamboo raw materials for industries.

- b) Lack of sustainable management of bamboo, resulting in poor quality of bamboo. Bamboo is mostly extracted from natural bamboo forests, where it grows independently without any additional care.
- c) Lack of interest among communities and private growers in bamboo planting, mainly due to negative attitudes (makes soil infertile, organised markets are lacking).
- d) Lack of awareness on the possibilities and potential of bamboo, which is still considered a poor man's timber used for low-quality and less durable products.
- e) High cost of planting materials prohibit growers from investing in large bamboo plantations.
- f) Inadequate capital for establishing and maintaining the bamboo industry.
- g) High taxation of bamboo products (value-added tax [VAT], excise duties); the upcoming industry needs to compete with imported products and cheaper alternatives.
- h) Limited technology and capacity for production and value addition.
- i) No established institutional support that focusses on bamboo industry development.

2.5 Opportunities for bamboo development in Uganda

- 29. The global bamboo economy is now valued at USD 60 billion, and it is a potential income generator for rural communities. The largest markets are handicrafts (USD 3 billion), bamboo shoots (USD 1.5 billion) and traditional furniture (USD 1.1 billion; Greijmans, Oudomvilay and Banzon, 2007). Emerging bamboo markets are timber substitutes, such as flooring, panels and non-traditional furniture.
- 30. A number of timber substitutes can be made from the indigenous bamboo species. According to the UN Comtrade database, on average (2016 and 2017), Uganda imports wood parquet panels, plywood and laminated wood, packaging boxes, particleboard and fibreboard valued at USD 778,757, USD 1 million, USD 96,209, USD 298,312 and USD 9,083,000, respectively.
- 31. Bamboo is a suitable material for the production of pulp and paper. On average (2016 and 2017), Uganda imports pulp and paper valued at USD 497,964 and USD 121.42 million, respectively.
- 32. Uganda also exports the abovementioned products. The products imported could be suitably substituted with locally grown bamboo, and at the same time, could become an export revenue earner.
- 33. Bamboo shoots are an important food for the Gisu communities living around Mt. Elgon. Nutrient content analysis of bamboo shoots (including *Yushania alpina*) shows that bamboo shoots are rich in important macro-nutrients, such as proteins, carbohydrates and fibre and has good micro-nutrients, such as calcium, magnesium and zinc. It also possesses high levels of polyphenols and flavonoids, with

potential for contributing to human health as important antioxidants (Karanja, 2017). Markets for bamboo shoots are available in Uganda (Mt. Elgon sub-region), and they have a large export market. According to the UN Comtrade database, on average (2014-2016), the global annual export of bamboo shoots is valued at USD 308 million. In the short term, the bamboo shoot value chain can be developed to suit the local market, and in the long term, export markets can be tapped.

34. Harvesting and trading of bamboo poles for construction, scaffolding and use as props for the agriculture and horticulture industry is one of the prominent value-chains in Uganda. The market is growing, and there is a scarcity of bamboo poles. Faced with an average population growth rate of 3% annually, coupled with an influx of over 1 million refugees fleeing the war from South Sudan, the Democratic Republic of the Congo and Burundi and the needs for affordable housing, shelter and energy, a high demand for bamboo poles can be created. Trading of bamboo poles represents 10% 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.
35. Most households in bamboo-growing regions use bamboo products as household and farm utility products. Currently, the markets are confined to rural areas. Therefore, the basic skillsets are available in the community. It will be easy to upscale the bamboo crafts production to cater to low-value, large consumption products, such as basketry for households, the agriculture and horticulture industry and lifestyle products for urban markets.
36. Uganda has a robust coffee and tea sector, requiring several bamboo products, such as tea-picking baskets, coffee collection baskets and mats for drying coffee. Baskets for agriculture produce packaging and collection, household utility items and beehives all have enormous markets. In addition, bamboo souvenir products are in high demand. This market will be further boosted by the flourishing Ugandan tourist sector, which had about 1.3 million tourist arrivals in 2013.
37. According to the UN Comtrade database, bamboo basketry and wicker works represent around 14% of the global trade, valued at USD 171 million (average for 2014–2016). With the upgraded value chain, including diversification and improvement in product quality, bamboo has the potential to reach the international market. It is also important to note that nearly 60% 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, are known to create large-scale local employment.
38. As mentioned above, about 60% 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. The timber furniture industry in Uganda is flourishing; timber working enterprises can be found along roadsides 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 values of metal furniture, wood furniture and plastic and other furniture were USD 1.9, USD 9.8 and USD 1.4 million, respectively.

39. According to Uganda National Household Surveys (2016), household firewood and charcoal was nominally valued at Ugandan shillings (UGX) 409.1 billion in 2009/10. Over 90% of the households 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. On average, Uganda imports activated carbon valued at USD 95,388 (2016 and 2017).
40. Because of its versatility, rapid growth and dense canopy, bamboo is an excellent crop that can tap into the carbon market and help propel Uganda's green growth agenda to a high level.

3 GUIDING PRINCIPLES, OBJECTIVES AND STRATEGIES:

3.1 Guiding principles

41. **Private sector-led and market-driven industry:** The private sector shall lead the development of the bamboo industry. This will be coordinated by government institutions, which shall provide the necessary support and regulatory framework. Since Uganda is following a market-driven economy, every effort will be put in place to provide a level playing field for bamboo products.
42. **Holistic and integrated development:** Bamboo growing and management shall be done in a sustainable manner with a focus on livelihood, economy and environmental development.
43. **Restoring bamboo forest** ecosystem and protecting community livelihoods will be dynamic, comprehensive and integrated.
44. **Developing strong synergies and convergence:** Sustained investment and efforts from government, development partners, investors and local private-sector players will be synergised to support development of bamboo-based jobs and economy.
45. **Adaptive management approach:** This will be used to develop bamboo industry development and restoration of the bamboo forest.
46. **Gender and equity:** Bamboo contributes to gender and equity, with the participation of vulnerable communities aimed at equitable distribution of benefits derived from the sustainable management and value addition of bamboo.

3.2 Bamboo strategic statements

The vision, mission, goal and strategic objectives are outlined below.

3.2.1 Vision

47. ***'Sustainably managed bamboo resources for community livelihoods, socio-economic development and environmental protection'***

3.2.2 Mission

48. To build a robust bamboo industry in Uganda by sustainable management of bamboo resources and high value addition, contributing to gross domestic product growth, green economic development, job creation and enhanced ecosystem services.

3.2.3 Goal

49. ***The overall goal of the bamboo strategy is to ensure coordinated development of the bamboo industry to propel green economic development and production of high-value products targeting domestic, regional and international markets.***
50. The FLR target for Uganda is 2.5 million ha by 2030. The MWE (FSSD) is projecting that 15% (375,000 ha) of this target will be contributed to by planting and/or managing bamboos. Twenty-eight per cent (104,000 ha) of the restoration will be on government land and 72% (271,000 ha) will be on private land. A total of UGX 442.8 billion (USD 118 million) will be required to implement this strategic plan.
51. The short-term goal (2019–2024) is to plant 70,000 ha (30,000 ha on government land and 40,000 ha on private land) and restore 15,000 ha of natural bamboos both on private and government lands. An estimated 140 million bamboo poles will be produced per year. It is envisaged that 150,000 full-time jobs will be created.
52. In the long term (2025–2040), it is envisaged that an additional 230,000 ha of planted bamboo will have been established on farms and 60,000 ha of natural bamboos will have been regenerated. By that time, 700,000 full-time jobs will have been created. An estimated 460 million bamboo poles will be produced per year from the venture.
53. The net value of the bamboo trade at farm gate price should reach UGX 1.9 trillion (USD 508.4 million) by 2030.

3.2.5 Strategic objectives

54. Four strategic objectives have been developed to guide the bamboo industry development, and these are as follows:
 - i. To increase production and productivity of bamboo forests in Uganda.
 - ii. To increase return on investment (ROI) in the bamboo industry through processing and value addition.
 - iii. To improve knowledge management in the bamboo industry through awareness creation, education and research.
 - iv. To improve governance and institutional arrangement in support of the bamboo industry.

3.2.6 Specific objectives

55. From the four strategic objectives, ten specific objectives have been developed to support bamboo industry development. To achieve each of the strategic objectives, a number of strategic actions will be implemented. The specific objectives are based on the guiding principles and strategic objectives outlined in 3.1 and 3.2 above. The specific objectives are as follows:
 - i. To identify and develop bamboo clusters.
 - ii. To manage natural bamboo on PAs/government land.

- iii. To promote bamboo plantations on government and private land.
- iv. To produce and supply quality planting materials.
- v. To develop bamboo SMEs and industries.
- vi. To support bamboo market development.
- vii. To support bamboo education, training and research.
- viii. To develop communication and knowledge management systems.
- ix. To create an enabling environment.
- x. To create institutions and governance mechanisms.

56. **Specific objective i: To develop species-specific bamboo clusters for integrated bamboo development:** Site species matching for bamboo production will be undertaken. The developed site-specific species of bamboo resources are aimed at end use and agro-climatic suitability in a close geographical cluster to develop the complete value chain, that is, the linkages between the nursery, producers (farmers), value addition including primary processing and treatment, micro-enterprises and SMEs, high-value products, markets and skill development, ensuring a complete value chain for growth of the bamboo sector to boost bamboo-based industry. This would reduce wastages, promote efficiency and develop expertise via specific steps, resulting in a significant drop in the cost of production, ensuring employment generation and strengthening the rural economy.
57. *Strategies for implementing specific objective i will include the following:*
- Developing a set of criteria for identification of bamboo clusters, especially in existing bamboo growing regions and high potential locations.
 - Identifying and establishing five bamboo development clusters in the short term (2019–2025) and an additional ten bamboo development clusters in the long term (2025–2040).
 - Establishing and/or strengthening supporting an institutional framework for handholding the bamboo development in identified clusters.
58. **Specific objective ii: To sustainably manage natural bamboo on PAs (government lands):** Central and local governments (LGs) will sustainably manage the current 54,533 ha of bamboo resources on government lands (PAs). However, every effort will be made to expand the bamboo resource base on government land. As guided by the sector laws and policies, the NFA will be responsible for the management of bamboos in CFRs. The UWA will manage bamboos in NPs. The district LG (DLG; through District Forestry Services [DFS]) will manage bamboos in Local Forest Reserves. Where feasible, a partnership arrangement can be entered into for the management of bamboo resources in PAs. The arrangement will be guided by a management plan developed and agreed upon by the partners.
59. *Strategies for implementing specific objective ii will include the following:*
- Developing zones of bamboo resources in PAs for sustainable management and conservation of ecologically sensitive and fragile zones; 50% of high-value ecologically sensitive and fragile zone should be protected and the other 50% sustainably managed for production.
 - Developing a bamboo resources management plan in PAs.

- Developing and implementing guidelines for regulating sustainable management of bamboo and its value chain.
- Promoting collaborative management of PAs with the local communities.
- Developing and implementing sustainable management and harvesting guidelines.
- Promoting and developing bamboo based ecotourism.

60. **Specific objective iii: To promote bamboo plantation on government and private land:** Bamboo plantation establishment in both public and private land will be encouraged to increase the bamboo resource base for value addition. Government will ensure that deliberate efforts are made to increase the bamboo resource base and reverse the high rate of bamboo decline on government and private land. This will be undertaken as part of the greater integrated land use and landscape management approach. The FLR target for Uganda is 2.5 million hectares. The MWE/FSSD estimates that 15% (375,000 ha) of the land to be restored under FLR will be through planting bamboo. About 37,000 ha will be planted and 67,000 ha of natural bamboo maintained on government land (PA). About 263,000 ha will be planted and 8000 ha of natural bamboo maintained on private land.
61. *Strategies for implementing specific objective iii will include the following:*
- Encouraging land licensing to private investors for setting up large-scale bamboo plantations on government land.
 - Developing and disseminating standards, best practice and technologies for commercial bamboo plantation development and management.
 - Strengthening private sector access to innovation, financing, access to market and technical information.
 - Supporting the establishment of bamboo plantation in PAs, wildlife conservation and ecologically fragile zones for landscape restoration and enhancing productive function.
 - Mandating and/or encouraging bamboo planting as farm boundary and shelter belts in slope land above 20%.
 - Promoting the establishment of bamboo for watershed management; mandate planting of bamboo around water bodies (streams, 10 m; rivers, 30 m; and water bodies, 100 m) aimed at income generation, landscape restoration and environmental management.
 - Encouraging establishment of bamboo plantations on farms, especially in forest fringes, to reduce pressure on natural forests.
 - Promoting best practice in the production and use of bamboo resources among smallholder farmers by providing capacity-building and handholding support services.
62. **Specific objective iv: To produce and supply quality planting material:** Government, non-governmental organisations (NGOs) and the private sector will promote innovative ways of ensuring the supply of quality bamboo planting materials (shortlisted species). The ministry responsible for phytosanitary programmes will ensure that clean and disease-free planting materials are imported into the country. Government will ensure that technologies for production of indigenous and exotic bamboo planting materials are developed and disseminated.

63. *Strategies for implementing specific objective iv will include the following:*
- Assessing national bamboo planting material demands and supply.
 - Developing a network of planting material producers in government, NGOs and the private sector.
 - Developing standards and guidelines for the collection, production and distribution of bamboo planting materials.
 - Developing a mechanism for quality control and a certification mechanism for bamboo nurseries.
 - Promoting tissue culture technology for mass propagation of quality planting materials.
 - Supporting research on species selection and planting material production technologies to enhance production capacity and reduce the cost of bamboo plants.
 - Undertaking capacity-building and training of bamboo planting material producers.
64. **Specific objective v: To develop bamboo SMEs and industries:** Bamboo resource development is only a starting point; the real benefit and scaling up of bamboo resources will only emerge with value-chain development. Government will play an enabling role, and the private sector will play a key role in value addition. In the short term, the emphasis will be on developing micro-enterprise and SME products targeting the domestic market, and in the long term, the focus will be on developing high-end industrial products targeting domestic, regional and international markets.
65. It is envisaged that government will form an entity to play a coordinating role (bamboo development agency) that will cut across all sectors/stakeholders. The agency will be hosted by the MWE.
66. *Strategies for implementing specific objective v will include the following:*
- Supporting the establishment of model demonstration production and training centres in each cluster to provide forward and backward linkages.
 - In the short term, the focus will be to promote micro-enterprises and SMEs producing bamboo furniture, energy products, bamboo shoots, construction material and craft products.
 - Encouraging private and foreign investment by creating attractive investment packages (e.g. tax incentives, soft loans, grants, guaranteeing a bamboo-based business incubation period).
 - In the long term, the focus will be to promote industries for high-end value addition—bamboo pulp and paper, bamboo timber substitutes, energy products (thermal energy, bio-energy), fibre and textiles, sanitary products, bicycles, beauty products, bamboo shoots and pharmaceutical products, as well as short-term products.
 - Diversifying the product utilities and range to tap into the large domestic market for packaging (agriculture [fodder for livestock]: fishery [feeds, fishnet supports, fish cages, bio-char], coffee [drying racks] and tea [harvesting baskets]; horticulture [staking sticks, mulching with leaves, bio-char], the floriculture sector and the tourism sector [crafts, cottages]).
 - Introducing tools and technologies for efficient processing aimed at improving quality and reducing waste.

