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MINISTRY OF FORESTRY AND MINES

National Bamboo Policy

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ACRONYMS

ARS	: Action Research Site
AFDB	: African Development Bank
BEST	: Biomass Energy Strategy
CFC	: Common Fund for Commodities
EDPRS	: Economic Development and Poverty reduction strategy
GEF	: Global Environmental Facility
GIS	: Geographic Information System
GMI	: Global Marketing Initiative
GPS	: Global Positioning System
IDRC	: International Development Research Center of Canada
IFAD	: International Fund for Agricultural Development
IFC	: International Finance Corporation
INBAR	: International Network for Bamboo and Rattan
NAFA	: National Forestry Authority
NGOs	: Non Governmental Organization
PPP	: Plant Tissue Culture
PPPs	: Public Private Partnerships
RDB	: Rwanda Development Board
REMA	: Rwanda Environment Management Authority

FOREWORD

This Policy has been developed to fully integrate bamboo into Rwanda's forestry and overall development strategies, harnessing its ideal climatic potential to offer solutions to the country's employment, environment, and energy challenges. With effective implementation, the Policy will contribute to making Rwanda a truly "green" country, with a stronger economy and more secure environment.

The implementation of Bamboo Policy would result to an increase of land under perennial green cover, thereby meeting the national target of 30% land cover. Bamboo development through propagation, processing, value addition and marketing will go a long way in guaranting socio-economic and environmental benefits, to the population and the country at large.

Indeed, Bamboo propagation will provide a sustainable basis for addressing several of Rwanda's most pressing environmental concerns; namely, the need to reverse the rampant soil erosion and deforestation. In addition, it will play a core role in creation of employment, income generation, as well as foreign exchange.

This Policy gives guidelines on how Bamboo will be developed in Rwanda, to derive all benefits from it, ensuring national sustainability. Since this Policy was developed with collaboration with partners such as INBAR, it's my sincere believe that this Policy will benefit from bilateral and multilateral cooperation.

BAZIVAMO Christophe
Minister of Forestry and Mine

1 ISSUE

In Rwanda, there is substantial deforestation of 1.87% (50 sq. km) per year, though the situation seems to be reversing. The main driver of deforestation and soil erosion is the demand for fuel wood and food. With a population growth rate of over 2.8%, there is a growing gap in food production. Increasingly, steeper and higher upland areas are being cultivated. This is leading to considerable soil erosion which is damaging local ecologies that are supporting agricultural production systems and ecological services such as water capture, recharge and cycles, as well as carbon cycle. The turbulent and muddy streams and rivers drain into lakes contributing to their siltation. In the medium to long-term, this loss of topsoil would affect agricultural productivity. It is worthy noting that most Rwandan population depends on agriculture for their livelihoods.

Apart from demand for food, the use of biomass for energy also drives local deforestation. Firewood is the main energy source for more than 98% of rural households comprising 91.4% of population, while charcoal is used by 1.3% of rural households, covering 1.2% of total population. In urban areas, biomass places a similarly large role in meeting domestic energy needs, with more than 52.5% and 39.9% of urban households relying on firewood and charcoal respectively as their primary source of energy.

Rural unemployment and underemployment needs addressing, and surplus rural labor absorbed. This would need leveraging and value addition of natural resources produced in rural areas for both rural and urban consumption. One of the remedy to the aforementioned issues would be bamboo.

Indeed, bamboo is characterized by high growth rate, it's a renewable resource, has a high level biomass production and it is environmental friendly. Most importantly, Bamboo will contribute to the social income generation through sales of high quality bamboo products. Its contribution will also be observed in environmental issues through soil stabilization.

2 CONTEXT

2.1. International and regional context

Bamboo is one of the most commonly used natural resources by people all over the world, and provides substantial benefits for poor rural communities, the environment, and the economy. The International Development Research Center of Canada (IDRC) sought to take this forward and built up a base of technical information and expertise between 1979 and 1993 with a string of integrated projects in several countries in Asia. These were largely focused on research and capacity building, a role that was important at a time when little critical mass existed in most countries. In 1984, it also brought the projects together into an informal network called the IDRC Bamboo and Rattan Research Network in Asia.