- Collaborating closely with the Uganda National Bureau of Standards (UNBS) to develop bamboo standards for all products and promote certification of products for quality assurance.
- Supporting bamboo primary producers to cater for needs of upstream industries by producing commoditised intermediary products.
- Providing tailor-made skill development and technology dissemination to enterprises and entrepreneurs.
- Supporting the development of private-sector enterprises with a focus on bamboo resource management in PA.

67. **Specific objective vi: To support bamboo market development:** Bamboo marketing has to deal with several constraints related to the prejudice associated with its quality and durability. Government will provide initial market support for the bamboo sector. The support will be provided in two forms—through public procurement and by creating visibility.

68. *Strategies for implementing specific objective vi will include the following:*

- Including bamboo and its products in governments' preferential procurement list to enable markets for bamboo furniture, construction and bio-energy.
- ☐ Facilitating allocation of land for market hubs for bamboo and its products in strategic locations to create a wider market and visibility.
- ☐ Developing linkages with government and privately run market and sales outlets for bamboo products.
- Developing linkages with the large consumption sector for packaging—agriculture, horticulture, apiculture, coffee and tea sector to create markets for bamboo products.
- ☐ Facilitating participation in national and international trade fairs and exhibitions.
- ☐ Instituting domestic and international market surveys to feed in market intelligence in developing value chains and products.

69. **Specific objective vii: To support bamboo education, training and research.** Government and the private sector will develop, promote and implement bamboo-related education, research and training programmes to build skills and technical capacities. This effort should not be limited to tertiary institutions. Primary and secondary institutions should be part of education, training and research.

70. *Strategies for implementing specific objective vii will include the following:*

- Developing south-to-south cooperation, for example, with China's National Forestry and Grassland Administration (NFGA), International Centre for Bamboo and Rattan (ICBR), INBAR and any other partner for technology transfer, research, capacity-building and investment.
- Developing a specialised bamboo curriculum for university and technical and vocational education and training (TVET) to build a pool of trained professionals and trainers.
- Developing tailor-made training modules targeting bamboo growers, nursery operators, micro-enterprises and SMEs.
- Supporting bamboo research on bamboo planting material, bamboo plantation and management, value-chain and product development, markets, tools and machines and

ecosystem services of bamboo through education institutions and research organisations

- Developing a technical platform in bamboo clusters to provide technical support.
- Establishing a bamboo arboretum for the preservation of germplasm, research and learning.

71. **Specific objective viii: To support developing communication and knowledge management systems:** There will be two-way communication, both vertical and horizontal, between government and other stakeholders. Opportunities will be provided for facilitating evidence-based public dialogues, knowledge sharing and information flow. Central in this, ENR-sector working groups will be a platform for regular dialogue and feedback mechanism for implementation of the strategy to both government and other relevant stakeholders.

72. *Strategies for implementing specific objective viii will include the following:*

- Facilitating development of information education and communication (IEC) materials and support to raise public awareness through television, radio, print media, social media, and institutional web portal.
- A knowledge-generation and management system will be established to document the progress, technical and technological processes, key learning and case studies and develop mechanisms for dissemination to targeted audience.
- Detailed communication guidelines and action plans will be developed and implemented.

73. **Specific objective ix: To create an enabling environment:** The government will facilitate the creation of an enabling environment to attract investments to the bamboo sector.

74. *Strategies for implementing specific objective ix will include the following:*

- Encouraging public–private partnership (PPP) as a main vehicle to transform, scale up and modernise the bamboo sector.
- Facilitating access to land, loans and finances for growers, enterprises and industries.
- Exempting bamboo products of micro-enterprises and SMEs from VAT, sales and services tax to increase their competitiveness against cheaper alternatives.
- Simplifying and/or easing bamboo transport and the transit permit system.
- Developing an incentive package providing maximal tax exemptions and incentives to bamboo industries and investors in the framework of existing legal provisions.
- Supporting demand-driven bamboo industrial research through government research institutions.
- Developing bamboo standards, codes of practice and guidelines for bamboo products to facilitate regional and international trade.

75. **Specific objective x: To create institutional and governance mechanisms:** Government will develop an institution and governance framework to stimulate coordinated development of the bamboo sector. The development and management of bamboo resources will be done by a number of stakeholders. Their involvement will build on and support efficient use of resources, coordinated development, professionalism, transparency and accountability. The roles of key stakeholders and mandates are shown in Appendix 4. The

key actors are the central government, LG, private sector, local communities/farmers, civil society organisations (CSOs) and cultural/traditional institutions.

76. *Strategies for implementing specific objective x will include the following:*

- **Implementation:** Establishing a dedicated bamboo unit at the national level and in each bamboo cluster with adequate labour and other resources to implement and monitor progress.
- **Sector coordination and planning:** Establishing a forum or steering committee with members drawn from central government ministries, LGs, the private sector and civil society. The forum or steering committee will meet at regular intervals (every six months) to devise action plans and combine resources for bamboo development.
- Establishing a **national consultative forum** to provide opportunities for international donor agencies and partners, investors, the general public and all other interested parties to contribute to a regular debate on the bamboo sector, improve sector coordination and inform national priorities.

4 IMPLEMENTATION FRAMEWORK

4.1 Implementation modality

77. The strategy implementation will be undertaken by the MWE through the NFA and DFS. The ministry will be supported by the Ministry of Agriculture, Animal Industries and Fisheries (MAAIF), Ministry of LG (MoLG) and lower LG, the private sector, CSOs and development partners as primary stakeholders. Other secondary stakeholders will also be considered. This is important for strengthening intra- and inter-sectoral linkages with other ministries, LGs, CSOs, development partners, the private sector and bamboo farmers/owners. The roles of various partners are shown in Appendices 4 and 5.

4.2 Sector-wide planning

78. To support implementation of the bamboo strategy, a detailed National Bamboo Plan (NBP) will be developed by the MWE/FSSD in collaboration with the NFA and LG. With the steering committee in place, the NBP will be updated regularly to take care of emerging challenges. The NBP will clearly define short-term, medium-term and long-term goals and programmes for the sector, addressing critical issues in order of priority. The NBP will in turn be supported by a process of regular bamboo sector evaluation and reviews.

4.3 Investment

4.3.1 General overview and targets

79. To implement the bamboo strategy and NBP, the government will facilitate bamboo development through public expenditure (convergence of the action plans of the relevant ministries), private investment, foreign investment, impact investment funds, development grants and loans, climate financing and a biodiversity conservation fund.
80. In the next ten years, a total of UGX 442.761 billion (USD 118 million) will be required to stimulate and help facilitate the development and growth of the bamboo industry in Uganda. For each specific objective, the estimated costs of operation that will need urgent support are as follows (see Appendix 6 for the detailed strategy, action plan and budget):
- i. Identify and develop bamboo clusters: UGX 3.817 billion (USD 1.015 million).
 - ii. Manage natural bamboo on PAs/government land: UGX 1.605 billion (USD 427,000).
 - iii. Promote bamboo plantations on government and private land: UGX 378.675 billion (USD 100.98 million).
 - iv. Produce and supply quality planting materials: UGX 1.933 billion (USD 515,300).
 - v. Develop bamboo SMEs and industries: UGX 2.467 billion (USD 655,000).
 - vi. Support bamboo market development: UGX 512.25 million (USD 139,000).

- vii. Support bamboo education, training and research: UGX 38.84 billion (USD 10.355 million).
 - viii. Develop communication and knowledge management systems: UGX 1.848 billion (USD 490,000).
 - ix. Create an enabling environment: UGX 680 million (USD 180,700).
 - x. Create institutions and governance mechanisms: UGX 12.374 billion (USD 3.23 million).
81. A total of 375,000 ha will be developed and supported. Of this land, 300,000 ha will be planted (this will require 120,000,000 seedlings) and 75,000 ha will be restored through natural regeneration. Of the 300,000 ha of planted bamboo, 37,000 ha will be on government land and 263,000 ha on private land. Of the 75,000 ha of naturally regenerated bamboo, 67,000 ha will be on government land and 8000 ha on private land. Therefore, the total acreage of bamboo on government land will be 104,000 ha (28%), and that on private land will be 271,000 ha (72%).
82. The total acreage of highland areas is estimated at 25% (about 93,750 ha) and that of lowland areas is estimated at 70% (about 281,250 ha). Implementation for the highland bamboo plantations will be in the Mt. Elgon region, Kigizi region (Mgahinga NP, Bwindi NP, Kisoro areas, etc.) and Mt. Rwenzori region, and that of lowland bamboo will be in the Northern (Lamwo, Pader, Agago, Kitgum areas), West Nile (Moyo, Adjumani, Arua, Koboko and Yumbe areas), Central (Luwero, Nakaseke, Lake Victoria shores) and Eastern regions (Teso and Karamoja areas).
83. Of the 19 species of bamboo found to be suitable to grow in Uganda (see appendix 6 for details), efforts will be made to promote 4 of them, which are as follows: *Oldeania alpina*, *Oxytenanthera abyssinica* (which are native), *Dendrocalamus giganteus* and *Bambusa vulgaris* (which are introduced). Other introduced species trials will be done on a small-scale basis before scaling out.
84. It is envisaged that government will establish a unit tasked with overseeing the investment in bamboo. That unit should be trade oriented, with the capacity to oversee and regulate trade.

4.3.1 ROI

85. Bamboo can produce several products and services (with direct and indirect economic values). The important ones are returns from plantation development, nursery operation (seedling production), carbon sequestration, soil and water conservation, support of biodiversity and biodiversity conservation, value associated with food (Malewa) and primary and secondary processing. Within the ten-year period, about 3.8 billion bamboo poles will be produced.
86. Planted bamboo investment or bamboo plantation development will take place in two phases. Phase 1 will run from 2019/20 to 2023/24, during which time, 70,000 ha will be

established (30,000 ha will be on government land and 40,000 ha on private land). During phase 2, which will run from 2022/23 to 2025/26, an additional 230,000 ha will be established (7000 ha will be on government land and 223,000 ha on private land). It is estimated that 225,000 ha (75%) will be planted in the lowlands and 75,000 ha (25%) in the highlands.

87. Based on the ROI calculations, on average, 1 ha (comprising 400 rhizome structures or clumps) of planted bamboo on average can produce 2000 poles per year and can generate between UGX 1,600,000–1,800,000 (USD 427–480) per year. The estimated cost of production can range from UGX 390,000–450,000 (USD 104–120) per year. This will give a profit of UGX 1,200,000–1,400,000 (USD 320–373) per hectare per year. The internal rate of return (IRR) range stands at 36–40%.
88. The ROI for establishing and managing 300,000 ha of bamboo (over a period of ten years) will yield the following: The expected total investment cost is about UGX 930 billion (USD 248 million). The expected gross income from sale of poles at farm gate price is about UGX 2.8 trillion (USD 756 million). This investment will give a present value (PV) of UGX 1.9 trillion (USD 508 million). The IRR is estimated at 37%. For detailed ROI values, refer to Appendix 7.
89. In relation to bamboo seedling production, most production will be from seeds and cuttings. Nevertheless, the micro-proliferations technique will be adopted to reduce the cost of future planting materials. It is estimated that about 120,000,000 bamboo seedlings will be needed to plant the 300,000 ha. On average, the current cost of bamboo seedling production is about UGX 2400, and the average sale price for each seedling is UGX 3000, giving a profit margin per seedling of UGX 600. Therefore, the total investment in bamboo nurseries is estimated at UGX 288 billion (USD 76.8 million), and the overall return is estimated at UGX 360 billion (USD 96 million). This gives an income of UGX 72 billion (USD 19.2 million). See Appendix 8 for more details.
90. In relation to carbon sequestration, the 300,000 planted bamboo seedlings will absorb 296 million tons of CO₂ from the atmosphere. During the initial five years of planting, the average CO₂ accumulation will be 12.81 tons/ha, and from year 5, with annual harvesting, the average carbon sequestration will be 25.46 tons/ha (Kathumbi et al, 2017; Darcha and Birhane, 2015; Muchiri and Mugo, 2013; Mengesha, 2012). The total carbon sequestered will be 29.6 million tons during the project period, with an annual carbon sequestration of 7.6 million tons after the project period. With the voluntary market offering UGX 72,000/ton (USD 19), the 300,000 ha will generate carbon credit worth UGX 2 trillion (USD 569 million). See Appendix 9 for more details.
91. During phase 1 of the strategic plan implementation, 15,000 ha of natural bamboo will be restored (of which 13,000 ha will be on government land and 2000 ha on private land). During phase 2, 60,000 ha of natural bamboo will be restored (54,000 ha on government land, 6000 ha on private land).

92. From the 75,000 ha of natural bamboo (mainly in PAs), the economic values have not been estimated. However, it is important to note that bamboo in PAs plays a key role in soil and water conservation, biodiversity conservation (the main source of food for mountain gorillas in Mgahinga NP) and a major source of food (bamboo shoots/Malewa) in the Mt. Elgon region of Uganda. It is estimated that each family involved in collecting bamboo shoots earns UGX 2,000,000 (about USD 533) per year on average. See Appendix 10 for suitable bamboo species for propagation in Uganda.

4.4 Monitoring and evaluation (M&E)

93. Implementation of the bamboo strategy will be monitored and regularly assessed as guided by the M&E frameworks in the NFP and development strategies and investment plans for agriculture of the MAAIF. Impacts will be measured in terms of the following policy performance indicators:
- a) The sustainable use of the resource base;
 - b) The growth of the economy in bamboo-related business;
 - c) The alleviation of poverty amongst the rural and urban populations who depend on bamboo for their livelihoods;
 - d) The maintenance of vital ecological services and conservation of biodiversity; and
 - e) Flow of funds into the bamboo sector.
94. Well-defined information systems will be established, with reliable data on agreed indicators. All bamboo investment programmes will set out plans for M&E and develop specific indicators to show the progress and impact. The results of this sector's M&E will be published regularly in reports on the state of the bamboo sector.