Recognizing the immense and geographically widespread potential that bamboo, especially holds for rural income generation, International Fund for Agricultural Development (IFAD), together with IDRC helped to set up International Network for Bamboo and Rattan (INBAR), as an International Secretariat in 1993 and as an intergovernmental international organization in 1997. The goal was to strengthen the adaptive/action-research part of the programme for

improving technology diffusion and scaling-up, and to promote transfers of promising and appropriate bamboo and rattan technologies from Asia to Africa. Starting from 9 members in 1997, INBAR now has 36 member countries including Rwanda, which is member since 2006.

Production to Consumption Systems (PCS) were carried out within a broad framework that took a local to national view in Asia, Africa and Latin America and helped identify entry points for development research and national planning. A number of TOTEMs (transfer of technology models) were developed. As a result, the focus of INBAR's activities from 1999 had seen a shift away from economic research to activities with clearly defined research-development linkages. On this basis, the socioeconomic programme was restructured and the INBAR Livelihoods and Economic Development Programme launched in 2000. The programme has since been focused on developing better ways and means of livelihood development, in particular in rural areas. Considerable progress has been made in developing institutional systems, enabling access to diverse kinds of capital, and ensuring sustainability. Policy support to the sector and market support is increasingly being provided to some countries.

Field Action Research Sites (ARS) have been established in INBAR member countries in Africa, Latin America and Asia to serve as learning models in their respective countries, through a policy of continued technical and policy support to them over the long term and mainly initial financial support. For each site, a supporting NGO was established. The long-term action research sites have helped in the development and validation of new technologies, tools and machines, processes, institutional systems, developing supportive policy, identifying funding sources and financing options, and establishing market linkages, in the process contributing to making these into financially viable economic models. There has been a progressive identification of constraints and opportunities and new bottlenecks to development that are addressed in a technical and methodical manner in collaboration with the community, the government, and others, while documenting the learning for adaptive replication elsewhere. Rural enterprise-market linkages have been developed, production systems improved, and tools and linkages for increased adaptive replication developed. A knowledge sharing initiative and twinning of ARS sites is enabling cross-learning across countries.

More than 20 NGOs across the ARS are being consolidated into an international NGO consortium as a legal entity, to aid cross-sharing of experiences, information, and increasing the efficiency of the programme. Likewise, the Global Marketing Initiative (GMI) 2.0 has been enhanced with country-based GMI Stewards and will also provide Chamber of Commerce activities and validated Yellow Pages functions. Increasingly, inclusive social enterprises are being set up under the banner of NATIVE (Natural Resource Technology and Innovation Enterprises) such as the rural producer community in the ownership. Existing social enterprises are being strengthened and made more sustainable. Supporting microfinance agencies, business development services, and preparation of investment plans for enterprises are being taken forward including Public Private Partnerships (PPPs).

2.2. National context

Background to bamboo policy

In May 2010, the Rwandan Ministry of Forests and Mines developed a new National Forestry Policy, which aims to integrate the forestry sector into existing national policy frameworks, such as Vision 2020 and the Economic Development and Poverty Reduction Strategy (EDPRS). Under the new National Forestry Policy, the Rwanda Government intends to put forests at the

forefront of Rwanda's sustainable development, bolstering their role in protecting the environment, generating employment and alleviating poverty. Using bamboo resources in Rwanda will help achieve the national forestry policy's main objectives of securing soil and water resources, protecting agriculture, enhancing permanent green cover, providing adequate woody biomass for fuelwood and charcoal, and generating economic and employment opportunities. In addition, this will help the country to contribute to the reduction of carbon emission.

Due to its woody properties, fast growth rates, and general ease of processing, bamboo cultivation can provide farmers with the opportunity to significantly increase supplies of timber and biomass without depleting resources.

The policy framework is designed to create strong linkages to markets which provide financial incentives for Rwandan population to grow bamboo. A market-based approach also complements the national forestry policy, which aims to encourage private sector investment in forestry. The policy and action plan is therefore prepared as a business plan for investment.

Status of Bamboo Resources in Rwanda

Bamboo resources of Rwanda comprise bamboos from the natural bamboo forests - Nyungwe Rainforest Park in the west and Volcanoes National Park in the north, and are exclusively for park protection. They constitute the preferred habitat and food for mountain Gorillas, one of the main tourist attractions of Rwanda. Additionally, bamboos are grown in northern and the western districts at the outskirts of the Volcanoes National Park and Natural Forest of Nyungwe (Congo-Nile Crest) respectively. Indeed, there are three species of bamboos which are known to grow naturally in Rwanda. These are *Yushania (Arundinaria) alpina* which is predominantly found in the north eastern part of Volcanoes National Park, *Bambusa vulgaris*, which is dominant in the natural forests of Nyungwe, and *Oxythenanthera abyssinica*. In Kigali, one can find a few clumps of *Bambusa oreobambos*.