4.5 Risk assessment and strategic options to avoid project crash

95. Risks were classified depending on the chances of affecting the strategic plan and the urgency with which they should be addressed. A scale of 1–5 was used, with 1 indicating the lowest risk and 5 showing the highest risk. Risk levels 1 and 2 (Code Green) are considered quite low and not likely to significantly affect the strategic plan. Risk levels 3–4 (Code Amber) are considered significant and should be addressed. Risk level 5 (Code Red) is considered the highest priority and must be managed urgently, as it will definitely affect the strategic plan. Therefore, it is important to address the identified risks before large-scale implementation of the strategic plan.
96. Six risks have been identified that could derail the implementation of this strategic plan. The important ones are as follows: (i) risk associated with an increasing resource base through plantation development, (ii) risk associated with negative political influences, (iii) risk associated with underdeveloped value addition, (iv) risk associated with limited financial opportunities, (v) risk associated with an underdeveloped market and (vi) risk associated with underdeveloped information and communications technologies (ICT). Appendix 11 gives the details of the major risks, risk levels and mitigation measures to follow.

5 CONCLUSION

97. Bamboo is a significant resource for most developing countries in Asia, Latin America and Africa. Several products are derived from bamboo to support human livelihood and sustenance. In Uganda, bamboo shoots, locally called '*Malewa*', are eaten by people around Mt. Elgon. Other uses of bamboo have included timber substitute, energy products, pulp and paper, bamboo fibre and textiles, lifestyle products, cosmetics and medicines, composites and other uses.
98. In Uganda, bamboo also contributes a lot to the national economy. However, it is not formalised. Bamboo plantations can offer employment opportunities to the people living near the plantations, as well as those employed in the bamboo-processing industries. Bamboo can contribute to revenue to the government through taxes levied on the bamboo-processing industries and the exporters of bamboo products. Bamboo forests can act as tourist attraction sites—for example, the Echuya and Mt. Elgon bamboo forests—thereby earning foreign exchange in the country's economy. Apart from the contributions discussed above, bamboo plays a big role in biodiversity conservation and environment services, including improvement of the soil fertility, water catchment, climate change mitigation and habitat for wild animals, birds and other small living organisms.
99. The above opportunities have called for urgency in developing this bamboo strategy to support the development of the bamboo industry in Uganda. All indications suggest that, when well developed and managed, bamboo can play an important role in the substitution of timber and energy, contributing to poverty alleviation, sustainable development and environmental protection and management. In addition, bamboo offers new market possibilities within climate funds, given its fast growth rate, wide range of products and carbon sequestration capacities.
100. The main focus of the bamboo strategy in Uganda is on the management and processing of bamboo resources to provide economic, social and environmental benefits to all the people of Uganda. The vision, goal, guiding principles, strategic objectives, specific objectives and strategies are all tailored towards achieving this. This is in line with the national development agenda and international obligations to which Uganda is a signatory.
101. The strategy will be subject to regular updates to address emerging developments and challenges in the sector. The bamboo strategy recognises that several players must be involved to ensure the success of the bamboo sector. Thus, it identifies key support sector policies, strategies and services for implementation of the bamboo development strategy. The different key actors are also identified and their roles clearly stipulated.

6 APPENDICES

Appendix 1: Projects/programmes/initiatives involved in bamboo resource expansion in Uganda (baseline)

No.	Project/programme /initiative	Funding source	Status	Location	Acreage target	Period
1	Re-Forest project, NFA/MWE/UNHCR (value addition with bamboo construction in the next phase starting next year	UNHCR: UGX 4.4 billion (USD 1.2 million)	Ongoing	Lamwo, Moyo, Kikube-Kyangwali around buffer zone of Bugoma	300 ha (100 ha each)	2018–Dec. 2019
2.	Promoting bamboo as energy crop (source of firewood, charcoal, feedstock for cogeneration of power): Ministry of Energy and Mineral Development (MEMD)	Government of Uganda (GoU)	Planned	Ntoroko	2000 ha in North Rwenzori	Fiscal years (FYs) 2017/18 and 2018/19
3	Uganda Bamboo Association	Private arrangement	Ongoing		500 ha	2020
4	Seed provision/NFA	INBAR (Dutch-Sino)	Ongoing	Jinja	100 ha, 23 ha planted	2019
5	Seed provision and nursery establishment and management for distribution to communities: NFA	INBAR (Dutch-Sino)	Ongoing	Mbale/Mt. Elgon area	25,000 seedlings	2019
6	Nursery establishment and management for distribution to communities: NFA	GoU	Ongoing	Various nurseries	100,000 seedlings	Annual projections
7	Encouraging bamboo planting for communities and nursery bed raising supported for one farmer: Kisoro District Local Government (KDLG), Bwindo Mgahinga	Kisoro (DLG)	Ongoing	Kisoro	a. Awareness raising b. 500,000 seedlings produced each season	Annual

	Conservation Trust (BMCT)					
8	UWA signed Memoranda of Understanding with communities adjacent to the Mgahinga NP; dry bamboo availed for domestic purposes (resource access agreements) in collaboration with bamboo for wood and INBAR, training of farmers	BMCT/INBAR	Ongoing	Kisoro	a. 200 m ² square plots to access dry bamboo b. Domestication of bamboo c. Green bamboo given on case-by-case basis	2016–2021
9	Rwenzori NP (MoU signed with communities): Provide both fresh and dry bamboo (impact and needs assessment conducted before signing agreements)	UWA	Ongoing	Rwenzori	CRM	Development stages
10	FIEFOC Project II: Restoration of degraded rivers and stream banks	African Development Bank (ADB), Nordic Development Fund, GoU	Ongoing	Manafwa, Bududa, Kween, Bukwo, Kapchorwa, Kasese	2500 km: Three rows planned, 150 km restored so far	2017–2020
11	Water Management and Development Project, Kalagala Offset Project and Rehabilitation of Nile banks project	World Bank	Ongoing	Jinja, Buikwe and Kayunga	1000 km: Three rows	2015–2020

12	Water Supply and Sanitation Programme Phase II Project, Mt. Elgon Climate Resilience Project, restoration of banks of major streams and rivers, e.g. Manafwa, Bukwo and Bududa	Global Environment Facility through the ADB	Completed	Manafwa and Bududa	120 km	2015–2017
13	Promoting bamboo product development (set up plantation): lessons for restoring degraded lands	World Bank through MAAIF: Agriculture Technology and Agribusiness Advisory Services Competitive grant schemes Project	Completed	Kifu/Mukono	6 ha (five species) managing plantation to develop products (furniture & charcoal)	2017
13	Wetlands restoration and associated catchments project	Global Climate Fund through UN Development Programme	Planned	Western and Eastern Uganda	To be determined	2020–2024
14	SPGS/FAO	EU	Planned	To be determined		
15	Bamboo standards: UNBS/MWE/MEMD and others; Technical Committee multi-sectoral	UNBS	Ongoing	National	Draft standard being discussed	2017 to date

Appendix 2: Legal frameworks and sections/provisions relevant to bamboo

Legal framework	Relevant sections and provisions
Constitution of the Republic of Uganda, 1995	<ul style="list-style-type: none"> • Article 237 (Land ownership) • Article 245 (Protection and preservation of the environment)
National Environment Act, Chapter 153 (1995)	<ul style="list-style-type: none"> • Part 4: Environmental planning (sections 18: Environment planning at the district level) • Part 5: Environmental regulations • Part 6: Establishment of environmental standards • Part 7: Management of the environment • Part 9: Environmental restoration orders and environmental easements (see sections 67–68 and 71–76) • Part 10: Records, inspection and analysis • Part 13: Offences and penalties • Part 14: Judicial proceedings
Land Act, Chapter 227 (1998)	<ul style="list-style-type: none"> • Part III: Control of land use • Part IV: Land management • Part V: Land tribunals
National Forestry and Tree Planting Act, 8/2003	<ul style="list-style-type: none"> • Part II: Forest reserves and other forests • Part III: Protection and conservation of forests • Part IV: Tree planting and growing • Part V: Licenses • Part VI: Trade in forest produce • Part IX: Offences
Uganda Wildlife Act, 1996	<p>Relevant Sections</p> <ul style="list-style-type: none"> • 5. Functions of the authority • 18. Description of wildlife conservation areas • 22. Entering wildlife PAs without authority • 23. Use of resources in wildlife PAs • 26. Regulations governing wildlife conservation areas • 27. Declaration of protected species • 29. Types of wildlife use rights • 30. Prohibition of utilisation of wildlife without a wildlife use right
Water Act, Cap. 152 (1997)	(Section 81: Protected zones)
Local Governments (LG) Act, Chapter 243, 1997	<p>PART III: LG setup</p> <ul style="list-style-type: none"> • Section 9: LG councils (District councils and lower LG councils) <p>PART IV: Functions and powers of LG councils</p> <ul style="list-style-type: none"> • Planning power • Legislative power <p>Relevant sections:</p> <ul style="list-style-type: none"> • 26. Functions of a lower LG executive committee • 30. Functions, powers and services of a council • 35. District planning authority • 36. District technical planning committee • 37. Planning units • 38. Enactment of district laws • 39. Byelaws by lower councils • 40. Ordinance may create offences and penalties

	<ul style="list-style-type: none"> • 41. Ordinance may impose fees, etc. for services • 42. Scope of an ordinance • 43. Effective date of an ordinance • 44. Local councils not to legislate on judicial powers • 98. Inspection and monitoring of LGs
Physical Planning Act, 2010	<p>PART III: District, urban and local physical planning committees</p> <ul style="list-style-type: none"> • <i>District physical planning committee</i> <p>Relevant sections</p> <ul style="list-style-type: none"> • 9. Establishment of district physical planning committee • 10. Functions of a district physical planning committee • Local physical planning committee • 13. Sub county council to constitute local physical planning committee • 14. Functions of local physical planning committees <p>PART IV: Physical development plans</p> <p>Relevant sections:</p> <ul style="list-style-type: none"> • 18. Physical development plans • 25. District, urban and local physical development plans • 31. Private local physical development plans <p>PART V: Control of development</p> <p><i>Development permission</i></p> <ul style="list-style-type: none"> • Section 32: Powers of local physical planning committee • Section 33: Development permission • Section 37: Environmental impact assessment

Appendix 3: Relevant support sector policies and services

Several other sector policies have been reviewed that helped in developing this bamboo strategy. There are multiple actors from various sectors that will be required to play various roles to support the successful implementation of the bamboo strategies; these are discussed below.

Institution	Policy/plans	Policy statements
MWE	<p>National Environment Management Policy, 1995: Section 3.1 (Policy statement 1)</p> <p>-Section 3.4 (Policy statement 4)</p> <p>-Section 3.7 (Policy statement 7)</p>	<ul style="list-style-type: none"> • The need to provide for a security of tenure in support of a sustainable agriculture/forestry production system. • Land and resource tenure policy should include property rights to other natural resources (e.g. trees and forest products, planted or natural). • Importance of forestry and forest resources (including bamboo) in the conservation of biodiversity. • Importance of estimating direct and indirect economic measures and potential effects on environmental resource use.
MWE	<p>Uganda Forestry Policy, 2001:</p> <p>-Policy statement 1: Forest on government land</p> <p>-Policy statement 2: Forest on private land</p> <p>-Policy statement 3: Commercial forest plantations</p> <p>- Policy statement 4: Forest products processing industries</p> <p>-Policy statement 5: Collaborative forest management</p> <p>-Policy statement 6: On farm forestry</p> <p>-Policy statement 7: Conservation of forest biodiversity</p> <p>-Policy statement 8: Watershed management and soil conservation</p> <p>-Policy statement 10: Education, training and research</p>	<ul style="list-style-type: none"> • Permanent forest estate under government trusteeship will be protected and managed sustainably. • The development and sustainable management of natural forests on private land will be promoted. • Profitable and productive forest plantation business will be promoted. • A modern, competitive, efficient and well-regulated wood and non-wood processing industry will be promoted in the private sector. • Collaborative partnership with rural communities will be developed for the sustainable management of forests. • Tree growing on farms will be promoted in all farming systems, and an innovative mechanism for the delivery of forestry extension and advisory services will be developed. • Uganda’s forest biodiversity will be conserved and managed in support of local and national socio-economic development and international obligations. • Watershed protection forests will be established, rehabilitated and conserved. • Government will support the sustainable forestry sector development through appropriate education, training and research.

Institution	Policy/plans	Policy statements
	-Policy statement 11: Supply of tree seeds and planting stock	<ul style="list-style-type: none"> • Innovative mechanisms for the supply of high quality tree seed and improved planting stock will be developed.
MWE	<p>Uganda National Climate Change Policy, 2013:</p> <p>-Chapter 4: Policy direction</p> <p>-Sub-section 4.2: Adaptation</p> <p>-Sub-section 4.3: Mitigation</p>	<ul style="list-style-type: none"> • The main goal of the policy is to harmonise and coordinate approaches towards a climate resilient and low carbon development for sustainable development in Uganda • The policy is based on adaptation; mitigation; and research and observation. • Some actors like agriculture and forestry are covered under both adaptation and mitigation sub-sections. • Adaptation is about increasing the resilience of Ugandans to the impact of climate change, particularly vulnerable groups/and or sectors. • Mitigation is about reducing greenhouse gas emissions and increasing carbon sequestration. Emphasis is put on land use, land use change and forestry • Both adaptation and mitigation require a series of coordinated policy responses that are either sector specific or cross-cutting in nature.
MAAIF	<p>National Agriculture, 2013:</p> <p>-Chapter 3, section 3.1, section 3.2 (objectives 1–6)</p>	<ul style="list-style-type: none"> • The vision of the National Agriculture Policy (2013) is ‘a competitive, profitable and sustainable agriculture sector’. • Focus on agriculture policy objectives and strategies (especially those associated with on-farm diversification and increased household income through coordinated intervention that supports sustainable production and value addition, promoting trade and providing employment opportunities).
Ministry of Land, Housing and Urban Development	<p>Uganda National Land Policy, 2013:</p> <p>-Section 2.2: paragraph 2i</p>	<ul style="list-style-type: none"> • The vision of the national land policy is ‘a transformed Uganda society through optimal use and management of land resources for a prosperous and industrialised economy with a developed services sector’. • Land plays a vital role in the health and vitality of other sectors that depend on it for productivity (e.g. forestry, agriculture, energy, wildlife, water).