Bamboo has not been widely cultivated in Rwanda. In some parts of the North, farmers have been growing bamboo on their farm and homestead lands. Because of the lack of an integrated policy for bamboo sector development, many farmers have replaced bamboo with other crops, such as Irish potatoes, which currently give higher returns. However, more recently, since bamboo is known for its ability to control erosion, the government is laying much emphasis on increasing the bamboo cover in the country which currently stands at 4,381 hectares, or 1.82% of the total forest area. Rwanda is currently promoting bamboo planting to protect riverbanks and lakeshores.

Bamboo has traditionally been used for construction, handicrafts, to support beans, and to make various household articles. In order to realize better value from bamboo and increase employment and income in rural areas, Government of Rwanda in collaboration with Government of China have initiated a Bamboo project called "Bamboo cultivation, Processing and Utilization Technology" to increase bamboo production, as well as its utilization. The project is training artisans from cooperatives, local NGOs, and local companies, on how to make high quality of furniture, handicraft items, toothpicks and barbeque sticks that have a better value and demand in the local and adjacent foreign markets. However, the sector still needs private investments in the projects related to bamboo plantations as well as related industries.

2.3. Utilization and potential of bamboo

Bamboo is a perennial tree-like woody plant that annually produces several poles. If managed effectively tropical bamboos can typically produce 10-40 tons of wood per hectare¹, however some species of bamboo have been reported to produce over 100 tons per hectare². Its tree-like form and stature add to the green-cover of a country. For millions of disadvantaged people in Asia and Latin America, bamboo helps reduce poverty and protect the environment³. Firstly, as a perennial crop with annual production, bamboo provides year-round income. Secondly, its timber-like nature and ease of processing provides rural communities with access to mainstream wood markets hitherto not possible – poor people mostly use wood only as firewood and charcoal. Thirdly, bamboo can be processed in households with little or no investment. Bamboo processing, in comparison to wood, is delightfully simple – it splits linearly, naturally, even with a simple knife or harvesting sickle. In comparison, most value added products from wood need machines and tools, which require purchasing power and capital investments that are often far beyond the reach of the rural poor. Bamboo provides employment opportunities to all, especially poor rural women and youth, as well as disabled people and those with HIV, who can only undertake light work. Both women and men participate in production of diverse products such as furniture, utilitarian items, bamboo charcoal, and charcoal briquettes.

Bamboo, which naturally occurs in Sub-Saharan Africa, grows in a wide range of agro-ecological conditions. It can rebuild soils, rejuvenate tired unproductive soils, and therefore rehabilitate degraded lands and wastelands, eroded lands and homesteads⁴. It grows even better if farmed and treated as any agricultural crop. There are several species of bamboo that are drought-tolerant and grow in semi-arid regions. The promotion of bamboo reduces deforestation, a key cause of poverty and urban migration. Due to its fast growth attributes as well as it's a renewable resource, bamboo can be harvested each year. Bamboos are perennially growing plants with many poles that are annually produced. Depending on use, poles that are 2-4 years old are commonly harvested, while the rest are left intact. Compared to trees, bamboos are more productive in terms of usable poles and woody biomass produced per year.

Finally, with its rhizome system, extensive fine roots and large canopy, bamboo can hold soil together, help recover top soil, increase water recharge and raise water levels, thus protecting agriculture and increasing flow in streams. Bamboo increases soil water holding capacity by producing abundant leaf fall that increases soil organic carbon and supports its micro-flora. Bamboo improves the pH of the soil and increases mineral availability to crops.

2.4. Bamboo contribution to Vision 2020

This policy is being put in place in order to enhance achievement of objectives and targets of the Vision 2020. This is, broadly, about improvement of livelihoods of Rwandans through employment creation, increased forest revenues, value addition, more balanced ecological

¹ Banik, R.L., 2000. *Siviculture and Field-Guide to Priority Bamboos of Bangladesh and South Asia*. Bangladesh Forest Research Institute, Chittagong

² Hunter IR, Wu JQ. *Bamboo Biomass*. International Network for Bamboo and Rattan. Working Paper 2002. Available at: http://www.inbar.int/publication/txt/INBAR_Working_Paper_No36.htm. Accessed March 1st, 2010

³ Kumar A., Rao, I.V.Ramanuja., Sastry C., 2002. *Bamboo For Sustainable Development*, Proceedings of the Vth International Bamboo Congress and the VIth International Bamboo Workshop, VSP, Utrecht

⁴ Kutty, V., Narayanan, C., 2003, *Greening Red Earth - Bamboo's role in the environmental and socio-economic rehabilitation of villages devastated by brick mining*, INBAR, New Delhi

benefits and a sustained yield. Specifically, the policy aims at ensuring that the present coverage of forest and bamboo is first overall maintained, well managed and increased to 30% of country total area by 2020. This policy will help to achieve the EDPRS target in forestry sector.

3 VISION AND OBJECTIVES

3.1. Vision

This policy will enhance bamboo development in broadening economic and environment opportunities for the benefits of Rwandans through diversification of forest products for both domestic and international markets. Increase of land under bamboo cover coupled with sound processing technologies will boost job creation opportunities, exportation of bamboo products with high value addition, income generation and hence contribute to poverty reduction. Environmental challenges such as soil erosion, and climate change due to global warming, will be addressed through soil stabilisation, rain water retention and purification of the atmosphere through Green House Gases sink.

3.2. Objectives

The overall goal of this policy is to make Rwanda a truly green Country with a stronger economy and more secure environment.

The specific objectives of this policy are to:

1. Increase bamboo resources and use them efficiently to alleviate shortage of fuel wood.
2. Reduce soil erosion, siltation of rivers and water bodies by growing bamboo on slopes and buffer zones along riverbanks and lakeshores
3. Reverse deforestation and raise the percentage of permanent green cover towards the national goal of 30% land cover
4. Increase economic opportunities of Rwandan population as well as diversifying forests products and promoting export.

3.3. Targets

Current and future biomass demand and supply scenario

In order to estimate the total amount of bamboo planting that is needed, an assessment of the demand for woody biomass is required. Currently, wood demand for firewood and charcoal is high, as well as for home construction and furniture. Alternatively, bamboo can be used to compliment woody trees.

Table 1: Increasing bamboo resources

Activities	2011	2012	2013	TOTAL
Seedlings production	9375	8,088,750	8,089,375	16,178,125
Plantation (ha)	15	12,492	12,493	25,000

Table 2: Capacity building

Activities	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Establishment of a Regional Center of bamboo training	Center will be operational	-	-	-	-	-	-	-	-	-	-
Capacity building in bamboo propagation	200 people will be trained	250	300	350	400	450	500	550	600	650	700
Capacity building in bamboo handcraft	150	200	250	300	350	400	450	500	550	600	650
Capacity building in bamboo furniture	50	100	150	200	250	300	350	350	400	550	600
Capacity building in bamboo modern processing	50	100	150	200	250	300	350	350	400	550	600

Table 3: Increase economic opportunities

Activities	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Job creation in bamboo propagation, plantation, handcraft, furniture and processing	200	250	300	350	400	450	500	600	700	800	900
Income generated from bamboo by year (x1000000)	144	180	216	252	288	324	360	432	504	576	648

Plantation and production plan of bamboo

Once the phase of detailed project planning and sourcing of finances is done during 2011, it is estimated planting will begin from 2011 to 2013, where a total of 25,000 ha will be planted. This will provide the needed biomass. It should be noted that wherever bamboo is planted for reforestation and soil protection, it can be inter-planted with other crops. The exception of course is on slopes steeper than 30°, where tilling is best avoided, unless terracing is possible with the bunds being protected by small diameter bamboo thickets as stabilizers and silt filters. Initially bananas and other light-loving crops can be included. As the canopy closes, it is recommended that yam, ginger, other tuberous crops, and mushrooms, which are all shade tolerant, can be grown within bamboo plantations.⁵

Table 4: Additional biomass production (excl. existing sources) (In Million Tons)