Institution	Policy/plans	Policy statements
	-Section 6.4 (paragraph 128) -Section 6.5 paragraph 134	<ul style="list-style-type: none"> • Focusses on integration of land with other productive sectors. • Focusses on land use planning and regulation, concentrating on the need for physical planning in both urban and rural areas.
Ministry of Land, Housing and Urban Development	National Land Use Policy, 2006: -Overall policy goal -Section 1, sub-section 1.2: Land use in the national economy -Section 2: Land use policy goals and principles -Section 3: National Land Use Policy statements	<ul style="list-style-type: none"> • The overall goal is to ‘achieve sustainable and equitable socio-economic development through optimal land management and utilisation in Uganda’. • Policy objectives were set out, but the key ones relevant to the bamboo policy are 1) Land use/land cover classification; 2) Agriculture; 3) Natural resources, 4) Human settlement and urbanisation; 5) Land management; 6) Institutional capacity and 7) Regional and international obligations.
MEMD	Energy Policy for Uganda, 2002: -Goal of the energy policy <ul style="list-style-type: none"> • Part 2, section 2.2.3 (The renewable sources of the energy sub-sector) 	<ul style="list-style-type: none"> • Aims meet ‘the energy needs of Uganda’s population for social and economic development in an environmentally sustainable manner’. • Of importance are the inefficiency in production and use of biomass energy and the associated impact on the environment and the health hazards associated with biomass energy use, especially for the rural households. • Also highlighted are the low public awareness about renewable energy technologies (RETs), underdevelopment of markets for RETs and inadequate data available on the potential of indigenous plant related renewable energy sources.
MEMD	Renewable Energy Policy for Uganda: -Government commitment -Section 2.1, sub-section 2.2.1 gives more detail about biomass energy	<ul style="list-style-type: none"> • The Government of Uganda is committed to increasing the use of modern renewable energy from the current 4% to 61% of the total energy consumption by 2017. • Highlights that renewable energy to includes solar energy, hydropower, biomass, wind and geothermal, as well as organic wastes.
Ministry of Trade, Industry and	- The vision of the Ministry	<ul style="list-style-type: none"> • Is ‘Sustainable cooperatives, competitive trade and world class industrial products and services’.

Institution	Policy/plans	Policy statements
Cooperatives (MTIC)	- Mission of the ministry	<ul style="list-style-type: none"> • ‘Develop and promote a competitive and export-led private sector through accelerating industrial development for economic growth’.
MoLG	Decentralisation programme in Uganda	<ul style="list-style-type: none"> • This has been going on since the late 1980s. Powers, functions and service provision have been delegated from the central government to LGs. The approach is aimed at developing and empowering the local people and their institutions. • Focus has been on increasing people’s participation in decision-making, assessing development capacity needs, enhancing transparencies, accountability, responsiveness and Providing improved delivery of services.
Ministry of Tourism, Wildlife and Antiquities	Uganda Wildlife Policy, 2014: -Vision - Policy objective 2.4	<ul style="list-style-type: none"> • The policy focusses on conservation and sustainable development of wildlife with a vision of having a ‘sustainably managed and developed wildlife resources and healthy ecosystems in a transformed Uganda society’. • Highlights the importance of management of wildlife within and outside PAs in partnership with LG and the private sector/private landowners.
Ministry of Finance, Planning and Economic Development (MoFPED)	- Mission of the ministry	<ul style="list-style-type: none"> • To formulate sound economic policies, maximise revenue mobilisation and ensure efficient allocation and accountability for public resources.
Ministry of Gender, Labour and Social Development	Uganda Gender Policy, 2007: -Chapter 3 (Goal, objectives and guiding principles) -Section 5.1 (Gender and livelihoods) -Section 5.2 (Gender and rights) -Section 5.3 (Gender and governance) -Chapter 6 (Institutional framework for the implementation of gender policy)	<ul style="list-style-type: none"> • Mandated to maximise individual and collective potential of Ugandans by developing skills, increasing labour productivity and cultural enrichment to achieve sustainable and gender-sensitive development. • The ministry has committed to bringing about more equal gender relations. • The Uganda Gender Policy framework is redressing gender imbalances and work, as well as serving as a guide to all development practitioners. • The guide is helpful during planning, resource allocation, implementation of the development plan and benefit sharing (equity).
Ministry of Disaster	National Policy for Disaster Preparedness and Management, 2010:	<ul style="list-style-type: none"> • The ministry is responsible for the coordination of all refugee matters in the country. It is also responsible for national preparedness for

Institution	Policy/plans	Policy statements
Preparedness and Refugees	<p data-bbox="440 302 789 338">-Chapter 1 (sub-section 1.1)</p> <p data-bbox="440 621 802 726">Section 2.1 (Natural hazards in Uganda); sub-section 2.1.4 (Landslide and mudslides)</p>	<p data-bbox="883 233 1333 296">disasters, including floods, landslides, earthquakes, droughts and famine.</p> <ul data-bbox="837 306 1479 835" style="list-style-type: none"> <li data-bbox="837 306 1479 478">• The policy recognises the great impact of human activities on the interrelationship within the natural environment, as well as human influence, industrial, expansion, resource exploitation and technology advancement. <li data-bbox="837 485 1479 621">• The policy also recognises the importance of restoring and maintaining the quality and overall welfare and development of humans in their environment. <li data-bbox="837 663 1479 762">• Community settlement on steep slopes and other uncontrolled land use practices increase the likelihood of landslides and mudslides. <li data-bbox="837 768 1479 835">• Detailed policy action and responsible institutions are highlighted in 2.1.4.1.
Ministry of Education and Sports (MoES)	<p data-bbox="440 884 797 1020">Technical and Vocational Education and Training in its BTVET Strategic Plan (2011–2020)</p>	<ul data-bbox="837 884 1479 1377" style="list-style-type: none"> <li data-bbox="837 884 1479 1377">• The BTVET Strategic Plan (2011–2020) emphasises ‘skilling Uganda’, with the following objectives: <ol data-bbox="883 989 1422 1377" style="list-style-type: none"> <li data-bbox="883 989 1422 1087">1. To make BTVET relevant to productivity development and economic growth; <li data-bbox="883 1094 1422 1129">2. To increase the quality of skills provision; <li data-bbox="883 1136 1422 1192">3. To increase equitable access to skills development; <li data-bbox="883 1199 1422 1297">4. To improve the effectiveness in BTVET management and organisation; and <li data-bbox="883 1304 1422 1377">5. To increase internal efficiency and resources available to BTVET.

Appendix 4: Roles and responsibilities of key stakeholders

4.1 MWE

The MWE is responsible for the ‘sound management and sustainable utilisation of water and environment resources for the betterment of the population of Uganda’.

The mandate of the ministry is derived from the constitution and the Local Government Act and includes initiating *legislation, policy formulation, setting standards, inspections, monitoring and coordination and backup technical support in relation to the water and environment sub-sectors.*

In relation to the bamboo policy, the core functions of MWE shall be as follows:

- i. Providing policy, legal and programme coordination and monitoring. Of importance are the development and monitoring of plans, standards, legislations (at the national, district and sub-county levels), promoting the interests of the private sector, farmers, local government and other sector stakeholders with interests in bamboo.
- ii. Developing regulation and providing quality assurance in relation to bamboo management, pest and disease control, silvicultural operations, phytosanitary regulations, quality planting material standards, legal trade and regulating input supply systems.
- iii. Developing the bamboo product value chain and trade (in consultation with the ministry responsible for trade).
- iv. Providing support and technical assistance to LG and inspecting, monitoring and evaluating forestry/bamboo-related activities.
- v. Supporting and coordinating bamboo-related research in collaboration with MAAIF (National Agriculture Research Organisation [NARO]/National Forestry Resources Research Institute [NaFORRI]).
- vi. Providing advisory and training services in collaboration with technical training colleges, universities and Nyabyeya Forestry College.

4.2 MoLG and lower LGs

The major role of the ministry responsible for local governance is to create, supervise and guide sustainable, efficient and effective service delivery in the decentralised systems of governance. Many natural resources, including bamboo, are found on private land under the control of LG, and hence, these bodies have a big role in ensuring that such resources are well managed.

Within the MoLG, focus will be put on the lower LG (districts and sub-counties). The core functions of the lower LG will be as follows:

- i. Implementing decentralised and devolved forestry services (e.g. planning, regulatory and advisory services, local taxation, issuance of permits).
- ii. Developing and implementing ordinances, bylaws and community-based constitutions.
- iii. Monitoring the implementation of bamboo-related plans and policies within a district setup.
- iv. Mobilising and supporting farmers, user groups and other interested parties in production, value addition, marketing, promotion and utilisation of bamboo products and services.

4.3 MAAIF research institutions (NARO/NaFORRI)

NARO is the apex body for guidance and coordination of all agricultural research activities in the national agricultural research system in Uganda. NARO will work through NaFORRI, which is mandated to undertake research in all aspects of forestry. Research in NaFORRI aims at increasing the benefits derived from trees and forests through conservation and sustainable management of the forest and tree resources.

NARO/NaFORRI will undertake the following roles and responsibilities:

- i. Conducting research in bamboo and bamboo product development, processing and utilisation.
- ii. Developing, testing and providing guidelines and standards for bamboo planting material propagation, plantation and sustainable management.
- iii. Coordinating and monitoring field-based trials in collaboration with farmers, district leaderships and other relevant actors for the promotion of the bamboo industry.
- iv. Monitoring and evaluating research programmes, both in the laboratory and on the farm.
- v. Mobilising fund for research and managing the research fund.
- vi. Coordinating and promoting cooperation and collaboration between Uganda and other countries, institutions and scientific and professional bodies to support research, development, technology transfer and so on in the bamboo value chain. This will ensure optimum use of the bamboo resources and improve on the production capacity.

4.4 MTIC

The ministry is mandated to promote *trade* and industry and cooperatives for the development of the country. The focus will include bamboo products.

- i. It is necessary to support the development of the bamboo industry and markets for the products.

4.5 CSOs

Organised forestry-based, traditional, faith-based and cultural institutions shall form part of the CSOs. The following will be the key roles and responsibilities of CSOs:

- i. Supporting the mobilisation of actors interested in bamboo enterprise development to access funding, technical support, market information, relevant goods and services needed for the production and sale of bamboo products.
- ii. Advocating for good governance and trade related to the bamboo value chain.
- iii. Monitoring the implementation of bamboo-related programmes.
- iv. Supporting the development of programmes that will improve on the management and trade in bamboo products and services.
- v. Contributing to policy formulation/reforms.

4.6 Private sector

The private sector will run the greatest part of the bamboo enterprise. Its role will complement government programmes through investing in the bamboo value chain, participating in technology development/transfer/multiplication/dissemination and engaging in marketing (of both inputs and outputs) at all levels. Also important will be advocating for improved policies, regulations and institutional frameworks that will support the resources. The important functions of the private sectors are as follows:

- i. Plantation and product development.
- ii. Service provision for extension and advisory services.
- iii. Value addition.
- iv. Trading.

4.7 Development partners

Several development partners (from within and outside Uganda) will be engaged during this policy implementation. The following will be the key roles of the development partners:

- i. Providing financial and technical support for the development, establishment and value addition of the bamboo products and services.
- ii. Promoting and supporting partnership arrangements donors and Government of Uganda
- iii. Documenting, evaluating and sharing good practices and alternative approaches to forestry/bamboo resources development.

Appendix 5: Roles and responsibilities of other stakeholders

Ministry/institution	Roles and responsibilities
Ministry of Land, Housing and Urban Development	<ul style="list-style-type: none"> • The ministry will work closely with other relevant ministries in ensuring that physical development plans and land-use plans are in place and adhered to. Land set aside for forestry/bamboo development (e.g. PAs) should not be diverted to other uses. • It is necessary for the ministry responsible for land to have in place an efficient and effective cross-sectoral institutionalisation of a well-integrated macro-level planning of the various sectors (including bamboo resources).
MEMD	<ul style="list-style-type: none"> • The ministry will, through its biomass and other renewable energy sub-sectors, support efforts to develop biomass resources (including bamboo resources) in agreement with the Forest Policy 2001. • Over 90% of Ugandans depend on biomass energy, and since bamboo development has the potential to tremendously increase biomass, this offers an opportunity for addressing the energy demands of Ugandans. • The ministry will take advantage of bamboo development to meet the growing energy needs of the country.
Ministry of Tourism, Wildlife and Antiquities	<ul style="list-style-type: none"> • The ministry is responsible for the management of forests in gazetted wildlife conservation areas, some of which are home to naturally growing bamboo. • The ministry will be responsible for ensuring sustainable management of bamboo habitat and the associated wildlife in such PAs. • The important mountainous NPs with bamboo forest that attract a lot of visitors include Bwindi and Mgahinga (for mountain gorilla tourism), Mt. Rwenzori and Mt. Elgon (for mountain climbing/trekking).
MoFPED	<ul style="list-style-type: none"> • Formulating sound economic and fiscal policies, mobilising resources for the implementation of government programmes, disbursing public resources as appropriate by Parliament, and accounting for their use in accordance with national laws and international best practices. • Mobilisation of public resources for the whole government. Success of bamboo development in the country will require substantial investment. The ministry's role will be to ensure that adequate financial resources are available to support successful implementation of the bamboo policy and plans.
Ministry of Gender, Labour and Social Development	<ul style="list-style-type: none"> • Supporting different gender sections and maximising their individual and collective potential. Different sections of the society (youth, women, men, the elderly, etc.) have varying interests in the bamboo resources.

Ministry/institution	Roles and responsibilities
	<ul style="list-style-type: none"> • Ensuring that most ministries have institutionalised key concepts of gender in their development work. • The ministry will ensure that the different interests, equity, roles and responsibilities are addressed by the bamboo policy.
Ministry of Disaster Preparedness and Refugees	<ul style="list-style-type: none"> • Giving early warning to the people of Uganda to minimise negative impacts of disaster on the ENR, including bamboo. • Ensure people are relocated from fragile sites (some of the sites have bamboo resources) to new settlement sites. The new settlement site should not be near fragile ecosystems. • The ministry will ensure that settling people affected by disasters is not done in such a way that it exposes environment/natural resources to unsustainable exploitation. • The ministry will promote bamboo growing in refugee/disaster-affected people resettlement areas to provide alternative sources of construction materials and fuelwood, which are basic requirements.
MoES	<ul style="list-style-type: none"> • Mandated ‘to provide technical support, guide, coordinate, regulate and promote quality education, training and sports to all persons in Uganda for national integration, development and individual advancement’. • Incorporate bamboo management into the curriculum of training institutions to produce graduates with skills in bamboo management. • The ministry, through its training institutions, will also conduct research for improving development and management of bamboo and its products. Such research findings will be passed on to relevant bodies for practical implementation.
Ministry of Works and Transport	<ul style="list-style-type: none"> ☐ The ministry has standard ‘technical specifications’ that act as a guide to quality assurance of all construction materials. • Through its Construction Standards and Quality Management Department, the ministry will be in charge of regulating bamboo use for construction purposes, such as scaffolding, formwork, floors, ceilings, roofing and furniture. ☐ Also important is that regulating of bamboo use will include specifying size, strength, fire resistance and durability requirements.