		Year of Production					
Years		2014	2016	2018	2020	2022	2024
Year of planting	2012	0.75	1.25	1.25	1.25	1.25	1.25
	2013		1.00	1.25	1.25	1.25	1.25
	2014		0.75	1.25	1.25	1.25	1.25
	2015			1.00	1.25	1.25	1.25
	2016			0.75	1.25	1.25	1.25
	2017				1.00	1.25	1.25
	2018				0.75	1.25	1.25
	2019					1.00	1.25
	2020					0.75	1.25
	2021						1.00
	Total		0.75	3.00	5.50	8.00	10.50

⁵ Boa, Eric. *Report on Integrated Bamboo Project, CABI/KFRI.*

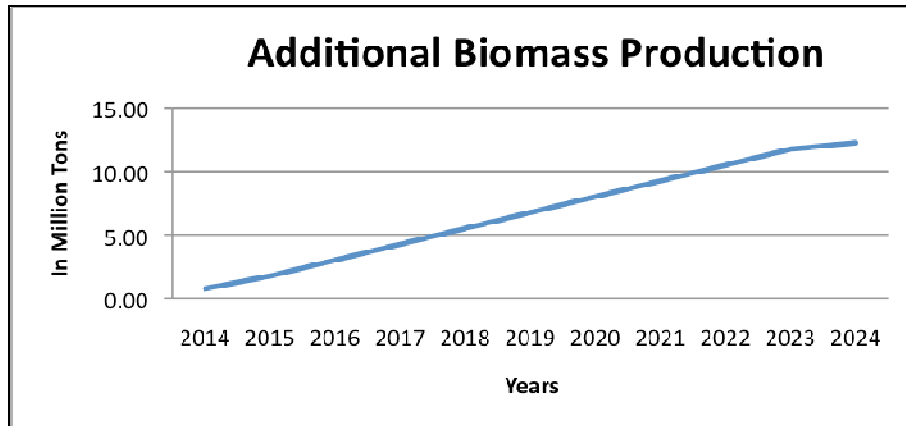


Figure 1: Additional biomass production (2014-2024)

4 GUIDING PRINCIPLES FOR THE BAMBOO POLICY

1. Complement fuel wood demand by bamboo supply: A major contributor to deforestation is demand for fuel wood. Bamboo has good calorific content, which makes it a viable source of energy. Due to its fast growth rates and perennial nature, promoting bamboo for energy could therefore play a major role in reducing deforestation. Indeed, to achieve this, there is dire need to increase land under bamboo cover.

2. Development of bamboo will be based on full engagement of people through tightly organised mobilisation: To enhance bamboo development and easy accessibility of planting materials, it's vital to train producers and processors, on bamboo propagation, maintenance, and processing, as well as value addition. This will in turn enhance their skills and expertise in bamboo development, as well as reduce the cost of production of the planting materials, thus increasing bamboo resources. A regional centre for bamboo development will be developed.

3. Promotion of bamboo will be economic-environment benefits driven: In the current world where economics rules, a direct economic incentive is needed. If the bamboo produced has a ready cash market, the planting would have an immediate incentive. It is then more likely that many of the 2.5 million households in Rwanda with access to land in rural areas (and even urban areas) would plant bamboos (and trees) and steward them.

The cash use of bamboos, which is important for economic growth and job creation, commonly would come from use as fuel wood production, honeycomb briquette making, for furniture, handcrafts and construction, as it does for wood. However, compared to the huge need for growing perennial woody plants like bamboo to meet green cover targets, the market absorption of annual production of bamboos for the above uses would be limited. Therefore, larger markets are also needed.

Bamboos as perennial woody plant, with a strong rooted system, will efficiently combat soil erosion in the context of our hilly country characterized by susceptibility of run-off. In regard to mitigation of climate change due to global warming, Bamboo as the most producer of biomass is among the most efficient species in contributing to the well being of people while serving the carbon sequestration function.

4. Bamboo research will address species diversification and processing, using modern technologies for high value addition to products:

In Rwanda, there are three species of bamboos known to grow naturally in Rwanda. These are *Yushania (Arundinaria) alpine*, *Bambusa vulgaris*, *Oxythenanthera abyssinica* and *Bambusa oreobambos*. Research need to be done on other bamboo species which can adapt in Rwanda, as well as on how to maximise benefits that can be derived from them.

5. Bind and tie-down soil by growing bamboos anywhere water soil erosion constitutes a threat:

While the soil needs binding, the soil layer as a whole needs to hold together and to be bound to the rock. Otherwise when there is excess water, the soil will liquefy, and get washed away incrementally or landslides will occur. Agriculture removes the protective canopy by cutting down trees and bamboos. Tilling further loosens soil and makes it easier for the rain to wash away more of the soil. Much of Rwanda's land is hilly and so agriculture is practiced on slopes. Water flows faster down slopes and takes away more soil. This effect can be reversed with suitable vegetation including bamboo. Like steel that keeps concrete together, the roots of perennials bind the soil, both the topsoil and the deeper sub-soil, and anchor the soil mass to the underlying bedrock. This is the underground architecture we do not see, but which it is essential to maintain. Bamboos especially, and trees, are needed to keep the soil together. Bamboos grow in the topsoil with a robust, spreading rhizome and an abundant network of roots, forming a protective web. In steeper slopes and areas with heavy rain, planting a few trees having deep roots in between could then "nail" this natural steel-like mesh holding the soil to the underlying rock. The canopy of both the bamboos and the trees reduces the force of rain drops and reduces the dislodging of soil particles which results in soil erosion.

5 PREFERRED OPTIONS AND METHODOLOGY

The preferred options detailed below constitute a national agenda that encompasses the environmental, social and economic realities in Rwanda. They map out the pillars on which the development of the bamboo in the country will be based. The preferred options are proposed on the basis of extensive analysis and they contribute to attain the forestry vision as outlined in Vision 2020. Each option represents a strategic direction that encapsulates the minimum set of investments needed to implement the bamboo policy.

5.1 Source of energy

As a source of woody biomass, bamboo is a good source of firewood. The introduction of bamboo species good in firewood will be done. The bamboo species characterized by larger diameter thick-walled bamboos such as *Bambusa balcoa var Bheema* and *Dendrocalamus asper*, and smaller largely solid bamboos such as *Dendrocalamus strictus* and *Thyrsostachys oliverii* are good as firewood. With their high annual productivity, these are reliable sources. Seeds, vegetatively propagated and tissue culture plants would be made available.

5.2 Soil erosion mitigation

Protection of existing terraces and development of new terraces in farming: Terrace borders can be protected by planting thin bamboos that grow as thickets. Some species of bamboos could be planted to protect newly formed terraces as well as existing ones. These bamboos would quickly grow and prevent soil erosion with rainfall and by runoff. In time, soil collected behind the plant barriers will lead to more horizontal and less erosive terraces.

Indeed, the main priority of the government is developing adequate resources to meet the gap in woody resources for fuelwood use and charcoal production, and the combating of soil erosion. In the Environment law, the distance of 20m of each riverbank on all streams and rivers, and 50m on the banks of lakes and reservoirs bamboo plantation should be used for protection of these areas.

5.3 Construction Sector – housing, buildings and bridges, fences

Stipulating the use of bamboo in house construction, backed by preservation to ensure long life, with advanced designs wood be attractive. In house construction, bamboo can be used in finishing. Consequently, such housing could be a major market for diverse products and would create rural jobs due to the use of a rural resource. Houses in Rwanda currently use resources that are not produced by rural communities – steel roofing sheets, cement, trusses, doors, flooring, etc. The exception is bricks, but substantial energy mainly derived from firewood is used in their production. This exacerbates deforestation, soil erosion and loss of fertility. Eventually, their production could lead to an increase in land degradation, to such a point that it would no longer be cultivable since all the clayey top-soil would have been removed. For the housing foundation too, an innovative construction method enables the building of bamboo houses without leveling and backfilling.

Bamboo houses (or those incorporating bamboo as a structural material) are quite long-lasting when the bamboo is duly treated. Construction for diverse uses is possible; for example, durable and robust bamboo buildings/hotels/lodges (including interiors) could be made in the Northern Province. In any case, bamboo is a favorite of Gorillas, which would make such buildings attractive to tourists. In addition, social housing, school buildings, etc. can be built, as well as, doors, windows, trusses, frames, roofing, and small bridges.

Fences: Fences are another opportunity as all houses need one. Demand on Bamboo as a fence will increase due to the recent policy change in Rwanda on fences. While bamboo fencing currently is a temporary solution, its treatment and better design can make bamboo fences durable, functional and elegant.