Goal: To ensure coordinated sustainable development of bamboo industries in Uganda to propel green economic development, and to produce high-value products catering to domestic, regional and international markets.

No.	Strategy (plan of action)	Target	Indicators	Timeframe										Re-sources required (UGX)	Funding source	Res-ponsible agency	Comments
				19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29				
Strategic objective 1: To develop species-specific bamboo clusters for integrated bamboo development																	
1.1	Develop criteria for identification of bamboo clusters, especially in existing bamboo growing regions and high potential locations.	1	Criteria	1										UGX 57 million (USD 15,000)	GoU, INBAR	MWE/FSSD	Consultancy meeting.
1.2	Identify and establish five bamboo development clusters in the short term (2019/20–2025/26); additional ten bamboo development clusters in the long term (2026/27–2029/30).	15	Cluster		5					5	5			UGX 760 million (USD 200,000)	GoU, INBAR, private sector, development partners	MWE/FSSD	Focus on mapping, site-species matching, socio-economic assessment
1.3	Establish and/or strengthen supporting institutional framework for handholding the bamboo development in identified clusters.	15	Supporting institutions		5					5	5			UGX 3 billion (USD 800,000)	GoU, INBAR, private sector, development partners		Private sector initiative that needs support

				Sub-total 1:								UGX 3.82 billion			
												USD 1.02 million			
Strategic objective 2: Sustainably manage natural bamboo on PAs (government lands)															
2.1	Develop zones of bamboo resources in PAs for sustainable management and conservation.	3	Zoned CFRs with conservation and production zones in three sectors		2	1						UGX 300 million (USD 80,000)	GoU, INBAR	NFA UWA	Inventory, mapping, marking, in three sectors (Otzi, Agoro-Agu and Mafuga)
2.2	Develop bamboo resources management plans in PAs.	Four Forest Management Plan (FMP) for NFA and five FMPs for UWA	Bamboo resource mgt plans		5	4						UGX 200 million (USD 52,000)	GoU, NFA and UWA	NFA and UWA	Four for NFA and five NPs. UGX 25 million per management plan per sector
2.3	Develop and implement guidelines for regulating sustainable management of bamboo and its value chain.	1	Guideline		1							UGX 55 million (\$15,000)	GoU and INBAR	MWE/FSSD NFA UWA MTIC	
2.4	Promote collaborative management of PAs with the local communities.	Four sectors for NFA & five FMPs for UWA (20 Community Forest Management (CFM) groups)	20 collaborative agreements implemented			5	5	5				UGX 600 million (USD 160,000)	GoU, INBAR, NFA, UWA, DLG	NFA and UWA	UGX 30 million per group for initiation, agreement signing and start-up project (Income Generating Activities)
2.5	Develop and implement sustainable bamboo management and harvesting guidelines.	1	Guideline			1						UGX 150 million (USD 40,000)	GoU and INBAR	MWE/FSSD	

2.6	Promote and develop bamboo based ecotourism.	Five tourism sites	Five running tourism destinations in PAs.			1	1	1	1	1				300 million (USD 80,000)	UWA	NFA and UWA	Tourism development in Echuya, Mgahinga, Mt. Rwenzori and Mt. Elgon
				Sub-total 2:									UGX 1.6 billion				
Strategic objective 3: Promote bamboo plantation on government and private land																	
3.1	Set up land licensing system and licensing for large scale bamboo plantation by private sector on government land (CFRs).	56,000 ha	No. of ha set aside for bamboo plantations											UGX 1 billion (USD 267,000)	NFA	NFA	Earmark particular CFRs for bamboo, land demarcation/ allocation, mapping, tracking plantation
	Note: 1000 ha (75 km) at UGX 32 million																Development, etc.
3.2	Develop and disseminate standards, best practice and technologies for bamboo plantation development and management.	Five standards	Approved and published standards			1	2	1	1					UGX 50 million (USD 13,400)	GoU INBAR UNHCR FAO	MWE/FSSD UNBS	Estimated cost for each standard is 10 million. -Charcoal -Baskets -Construction -Furniture -Bamboo shoots
3.3	Strengthen private sector access to innovation, financing, access to market and technical information.	50	No. of progressive private sector organisations actively involved			5	5	10	10	20				UGX 750 million (USD 200,000)	GoU INBAR UNHCR FAO Private sector	MWE/FSSD NFA INBAR MTIC	Exchange visits to bamboo-producing regions (ten investors/year for five years)

3.4	Supporting establishment of bamboo plantation in private land, PAs, wildlife conservation and ecologically fragile zones for landscape restoration and enhancing productive function.	300,000 ha	300,000 ha established		50 00	15, 00 0	20,0 00	30, 00 0	30, 00 0	500 00	50, 00 0	50, 00 0	500 00	UGX 375 billion (USD 100 million)	Development partners, private sector, GoU	MWE/FSSD NFA UWA DLGs INBAR Private sector	Establishment cost for each hectare of bamboo is estimated at UGX 400,000–500,000
3.5	Mandate bamboo planting as farm boundary and shelter belts in slope land above 20% slope.	25,000 ha	25,000 ha established		50 0	50 0	100 0	10 00	20 00	500 0	50 00	50 00	500 0			MWE/FSSD LGs	Implement existing laws on protection of steep slopes Enact and implement ordinances and bylaws
3.6	Promote establishment of bamboo for watershed management; mandate planting of bamboo around water bodies (riverbanks, lakeshores).	100,000 ha	100,000 ha established		10 00	20 00	500 0	50 00	50 00	20,0 00	20, 00 0	21, 00 0	21,0 00			MWE/FSSD LGs	Conduct mass education and sensitisation on management of watersheds, lakeshores and riverbanks Implement existing laws on protection of lakeshores and riverbanks
																	Enact and implement ordinances and bylaws
3.7	Encourage establishment of bamboo plantation on farms, especially in forest fringes to reduce pressure on natural forests.	175,000 ha	No. of ha established		35 00	12, 50 0	14,0 00	24, 00 0	23, 00 0	25,0 00	25, 00 0	24, 00 0	24,0 00			MWE/FSSD NFA UWA LGs	

3.8	Promoting best practice in the production and use of bamboo resources among smallholder farmers by providing capacity-building and handholding support services.	150	No. of outreach programmes achieved										UGX 1.88 billion (USD 500,000)	MWE/FSSD INBAR UNHCR FAO	MWE/FSSD NFA	15 clusters, two outreaches/year for five years
				Sub-total 3:								UGX 378.7 billion USD 101 million				
Strategic objective 4: Produce and supply quality planting material																
4.1	Assessing national bamboo planting material demands and supply.	1	Planting assessment report	1									UGX 112.5 million (USD 30,000)	NFA, INBAR	NFA/FSSD	15 clusters
4.2	Develop a network of planting material producers in government, NGOs and private sector.	30	No. of planting material producers supplying bamboo planting materials	10	20								UGX 56.25 million (USD 15,000)	NFA, INBAR UNHCR FAO	MWE/FSSD NFA	15 clusters
4.3	Develop standards and guidelines for collection, production, distribution of bamboo planting materials.	1 standard	Published standards and guidelines	1									UGX 20 million (USD 5300)	GoU INBAR UNHCR FAO	MWE/FSSD UNBS	
4.4	Develop a mechanism for quality control and certification mechanism of bamboo nurseries.	10	Number of certified nurseries operating	1									UGX 600 million (USD 160,000)	GoU INBAR UNHCR FAO	MWE/FSSD FAO	One nursery certification assessment per year
4.5	Promoting tissue culture technology for mass propagation of quality planting materials.	1	Functioning tissue culture production laboratory				1						UGX 750 million (USD 200,000)	GoU INBAR UNHCR FAO	NaFORRI NFA	Need to set up one laboratory

4.6	Support research on species selection, planting material and production technologies to enhance production capacity and reduce the cost of bamboo plants.	1	Research report		1							UGX 168.75 million (USD 45,000)	GoU INBAR UNHCR FAO	NaFORRI NFA	Consultancy, procuring planting materials and putting trials on the ground
4.7	Undertake capacity-building and training of bamboo planting material producers (nursery operators).	5	Training report with list of participants		2	2	1					UGX 225 million (USD 60,000)	GoU INBAR UNHCR FAO	NFA NaFORRI	Four to five days of training for 25–30 participants, including facilitators
				Sub-total 4:								UGX 1.933 billion (USD 515,300)			
Strategic objective 5: Develop Bamboo SME and industries															
5.1	Support the establishment of model demonstration, production and training centres in each cluster to provide forward and backward linkages.	2	No. of operating demonstration models		1		1					UGX 760 million (USD 200,000)	GoU INBAR UNHCR FAO	MWE INBAR UIRI NaFORRI	Focus on -furniture (UGX 123.7 million / USD 33,000) -charcoal (UGX 56.2 million / USD 15,000) -tooth-picks (UGX 56.2 million / USD 15,000), other (UGX 138.7 million / USD 37,000) -housing -bamboo shoots, etc.

5.2	In the short term, promote micro-enterprises and SMEs producing bamboo furniture, energy	Five Enterprises	No. of promotions undertaken			1	1	1	2					UGX 225 million (USD 60,000)	Private sector Ministry of Trade UIA	Ministry of Trade UIA	Enterprises to be promoted: -bamboo shoots -furniture -construction -charcoal -crafts
	products, bamboo shoots, construction material and craft products.																Field visits and trade fairs
5.3	In the long term, promote industries for high-end value addition—bamboo pulp and paper, bamboo timber substitutes, energy products, etc.	Ten industries	No. of promotions undertaken							2	5	5		UGX 562.5 million (USD 150,000)	Private sector Ministry of Trade UIA	Ministry of Trade UIA	Focus on high-end products
5.4	Encourage private and foreign investment by creating attractive investment packages (e.g. tax incentives, soft loans, grants, guarantees, bamboo based-business incubation period).	10	No. of meetings and dialogue reports submitted		2	4	4							UGX 112.5 million (USD 30,000)	Private sector Ministry of Trade UIA	Ministry of Trade UIA	Dialogue with relevant ministries Dialogue with Member of Parliament Round table meeting with investors
5.5	Diversify the product utilities and range to tap into large domestic market for packaging.	5	No. of contracts or Memoranda of Understanding signed					4	4	2				UGX 56.25 million (USD 15,000)	Private sector Ministry of Trade UIA	Ministry of Trade UIA	Meetings and contract negotiations with five large packaging companies
5.6	Introduce tools and technologies for efficient processing aimed at improving quality and reducing waste.	5	No. of technologies introduced			1	2	2						Refer to Objective 5.1	Private sector Ministry of Trade UIA FAO UNHCR	Ministry of Trade UIA	Technology transfer

5.7	Collaborate closely with UNBS to develop bamboo-based standards for all products and promote certification of products for quality assurance.	Refer to other standards above											Refer to other standards above	MWE/ FSSD Private sector Ministry of Trade UIA INBAR	MWE/FSSD UNBS	Regular development based on industry and enterprise needs
5.7	Provide tailor-made skill development and technology	20	No. of training programmes and		5	5	5		5	5			UGX 750 million (USD 200,000)		IURI NaFORRI Technical colleges	Four tailor-made skills per year for five years
	dissemination to enterprises and entrepreneurs.		people trained													
5.9	Support the development of private-sector enterprises with focus on bamboo resource management in PAs.	Addressed in Objectives 2, 3, 4 and 5												NFA, UWA	NFA, UWA	Technical support and monitoring
				Sub-total 5:									UGX 2.467 billion USD 655,000			
Strategic objective 6: Support bamboo market development																
6.1	Include bamboo and its products in governments' preferential procurement list to enable markets for bamboo furniture, construction and bio-energy.	4	No. of meetings and people attending		2	2							UGX 33.75 million (USD 9000)	MWE/ FSSD Private sector Ministry of Trade UIA INBAR	MWE/FSSD PPDA	Four meetings in two years

6.2	Facilitate allocation of land for market hubs for bamboo and its products in strategic locations to create wider market and visibility.	6	No. of meetings and people attending		2	2	2							UGX 37.5 million (USD 10,000)	MWE/ FSSD Private sector Ministry of Trade UIA INBAR	UIA FSSD	Six meetings in three years
6.3	Develop linkages with government and private run market and sales outlets for bamboo products.	Use existing outlets														MTIC	Use existing government outlets
6.4	Support bamboo primary producers, meet the market demand in terms of raw materials needed upstream	Addressed above														MWE/FSSD NFA UWA MTIC	
6.5	Develop linkages with large consumption sector for packaging—agriculture, horticulture, apiculture, coffee and tea sector—to create markets for bamboo products.	Part of networking														MTIC	
6.6	Facilitate participation in national and international trade fairs and exhibitions.	10	No. of trade fairs and exhibitions attended		2	1	1	1	1	1	1	1	1	UGX 375 million (USD 100,000)	MWE/ FSSD Private sector Ministry of Trade UIA INBAR	UIA FSSD MTIC	Participating in one trade fare/year
6.7	Institute domestic and international market survey to feed in market intelligence in developing value chains and products.	2	Survey report		1					1				UGX 75 million (USD 20,000)	MWE/ FSSD Private sector Ministry of Trade UIA INBAR	UIA FSSD INBAR MTIC	UGX 50 million for consultancy work

				Sub-total 6:								UGX 521.25 million				
												USD 7,139,000				
Strategic objective 7: Support bamboo education, training and research																
7.1	Develop south–south cooperation, e.g. with China’s NFGA, the ICBR, INBAR and any other partner for technology transfer, research, capacity-building and investment	5	No. of implemented Memoranda of Understanding		1	1	1	2					UGX 37.5 billion (USD 10 million)	UIRI NaFORRI Universities and forestry colleges Private sector	MWE/FSSD INBAR	Technology transfer Research Capacity-building Investment
7.2	Develop specialised bamboo curriculum for university and BTVET	1	No. of specialised bamboo curricula			1							UGX 112.5 million	Technical colleges, INBAR	MWE/FSSD and Ministry of Education	Consultancy and validation meetings
	build a pool of trained professionals and trainers.		developed										(USD 30,000)			
7.3	Develop tailor-made training modules targeting bamboo growers, nursery operators, micro-enterprises and SMEs.	5	No. of modules developed		3	1	1						UGX 190 million (USD 50,000)	NaFORRI Private sector	MWE/FSSD INBAR UIA	Consultancy and validation meetings
7.4	Support research on bamboo planting material, bamboo plantation and management, value-chain and product development, market, tools, machines and ecosystem services.	See 7.1 above											Addressed in 7.1 above	NaFORRI UIRI	MWE/FSSD, INBAR	

7.5	Develop a technical platform in bamboo clusters to provide technical support at the cluster level.	15	No. of working platforms		5	5	5							UGX 290 million (USD 75,000)	MWE/FSSD, NFA, DLG, INBAR Private sector	MWE/FSSD, INBAR	Understand development needs and provide solutions
7.6	Establish bamboo arboretum for preservation of germplasm, research and learning.	5	No. of arboreta established		1	2	2							UGX 750 million (USD 200,000)	NFA NaFORRI Private sector	MWE/FSSD, INBAR	Northern, Eastern, Central (lakeshores), South Western and Rwenzori regions
				Sub-total 7:									UGX 38.8 billion USD 10.36 million				
Strategic objective 8: Develop communication and knowledge management system																	
8.1	Facilitate development of IEC materials and support to raise public awareness through multi-media.		No. of IECs developed											UGX 300 million (USD 80,000)	MWE/FSSD, NFA, DLG, INBAR Private sector	MWE/FSSD, INBAR	
8.2	Establish a knowledge generation and management system to document the progress, technical and technological processes, key learning and case studies and develop mechanisms for dissemination to targeted audience.	16	No. of ICT units being used		8	7								USD 160,000	NFA, DLG, INBAR Private sector	MWE/FSSD, INBAR	One central coordination unit in Kampala linked with the 15 clusters (ICT based)
8.3	Develop and implement a detailed communication guideline and action plan.	1	Communication guidelines and actions being implemented	1										UGX 187.5 million (USD 50,000)	MWE/FSSD, NFA, DLG, INBAR Private sector	MWE/FSSD, INBAR	Consultancy work

8.4	Support stakeholders to organise periodic exhibitions and participate in trade shows at local, national and international levels.	10	No. of exhibitions and trade fairs attended		2	1	1	1	1	1	1	1	1	UGX 750 million (USD 200,000)	MWE/FSSD, NFA, DLG, INBAR Private sector	MWE/FSSD, INBAR MTIC	
				Sub-total 8:										UGX 1.85 billion USD 490,000			
Strategic objective 9: Create enabling environment																	
9.1	Encourage PPP as a main vehicle to transform, scale up and modernise the bamboo industry.	5	No. of PPPs involved in bamboo industry		1	2	2							UGX 375 million (USD 100,000)	Ministry of Finance Ministry of Trade MWE/FSSD	UIA MTIC	Initially start with five PPPs focussing on specific products
9.2	Facilitate access to land, loan and finances to growers, enterprises and industries.	As in 9.1 above												As in 9.1 above	Ministry of Finance Ministry of Trade MWE/FSSD	UIA	
9.3	Exempt bamboo products of micro-enterprises and SMEs from VAT, sales and services tax to increase their competitiveness against cheaper alternatives.	5	No. of lobbying and advocacy measures undertaken											UGX 190 million (USD 50,000)	Parliament of Uganda Ministry of Finance Ministry of Trade UIA	MWE/FSSD NFA MTIC	Lobbying and advocacy of the key stakeholders
9.4	Simplify and/or ease bamboo transport and transit permit system.														MWE/FSSD, NFA, DLG, INBAR Private sector	MWE/FSSD NFA	Modification in regulation

9.5	Develop inventive package providing maximal tax exemptions and incentives to bamboo industries and investors within the framework of existing legal provisions.	1	Package developed to assist with lobbying and advocacy										UGX 40 million (USD 10,700)	Ministry of Finance Ministry of Trade UIA	MWE/FSSD UIA MTIC	Consultancy work
9.6	Support demand-driven bamboo industrial research through government research institutions.	See 7.1 and 7.4 above											See 7.1 and 7.4 above			Research resource development and value addition – demand driven
9.7	Develop bamboo standards, codes of practice and guidelines for bamboo products to facilitate regional and international trade.	1	Standard in support of regional and international trade										UGX 75 million (USD 20,000)	MWE/FSSD, NFA, DLG, INBAR Private sector	MWE/FSSD UNBA	Demand driven to develop standards
				Sub-total 9:									UGX 680 million USD 180,700			
Strategic objective 10: Create institutional and governance mechanism																
10.1	Establish and run a dedicated bamboo unit at the national level and in each bamboo cluster with adequate labour and other resources to implement and monitor progress.	16	No. of units established and running										UGX 11.5 billion (USD 3 million)	MWE/FSSD, NFA, Other relevant ministries DLG, INBAR Private sector	MWE/FSSD	This is a private sector led with some support from government and development partners

10.2	Form a forum or steering committee for bamboo sector coordination with members drawn from central government ministries, LGs, the private sector and civil society.	3	No. of meetings for formation of the committee										UGX 114 million (USD 30,000)	MWE/FSSD, NFA, Other relevant ministries UIA DLG, INBAR Private sector	MWE/FSSD	Meetings twice a year for finalising and approving action plan
10.3	Establish and run a national consultative forum for providing opportunities for international donor/development partners, investors and the general public with interest in the bamboo sector.	10	No. of national consultative fora run										UGX 760 million (USD 200,000)	MWE/FSSD, NFA, Other relevant ministries UIA DLG, INBAR Private sector	MWE/FSSD MTIC	This is private sector led with some support from government and development partners
				Sub-total 10:									UGX 12.37 billion USD 3.23 million			
				Grand total									UGX 442.8 billion USD 118 million			

Appendix 8: ROI from bamboo seedling production, 2019/20–2029/30

Bamboo seedling production																
Assumptions																
Number of seedlings/ha	400															
Year	Units	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	Total	USD equivalent
Total area (ha)		20,000	25,000	25,000	58,000	58,000	58,000	56,000	-	-	-	-	-	-	300,000	
No. of seedlings		8,000,000	10,000,000	10,000,000	23,200,000	23,200,000	23,200,000	22,400,000	-	-	-	-	-	-	120,000,000	
Production cost/seedling (UGX)	2,400	19,200,000,000	24,000,000,000	24,000,000,000	55,680,000,000	55,680,000,000	55,680,000,000	53,760,000,000	-	-	-	-	-	-	288,000,000,000	78,800,000
Sales/seedlings (UGX)	3,000	24,000,000,000	30,000,000,000	30,000,000,000	69,600,000,000	69,600,000,000	69,600,000,000	67,200,000,000	-	-	-	-	-	-	380,000,000,000	98,000,000
Return (UGX)		4,800,000,000	6,000,000,000	6,000,000,000	13,920,000,000	13,920,000,000	13,920,000,000	13,440,000,000	-	-	-	-	-	-	72,000,000,000	19,200,000
USD Equivalent		USD 1,280,000	USD 1,600,000	USD 1,600,000	USD 3,712,000	USD 3,712,000	USD 3,712,000	USD 3,584,000	USD 0	USD 19,200,000						

Appendix 9: Return on carbon sequestration by bamboo (tons of C) 2019/20-2029/30

Carbon sequestration by bamboo (tons of C)																			
Assumptions																			
Yushania alpina	Initial five yrs	55 tons: Biomass	Muchiiri and Mugo, 2013 (55 tons dry weight); 86 tons/ha (Kathumbi et al, 2017)																
Total carbon	48%	26.4 tons: Carbon																	
Dry weight harvesting	15 tons per hectare		Mengesha, 2012																
Weight per pole: dry weight		9.6 kg																	
Carbon		4.608																	
Oxytenanthera abyssinica	Initial five yrs	14.48 Tons: Carbon	14.48 tons of carbon per hectare (Darcha and Birhane, 2015)																
Weight per pole: dry weight		3.09 kg	3.09 kg of carbon per culm (Darcha and Birhane, 2015)																
Carbon to CO ₂		3.67																	
Tons of CO ₂ absorbed/ha/yr	Yushania alpina	96.888																	
Tons of CO ₂ absorbed/ha/yr	O. abyssinica	53.1416																	
Average for initial five years		64.0782 tons/ha	25 % Yushania alpina and 75% Oxytenanthera abyssinica																
Average per year		12.81564 tons/ha																	
Annual C accumulation	Y. alpina	9.216																	
Annual CO ₂ accumulation	Y. alpina	33.82272 tons/ha																	
Annual C accumulation	O. abyssinica	6.18 tons/ha																	
Annual CO ₂ accumulation	O. abyssinica	22.6806 tons/ha																	
Average		25.46613 tons/ha	25 % Yushania alpina and 75% Oxytenanthera abyssinica																
Price of CO ₂ absorption/ton		72,000																	
Accreditation of bamboo farmers for C credit																			
Year	Units	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	Ten-yr total	
Total area (ha)		-	5,000	20,000	40,000	70,000	100,000	150,000	200,000	250,000	300,000	-	-	-	-	-	-	14,737,986	
Initial five years (CO ₂ sequestration)	12.81 tons/ha	-	64,078.20	256,312.80	512,625.60	897,094.80	1,217,486	1,666,033	2,050,502	2,306,815	2,563,128	1,822,346	1,281,564	640,782	-	-	-	14,737,986	
Annual harvesting: tons of CO ₂ 25.46 tons/ha		-	-	-	-	-	-	127,330.68	509,322.60	1,018,645.20	1,782,629.10	2,546,613	3,819,919.50	5,093,226	6,366,532.50	7,639,839	7,639,839	14,897,686	
Total CO ₂ sequestration		-	64,078	256,313	512,626	897,095	1,344,816	2,175,356	3,069,148	4,089,444	5,109,741	5,742,266	6,374,790	7,007,315	7,639,839	7,639,839	7,639,839	29,635,672	
Carbon credit (UGX)	72,000	-	-	4,613,630,400	18,454,521,600	36,909,043,200	64,590,825,600	96,826,784,400	156,625,617,600	220,978,627,200	294,439,989,600	367,901,352,000	413,443,116,000	458,984,880,000	504,526,644,000	550,068,408,000	550,068,408,000	550,068,408,000	2,133,768,387,600
USD equivalent		USD 0	USD 0	USD 1,230,301	USD 4,921,206	USD 9,842,412	USD 17,224,220	USD 25,820,476	USD 41,766,831	USD 58,927,634	USD 78,517,331	USD 98,107,027	USD 110,251,498	USD 122,395,968	USD 134,540,438	USD 146,684,908	USD 146,684,908	USD 146,684,908	USD 569,004,300

Appendix 10: Bamboo species suitable for Uganda, its agro-climatic conditions and uses

Bamboo species	Ideal altitude range	Introduced or observed altitude range	Site agro-ecological conditions	Specifications of bamboo poles	Main uses	Propagation methods
1. <i>Yushania alpina</i> (K. Schum.)	2200 – 3500 m AMSL	1700–4000 m AMSL	<p>Sub-tropical bamboo. Commonly found in higher elevations and mountain areas of East Africa.</p> <p>Grows well in mountain and volcanic soils.</p> <p>Rainfall ranging from 1250 to 3000 mm.</p> <p>Temperature is a limiting factor, confined to areas of mean annual temperature of 11.6–15.9°C, tolerates down to –4°C</p>	<p>Height: 2–19.5 m Diameter: 5–12.5 cm</p> <p>Thin walled, with wall thickness ranging from 2 cm in the bottom to 0.3 cm at the top.</p>	Bamboo flooring tiles, timber, handicrafts, furniture, bamboo stick-based products, bamboo sliver-based products like mats and bamboo matboard, bamboo shoots, etc	Rhizome/offsets; seeds
2. <i>Oxytenanthera abyssinica</i> (A. Rich.) Munro	1000–1800 m AMSL	500–2200 m AMSL	<p>Tropical bamboo species. Suitable for lowlands and mid-elevation with rainfall between 900 and 1400 mm, drier and hot location. It needs minimum rainfall of about 700 mm. It can grow in poor and marginal soil. It is also drought resistant. Prefers comparatively warm temperature.</p>	<p>Height: 7–10 m Diameter: 5–10 cm</p> <p>Solid bamboo poles when grown in drier climatic regimes, and slightly hollow in case of wet climatic regimes.</p>	Construction, furniture, basketry and handicrafts, props, agricultural implements. Shoots edible. Leaves extensively used as fodder. Suitable for biomass, charcoal and energy.	Rhizome, seed, culm cuttings, layering
3. <i>Dendrocalamus giganteus</i> Wallich ex. Munro	0–1200 m Can tolerate frost to –1°C	Grows well at 1300 – 2100 m in North Kivu	<p>Tropical to sub-tropical bamboo. Grows well in humid tropical highlands and in lowlands with high humidity and good alluvial soil. Can tolerate low temperatures to –2°C. Prefers well-drained, loamy soils.</p> <p>Prefers a mean annual rainfall of 1800–3600 mm, but tolerates 1200–4500 mm.</p>	<p>Height: 20–30 m Diameter: 15–30 cm. Medium to low wall thickness.</p>	Construction, handicrafts, furniture, industrial panel products. Leaves good fodder. High Biomass production capacity (charcoal and energy).	Layering, branch cuttings and culm cutting.

Bamboo species	Ideal altitude range	Introduced or observed altitude range	Site agro-ecological conditions	Specifications of bamboo poles	Main uses	Propagation methods
4. <i>Bambusa vulgaris</i> Schrad ex. Wendl	0–1500 m AMSL	Observed in 1900 m in North Kivu and 2000 m in Madagascar	It is a pan-tropical species. Prefers moist tropical climate. It grows best in low altitudes; above 1200 m elevation the culm size reduces. It prefers a mean annual rainfall of 1200–2500 mm but tolerates 700–4500 mm. Thrives in a wide range of soil and moisture conditions. Prefers moist alluvial soil; also grows well in well drained sandy and clayey soils. Tolerant to salinity and water logging. It is drought resistant and frost hardy (–3°C).	Moderately tufted bamboo Dwarf green Height: 7 – 15 m Diameter: 4–7 cm Yellow type: Height: 7–15 m Diameter: 5–10 cm	Basketry and handicrafts; fencing and low-cost application. High biomass production capacity; suitable for energy (charcoal and biomass).	Easy to propagate. Branch cuttings, culm cuttings and layering.
5. <i>Cephalostachyum pergracile</i>	500–1200 m AMSL	Up to 1500 m AMSL`	Tropical lowland bamboo, thin walled. Commonly found in Indian sub-continent, Myanmar, Laos, etc. <i>C. pergracile</i> occurs in semi-humid to semi-arid regions in a range of soils; it is most common in well-drained, loamy soils in Myanmar. Mean annual rainfall: 800–1000 mm Mean annual temperature: 22–33°C Tolerates temperatures down to –6°C.	Height: 7–20 m Diameter: 5–7.5 cm	Bamboo stick- and sliver-based product line, bamboo shoots.	Seed, offsets and culm cuttings.
6. <i>Dendrocalamus membranaceus</i> Cv. Grandis	50 – 1150 m AMSL	Up to 1400 m	Tropical bamboo, growing in mixed deciduous or monsoon forest. Average annual temperature of 22–33°C. Minimum rainfall of above 1000 mm/annum.	Height: 20–25 m Diameter: 6–12 cm	Construction/pulp and paper; laminated boards; bamboo shoots.	Seed, offsets, branch cuttings, culm cuttings.
7. <i>Dendrocalamus barbatus</i>	300–1100 m AMSL		Tropical large-diameter bamboo with medium wall thickness. Minimum rainfall of 1000 mm per annum.	Height: 15–18 m Diameter: 10–15 cm	Craft, construction, plyboards, handicrafts, furniture; edible shoots.	Seeds, offset, culm cuttings

Bamboo species	Ideal altitude range	Introduced or observed altitude range	Site agro-ecological conditions	Specifications of bamboo poles	Main uses	Propagation methods
8. <i>Bambusa polymorpha</i>	0–1500 m AMSL		<p><i>B. polymorpha</i> grows naturally in semi-humid areas on medium to rich, well-developed soils.</p> <p>Grows in moderately high rainfall zones higher than 800–6000 mm.</p> <p>Resistant to low temperature (–3°C) and high temperature (+53°C). Suitable average annual temperature of 18–30°C, Bamboo branch height of 12–20 m, a particularly high rate of timber, making costs extremely low.</p>	<p>Height: 15–25 m Diameter: 5–15 cm Thickness: ≈2 cm at the bottom and 0.3 cm at the top</p>	Bamboo stick-based products; mats, blinds, chopsticks and handicrafts; edible Shoots.	Seed, offset, branch and culm cutting, layering, etc.
9. <i>Dendrocalamus yunnanensis</i>	80–800 m AMSL	Also found at 1700–2840 m, in Baimahe from 1800–2300 m and in Xishan around 2000 m.	<p>Tropical large-sized bamboo; requires rainfall ranging from 1000–3000 mm.</p> <p>Accumulated temperature is the total daily average temperature (≥10°C) for the whole year.</p>	<p>Height: 18–25 m Diameter: 11–18 cm</p>	Bamboo shoot, construction, construction and paper manufacture construction; paper pulp and wood.	
10. <i>Dendrocalamus strictus</i> (Roxb.) Nees	0–1200 m AMSL;	1500 m	<p>Suitable for tropical and sub-tropical climates. Grows well in sandy loam soil. Rainfall of 750–4000 mm. Resistant to frost and drought (can withstand –5°C to 45°C). Optimum temperature: 20–30°C.</p> <p>Well-drained, coarse-grained/stony/degraded/dry soils.</p>	<p>Height: 7–20 m Diameter: 3–8 cm</p> <p>Solid bamboo poles</p>	Furniture, construction, basketry products, shoots edible. Good fodder. Highly suitable for charcoal and energy applications.	Offsets; Culm cuttings, branch cuttings and layering.

Bamboo species	Ideal altitude range	Introduced or observed altitude range	Site agro-ecological conditions	Specifications of bamboo poles	Main uses	Propagation methods
11. <i>Bambusa bamboos</i> (L.) Voss.	0–1500 m AMSL	Up to 1800 m in Uttarakhand, India	Suitable for tropical and sub-tropical climate. Prefers sandy loam and fertile soil. Can withstand frost and is similar to <i>Dendrocalamus strictus</i> in its range. Rainfall between 750 and 4000 mm. Both <i>D. strictus</i> and <i>B. bamboos</i> have a wide range and are hardy.	Height: Up to 30 M. Diameter: 10–18 cm Thick walled bamboo. Very densely tufted thorny bamboo producing large dense clumps of packed culms.	Construction, furniture, basketry, edible shoots. Ideal for windbreaks and boundary fencing (spiny).	Branch cutting and culm cutting.
12. <i>Bambusa nutans</i> Wallich ex. Munro	600–1500 m	Grows well around 2000 m in Uttarakhand, India.	Sub-tropical Bamboo (sub-Himalayan regions). Grows well in moderate and high rainfall regions; prefers a mean annual rainfall in the range 2300–3000 mm, but tolerates 700–4500 mm. Temperature range of 4–37°C.	Height: 10–20 m Diameter: 5–10 cm Medium thickness and straight bamboo poles	Construction, furniture, basketry.	Offsets, branch cutting, culm cutting and layering.
13. <i>Bambusa balcooa</i> Roxb.	0–1000 m AMSL;	Grows well up to 2000 m (Amhara, Ethiopia; Mbeya, Tanzania).	Grows well in high rainfall regions (1500–5000 mm). Can withstand drought (700-mm rainfall) and temperature down to –5 °C.	Height: 15–25 m Diameter: 8–15 cm Good wall thickness High biomass production potential	Construction, furniture, basketry products. Edible shoots. Suitable for biomass, charcoal and energy.	Culm cuttings, branch cuttings, layering.
14. <i>Dendrocalamus hamiltonii</i> Nees & Arn ex. Munro	600–1500 m	Grows well at ≈2000 m in Western Himalayas (India) and Amhara Province (Ethiopia).	Suitable for sub-tropical climate. Requires moist and moderately good rainfall. Rainfall varies from 750 to 5000 mm in its natural range; temperature is maximum 46°C and minimum –5°C.	Height: 15–25 m Diameter: 9–19 cm Moderate wall thickness and very flexible bamboo	Construction, handicrafts and furniture. Excellent bamboo shoots. Leaves: good fodder.	Branch cuttings, culm cuttings and layering.
15. <i>Dendrocalamus asper</i> (Schult. f.) Backer ex. Heyne	400–1500 m Thrives well at 400–500 m	Grows well at an elevation of 2000 m in Madagascar.	Tropical to sub-tropical bamboo. Can withstand frost and cool temperatures down to –4°C.	Height: 15–20 m Diameter 8–20 cm Medium to low wall thickness	Construction, furniture, basketry and handicrafts; excellent shoots and fodder. Industrial panels.	Culm cutting and branch cutting.

Bamboo species	Ideal altitude range	Introduced or observed altitude range	Site agro-ecological conditions	Specifications of bamboo poles	Main uses	Propagation methods
			Grows well in areas with good rainfall, prefers heavy and well drained soils. Prefers a mean annual rainfall of 1800–3600 mm, but tolerates 1200–4500 mm.		products, chopsticks, toothpicks.	
16. <i>Dendrocalamus hookeri</i> Munro	700–1500 m		Tropical to sub-tropical bamboo. Soil range: sandy loam to clayey loam. Grows well in humid tropical highlands with high humidity; a minimum of 1200 mm rainfall.	Height: 15 – 20 M Diameter: 10-20 cm A large tufted bamboo	Construction, basketry and panel-based Products. Bamboo shoots. High biomass production potential suitable for Energy.	Culm cuttings.
17. <i>Dendrocalamus brandisii</i> (Munro) Kurz	700–1500 m	Grows well in moist and well-drained conditions	Tropical–sub-tropical bamboo, tolerates frost and cool temperatures to –3°C. It prefers a mean annual rainfall of 1800–3600 mm, but tolerates 1200–4500 mm.	Height: 19–33 m Diameter: 13–20 cm Very large tufted bamboo	Construction, furniture, farm implements, basketry and handicrafts. Edible shoots. High biomass production capacity, suitable for energy.	Culm cuttings, branch cuttings.
18. <i>Guadua angustifolia</i> Kunth	500–1600 m	Coincides with major coffee growing regions	Suitable for sub-tropical climate, can withstand temperatures down to –2°C. Annual average temperature range is 20 – 26°C. Rainfall range: 1200–2500 mm per year	Height: Up to 30 m Diameter: Up to 20 cm Good wall thickness (short internodes)	Construction and building material; furniture, handicrafts.	Branch cuttings.
19. <i>Thyrsostachys oliveri</i> Gamble	500–700 m	Up to 1000 m in Uttarakhand, India	Suitable for tropical climate–high rainfall and deciduous. Minimum 1000 mm to maximum 3000 mm of rainfall.	Height: 15 – 25 m Diameter: 5 cm Solid bamboo poles	Construction, furniture, props, agriculture implements, tools. Suitable for farm boundary fencing and agro-forestry. Edible shoots/	Offset planting.

Source: INBAR (2018)

Appendix 11: Six major risks and proposed mitigation measures

Risk	Risk level	Mitigation
1. Plantation development	5	
(a) Public land (PA) access <ul style="list-style-type: none"> • Access to existing land • Access to existing plantations 	5	<ul style="list-style-type: none"> • Licensing regime (incentives): Low land license rate. • Timeliness of actions to secure land.
(b) Private land access (insecurity of tenure)	5	<ul style="list-style-type: none"> • Fast track land registration by communities (increase tenure security). • Amend laws for leasing of customary land (land tenure reform). • Cultural/community leaders' involvement.
(c) Plantation management: pests and diseases, low skills, etc.	5	<ul style="list-style-type: none"> • Good management practices. • Skills development. • Choices of varieties with better return and environmental suitability.
2. Political risks	5	
(a) Political will for green bamboo economy.	5	<ul style="list-style-type: none"> • Political will to develop the green bamboo economy with policy incentives. • Decision support mechanism to move bamboo issues to highest level for actions. • Petitions, question sessions and parliamentary motions to be used/made.
3. Value-addition risks	5	
(a) Quality perceptions on current bamboo products	5	<ul style="list-style-type: none"> • Proof of value-addition concept. • Focus on the concept of 'low-hanging fruit' in terms of product development. • Apprenticeship placements for artisans in industries, including under south-south cooperation. • Importation of appropriate technologies (which must be easy to service or repair locally).
(b) Product selections	5	<ul style="list-style-type: none"> • Selection of a few product developments for fast tracking. • Developing standards for enforcement. • Capacity development and mentoring of SMEs.

4. Financing	5	
(a) Pre-investment costs: high cost of project development	5	<ul style="list-style-type: none"> • Incentives, tax waivers, guarantees and subsidies.
(b) Access to finance	5	<ul style="list-style-type: none"> • Bring down interest rates for bamboo project development, e.g. solar loan schemes by Uganda Energy Credit Capitalisation Company.
5. Marketing development risks	5	
(a) Market study	5	<ul style="list-style-type: none"> • Market study is already done but needs to be reviewed. • Ensuring product competitiveness. • Import substitution quality assessment.
(b) Market access	5	<ul style="list-style-type: none"> • Formation of cooperatives to cut off middlemen (speculators). • Direct procurement policy by government on bamboo products for public institutions (schools, offices, hospitals, etc.). • Bamboo machineries integrated in agricultural financing, e.g. World Food Programme.
6. ICT	5	
<ul style="list-style-type: none"> • Information 	5	<ul style="list-style-type: none"> • Bamboo showroom and exhibitions with both local and international products.
<ul style="list-style-type: none"> • Technology 	5	<ul style="list-style-type: none"> • Bamboo networking and dialogue fora for stakeholders. • Awareness creation, training, media, targeting training for churches, cultural leaders, community leaders, etc. • Triple Helix (private sector, public sector and academics).

Appendix 12: List of workshop participants (28 and 29 January 2019)

No.	Participants			Title	Address		Email
	Participant's name	Sex	Age		Organisation	Telephone	
1	Mayega Isaac	M	43	Chairman	Mt. Elgon Coffee and Honey Group	0772825602	isacmayeku@gmail.com
2	Divine Nabaweesi	F	35	Chief Executive Officer (CEO)	Divine Bamboo	0702502233	divine@divinebamboo.com
3	Nuwamanya Francis	M	51	Chief Executive Officer	Binewab International	0784574383	franuw@yahoo.com
4	Amoko Emmanuel	M	34	Council Speaker	Moyo District Local Government	0781026960	amokiwaemma@gmail.com
5	Mununuzi David	M	59	Director Plantation	National Forestry Authority	0772466498	davidm@nfa.org.ug
6	Tom. O. Okello	M	53	Executive Director	National Forestry Authority	0772550294	tomo@nfa.org.ug
7	Namirembe Sarah	F	27	Sales manager	Tree Trends Nursery	0704316744 0700518996	sarah.namirembe92@gmail.com
8	Issa Katwesige	M	37	Principal Forest Officer	Forestry Sector Support Division, Ministry of Water and Environment	0782432048	issakatwesige@gmail.com
9	Chepkowech Deborah	F	26	Administrative officer	Uganda Bamboo Association	0706316651	debicko@gmail.com
10	Sajjabi Tom	M	27	Manager	Bamboo Products (Uganda) Ltd.	0706316651	
11	Gertrude Newumbe	F	61	Chief Executive Officer	Elgon Naturals	0772350028	elgonnaturals@gmail.com nasiogetu@gmail.com
12	Munaaba Flavia Nabugere	F	63	Secretary General	Uganda Bamboo Association	0773586648 0772933354	munflavia2017@gmail.com

13	Fred Ijjo	M	40	Team Leader	Friends of Bamboo ConsultLtd	0772532154 0752532159	fob.consults@gmail.com fred.ijjo@gmail.com
14	John Tumuhimbise	M	51		Ministry of Energy and Mineral Development	0751993762	jumuhimbise@energy.go.ug
15	Fred Yikii	M	38	Assistant Lecturer	Mekerere University	0752818347	fyikii@gmail.com
16	Kalangwa Moses	M	31	Seedling Manager	Uganda Bamboo Association	0757491495 0778707787	mosesn40@gmail.com
17	Ibanada Ezra	M	24	Field Officer	Uganda Bamboo Association	0705479474	ezra.onson@gmail.com
18	Mugisha Herbert	M	46	Chief Executive Officer	Mgahinga Crafts Centre	0772484262 0703355558	habaconcepts@gmail.com
19	Gasana George	M	47	Coordinator Plantation	National Forestry Authority	0772631605	georgegasana72@gmail.com
20	Kasoma Nordin	M	39	Chief Executive Officer	Bogaali Bikes,Uganda	0782370048	kasoma@bugaalibikes.com
21	Adata Margaret	F	52	Commissioner of Forestry	Forestry Sector Support Division/Ministry of Water and Environment	0772540379	adatamargaret@yahoo.co.uk
22	Muwanga Allan	M	25	Nursery Manager	Divine Bamboo Group	0703183931	muwangaallan02@gmail.com
23	Achan Nancy	F	35		Muni University	0772001588	n.achan@muni.ac.ug
24	Watsemba Stella	F	38	District Environment Officer	Namisindwa District Local Government	0785351165	stellawassemba@gmail.com
25	Musimbi John Jimmy	M	23	Reporter	Record Television	0783956450	musimbijimmy@gmail.com
26	Langoya CD	M	56	Consultant	JC Holdings Limited	0772605432	langoyacd@yahoo.com
27	Joash Obbo Opata	M	53	Consultant	JC Holdings Limited	0772410637	obbojoash@gmail.com
28	Ojiambo Dickson	M	48	Transport Assistant	National Forestry Authority	0782778273	ojambodickson2@gmail.com

29	David Kisakye Ballese	M	25	Chief Technical Officer	Divine Bamboo LTD	0700292981	baleesedavid@gmail.com
30	Ritah Ainembabazi	F	26	Reporter	Sanyu FM	0705510407	
31	Jayaraman Durai	M	41	Regional Programme Manager	International Network for Bamboo and Rattan		jdurai@inbar.int
2	Malinga Michael	M	44	National Coordinator	International Network for Bamboo and Rattan	0772886580	mmalinga@inbar.int
33	David Walugembe	M	61	Secretary	Uganda Forestry Association	0772312992	davidwalugembe@yahoo.com
34	Justus Tusubira	M	55	Manager	Uganda Wildlife Authority	0772666091	justus.tusubira@ugandawildlife.org
35	Andrew Kalema Ndawula	M	49	Owner	Talent Agroforestry Farm	0772414047 0700984963	akndawula@gmail.com
36	Phillip Kihumuro	M	33	Research Associate	World Agroforestry Centre (ICRAF)	0781413057	P.kihumuro@cgiar.org
37	Edith Nakayiza	F	31	Pro-gramme Assistant	Food and Agriculture Organisation of the United Nations/Sawlog Production Grant Scheme	0707737233	enakah@gmail.com
38	Jackie Nantale	F	30	Reporter	Record	0704519608	nantale2015@gmail.com
39	Tenywa Isaac	M	24	Reporter	BABA TV	0785719295	Fredricktenywa@gmail.com
40	Musisi Lwanga	M	24	Reporter	Uganda Broadcasting Corporation /Star FM	075066801	realmusisilwanga@gmail.com
41	David Kisakye Baleese	M	25	Technical Officer	Divine Bamboo Group	0700292981	baleesedavid@gmail.com
42	Lydia Nakayenze	F	35	Founder	Elgon Naturals	0702339854	elgonnaturals@gmail.com
43	Andrew Timothy W	M	28	Project Manager		0753204537	
44	David Ebong	M	46	Director	Egrets Eco-conservation Estates Limited	0772551591	davidebong30@gmail.com

45	Mwodi Martin Kegere	M	40	Plantation Manager	National Forestry Authority	0781519433	mwodim@gmail.com
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Appendix 13: List of participants during the final validation workshop (23 May 2019)

#	Name	Gender	Age	Title	Organisation	Phone	Email	District
1	Mercy Naturinda	F	36	Partnership officer	Bwindi Mgahinga Conservation Trust	0772970802	mercy@bwinditrust.org	Kisoro
2	Wabuya M. Peter	M	59	Civic Leader	Namisindwa Local Government	0776332073	wabuyamp@yahoo.com	Namisindwa
3	Wolyama Rogers	M	32	Civic Leader	Namisindwa Local Government	0783154040		Namisindwa
4	Musila John	M	54	Civic Leader	Manafwa Local Government	0772458556	africanmissionaries@yahoo.com	Manafwa
5	Joash Obbo Opata	M	54	Consultant	JC Holdings Limited	0772410637	obbojoash@gmail.com	Tororo
6	Langoya CD	M	56	Consultant	JC Holdings Limited	0772605432	langovacd@gmail.com	Gulu
7	Mwodi Martin K.	M	40	Manager	National Tree Seed Centre	0781519433	mwodim@gmail.com	Kampala
8	Lugolobi Thaddeus	M	41	Civil Engineer	Ministry of Works and Transport	0701957782 0773956683	lugolobithaddeus@yahoo.com	Kampala
9	Abitekaniza Johnson	M	44	Principal Officer - Micro, small and Medium Enterprises	Ministry of Trade, Industry and Cooperatives	0704156428 0781562078	jabitekaniza@yahoo.com	Kampala
10	Christine Mwanja	F	36	Research Officer	National Forestry Resources Research Institute	0776581000	cmwanja@gmail.com	Kampala
11	Mr. Fred Yikii	M	38	Lecturer	Mekere University	075818347	fyikii@yahoo.com	Kampala
12	Olore Ronald	M	36	Researcher	Centre for Basic Research	0702500594	ronaldolore@yahoo.com	
13	Lydia Nakayenze Schulbert	F	35	Founder	Elgon Naturals	0702339854	elgonnaturals@gmail.com	Mbale
14	Dr. Sarah Mubiru	F	53	Managing Director	Aroma Honey Toffee	0772418678	sarah2mubiru@yahoo.com	Kampala
15	Mr. Nuwamanya Francis	M	51	Chief Executive Officer	Uganda Bamboo Renewable Energy Project	0784574383	francis@gmail.com	Kampala
16	Phoebe Goodwin	F	31	Site Planner and Shelter Officer	United Nations High Commissioner for Refugees	0771006483	goodwin@unchcr.org	Kampala
17	Charles Byaruhanga	M	54	Principal Forest Officer	Ministry of Water and Environment	0772469162	charlesakabyaruhanga@yahoo.com	
18	Denis Omodi A	M	41	Director	Humane African Mission	0772772250	daomodi@humaneafrikanmission.org	
19	Fred Ijjo	M	41	Team Leader	Friends of Bamboo Consult Ltd.	0772532159	fredijjo@gmail.com	
20	Olanya Jimmy	M	51	Chief Executive Officer	Jecon Group of Companies	0776652033	olanyajiekamgroup@gmail.com	
21	Francis Iwa	M	51	Executive Director	Care and Assistance for Forced Migrants	0772778877	Francis.i@cafomi.ug	Kampala
22	Ms. Chepkoech Deborah	F	26	Administrator	Uganda Bamboo Association	0750096016 0785514057	debieko@gmail.com	Kampala
23	Ms. Namirembe Sarah	F	27	Nursery Manager	Tree Trends Nursery	0700518996 070436744 0784422304	sarah.namirembe92@gmail.com	Kampala
24	Alfred Alumai	M	46	Senior Lecturer	Muni University	0776780280	a.alumai@ug.com	Arua
25	Moses Opio Ogal	M	64	Managing Director	Eco ways (Uganda) Ltd.	0772311810	ogwalopio@gmail.com	Agago
26	Ms. Divine Nabaweesi	F	36	Chief Executive Officer	Divine Bamboo Group	0702902233	info@divinebamboo.com	Kampala

27	Mrs. Gertrude Newumbe	F	62		Elgon Naturals	0772350028	nasiogetu@gmail.com	Mbale
28	Mr. Sajjabi Tom	F	27	Chief Executive Officer	Bamboo Products U Ltd.	0706316657 077505480		Kampala
29	Mr. Gasana George	M	47	Coordinator - Plantations	National Forestry Authority	0772631605	georgegasana72@gmail.com	Kampala
30	Leo Twinomuhangi	M	42	Coordinator – Policy and Planning	National Forestry Authority	0782561940	loet@nfa.org.ug	Kampala
31	Hon. David Ebong	M	47	Chief Executive Officer	Egrets Eco- conservation Estates Limited .	0772551591	davidedong70@gmail.com	Apac
32	Olwo Tonny	M	45		Apac Bioenergy Cooperative Society	0772531383	olwotonny27@gmail.com	Apac
33	Stephen Nabende	M	65		Elgon Naturals	0772420008	M	Mbale
34	Phillip Kihumuro	M	33	Research Associate	World Agroforestry Centre	0781413057	p.kihumuro/cgi.org	Kampala
35	Oundo Timothy	M	27	Public Relations Officer	National Forestry Authority	077727053	oundotimothy94@gmail.com	Kampala
36	Weyula Emmanuel	M	34	Public Relations Officer	Elgon Naturals	0752317166	weyulaemma@gmail.com	
37	Bwami Jauhalu	M	28	Economist	Ministry of Finance Planning and Economic Development	0756250308	bwani@gmail.com	
38	Wasike Martin	M	58	District Commercial Officer	Namisindwa Local Government	0782075099	martinwasike@gmail.com	Namisindwa
39	Annet Ayamba	F	35	Chief Executive Officer	Your choice Agro processors Ltd.	0772537093	annetayamba@gmail.com	Kabale
40	Bako Jean	F	43	Accountant Expenditure Accounting	National Forestry Authority	0772870746	bakojo2@gmail.com	
41	Jumba Michael	M	23	Intern Records officer	National Forestry Authority	0705538499	jumbamichael@gmail.com	
42	Ndawula Andrew	M	49	Owner	Talent Agro Forestry Farm	0772414049 0700984963	ndawula@gmail.com	Kampala
43	Namondo Marion	F	35	District Environment Officer	Bududa District Local Government	0785280279	marrionmn@gmail.com	
44	Lavynah Mbambu Marule	F	35	Warden	Uganda Wildlife Authority	0782147512	lavynahmbambu@gmail.com	
45	Tom Okello	M	53	Executive Director	National Forestry Authority	0772550294	lamo@nfa.org.ug	Kampala
46	Munezero Richard	M	38	District Tourism Officer	Kisoro Local Government	0772932018	richmuco@gmail.com	Kisoro
47	Peter Kityo	M		Environmental Specialist	Electricity Regulatory Authority	0782448041	p.kityo@era.org.ug	Kampala
48	Kidosa Ronald	M	30	Member	Elgon Naturals	0774556611	kidasa@gmail.com	Kampala
49	Fred Owera	M	57	Executive Director	Bamboo Forestry Wealth	0772589975	fjowora@gmail.com	Lira
50	David Mukisa	M	52	Managing Director	Nile Bioenergy Limited	0772314882	dmukisa23@gmail.com	
51	Munaaba. N.Flavia	F		Secretary General	Uganda Bamboo Association	0772933354	munflavia2017@gmail.com	Kampala
52	Kalagwa Moses	M	26	Member	Uganda Bamboo Association	0778707787		Kampala
53	Kisakye David	M	26	Chief Technical Officer	Divine Bamboo Group	0700292989	baleesedavid@gmail.com	Kampala
54	Ibanda Ezra	M	25	Director	Ezzy Bamboo Crafts	0705479474	-	Kampala
55	Olat James	M	43	Farmer	Consumer Garden	0773434592	jamesolat@yahoo.com	

56	Mugisha Herbert	M	45	Chief Executive Officer	Mugahinga Crafts Center	0772484262	_____	Kisoro
57	Chaiga Martin	M	44		Moyo District Local Government	0772823602	mchaiga@gmail.com	Moyo
58	Mayegu Isaac	M	44		Mt. Elgon Coffee and Honey Group	0772825602	isacmayegu@gmail.com	Mbale
59	John Okumu	M	60	Head Engineering Laboratory	Uganda National Bureau of Standards	0772937412	john.okumu@unbs.org.ug	Kampala
60	Walimbwa Irene	F	59	Managing Director	AW Bamboo Enterprise Ltd.	0782753448	irenewalimbwa@gmail.com	Mbale
61	Martha Ndyamahaki	F	27	Grower	Bamboo Village - Uganda	0783361289	ndyamuhakimartha@gmail.com	Kampala
62	Muhidwe Erina	M	24	Operation Manager	Bamboo Village - Uganda	0758576636	muhidwe@gmail.com	Kampala
63	Justine Akumu	F	30	Energy Officer	Ministry of Energy and Mineral Development	0789784613	jiakumu@energy.org.ug	Kampala
64	Nabasa K Moses	M	40	Chief Executive Officer	Albertine Investment Ltd.	0785960360		Kampala
65	Kanyesigye Clare	F	24	Manager	Mgahinga Cultural Crafts Centre	0778452008	inksonclaire@gmail.com	Kisoro
66	Bob Kazungu	M	40	Principal Regional Officer	Ministry of Water and Environment	07727712196	bob.kasungu@gmail.com	Kampala
67	Asuman Ratibu	M	40	Director Processing Systems	Uganda Industrial Research Institute	0772497853	asumanire@gmail.com	Kampala
68	Mafumbo Julius	M	54		Ministry of Water and Environment	0772469037		Kampala
69	Fredrick Okiru	M	35	Programme Manager		0772545933	omaxkelly@yahoo.com	
70	Daniel M	M	42		Uganda Forester's Association	0776422455		Kampala
71	Mwiru M Steve	M	45	Manager	Bamboo and Tree Grower	0706708250	_____	
72	Wawakwanyi Moses	M	26	Forest Manager	Manafwa District	0775072629		Manafwa
73	Maxima Migisha	M	50	Farmer	MBM Advertising	0701110000	mmigisha8@gmail.com	Kampala
74	Watsemba Stella	F	38	District Environment Officer	Namisindwa Local Government	0785351165	stellawatsemba@gmail.com	Namisindwa
75	Juliet K Mubi	F	30	Public Relations Officer	National Forestry Authority	0702444294	julietm@nfa.org.ug	Kampala
79	John Tumwebaze	M	51		Ministry of Energy and Mineral Development	0757993762	_____	Kampala
80	Opusi Stephen	M	35	Driver	National Forestry Authority	0776032241		Kampala
81	Lorna Turyahabura	F	48	Chief Executive Officer	KIWOCED CORB project	0773678942		Kampala
82	Muhumuza David	M	41		Uganda Bamboo Association	0772992091	_____	Kyenjojo
83	Mr. Mayegu Isaac	M		Chairman	Mt. Elgon Coffee and Honey Group			Mbale
84	Ms. Divine Nabaweesi	F		Chief Executive Officer	Divine Bamboo Group	0702 902233		Kampala
85	Mr. Nuwamanya Francis	M		Chief Executive Officer	Binewab International	0784 574383		Kampala
86	Hon. Amoko Emmanuel	M		Council Speaker	Moyo District Local Government			Moyo
87	Mr. Mununuzi David	M		Director Plantations	National Forestry Authority	0772 466498		Kampala

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