5.4 Diversifying Bamboo products

Bamboo products offer the singular opportunity for securing multiple benefits from a single investment since the resource is commonly grown by small farmers and even processed by them, and they benefit from the value addition. Products such as school furniture which is more often than not an institutional market, funded by government or donors, offer a splendid opportunity. Even if a fifth or even a tenth were produced in a year, this would create a large number of jobs in rural areas and a large number of micro and small-scale enterprises. Rwanda

could use international approaches for institutional markets and inter-ministerial/inter-agency coordination.

Volume products such as matchsticks, pencils, incense sticks, slat-flooring, packaging and glue and stress laminated panel boards are easy to produce locally. Craft products such as baskets, mats and other articles will always have their niche market.

6 STAKEHOLDER VIEWS

In the elaboration of this policy document, different stakeholders comprising Government Institutions, NGOs (ADARWA, ARECO, CJEPENYA, KIAKA, RWANDA BAMBOO SOCIETY, MUGACY COMPANY,...) and , private sector contacted and gave their point of view.

A stakeholder validation meeting was conducted in November 2010. Due to the diverse benefits derived from bamboo, the stakeholders expressed the need to develop bamboo and promote its uses by making high value modern products. They appreciated the diverse products that could be made from bamboo and the various production processes that they could engage in and benefit from.

In addition, all stakeholders welcomed the Policy intent of encouraging the private sector to be more engaged in Bamboo development. They believed that private investment will contribute to job creation, generate more monetary incomes and increase Bamboo production on sustainable basis. Stakeholders recognized that awareness raising and training on bamboo propagation, planting and management, as well as creation of Bamboo processing plants, would go a long way in ensuring Bamboo development in Rwanda. It will also encourage farmers to plant more Bamboo and this may result in more ecological benefits for the whole country.

7 IMPLEMENTATION PLAN

Meeting the demand in fuelwood, controlling soil erosion, reducing the erosive impact of agriculture, reducing river bed siltation, reducing lake/reservoir siltation, and reducing and reversing deforestation are all interlinked land-based or land related activities. All these can be linked to the subsistence and cash-generating activities of the people. Successful solutions need to be sought that address these problems at the root, while meeting the local people's aspirations. Thus the proposed solutions need to leverage the local presence of people in their application, and have national scale impact by multiplying the application in a very large number of locations.

The implementation of this policy needs the collaboration of all stakeholders including public institutions, NGOs, and private sectors. The Regional Center for Bamboo Development and other related specialized institutions will help in capacity building.

1. **Bamboo resource production:** Backward and forward linkages into bamboo growing will be established for ensuring efficient management, and labeling of age and location of the harvested culms (poles) such that consistency of quality of the product is ensured.

Planting material would be produced from seeds, and through vegetative propagation and plant tissue culture (PTC). The large number of planting material needed can be produced from tissue culture biotech laboratories that are proposed to be established, which would make Rwanda the highest such producer in Africa. The PTC biotech labs can also mass-produce planting material of most other crops used in Rwanda. In the immediate-term, mainly the first year, bamboo seeds would be used. One kilogram of bamboo seeds contains approximately 10,000 viable seeds (seed count varies widely, and 13,000-15,000 is the more common range). Conventional vegetative propagation would also be carried out.

The choice of species will be governed primarily by their utility and appropriateness as described below. The two main species in Rwanda are the native *Yushania (Arundinaria) alpina* which grows more in the upper reaches, and the exotic *Bambusa vulgaris*, that grows in the lowlands. The latter is not the best bamboo given its high starch content. However, it is easy to propagate. Specific species have been recommended contextually in this policy document.

A clustered approach is recommended. The local natural capital (growing stock) of the households of an area would be enhanced by a shared core plantation in a district of one or more square km subdivided into block plantations of various useful bamboo species that would not only provide the needed bamboo material for different products but also provide propagating material to enlarge the area of production of particular species should the demand rise. Such up scaling of proven species in demand would be done with the participation of interested farmers who would also be able to provide the labor and manage the resource. The endeavor would be to see that the plants are available within short distance such that distance does not become a barrier. The core plantations will thus be linked to the village nurseries in the vicinity, with the aim being to make the cluster independent of planting materials supply. Such core plantations would initially be set up in districts with the most potential and expanded to the others as other activities build up in them.

The household bamboo micro nurseries would be linked to the village nursery that would raise adequate planting material for all the households in the village. All villages in a district would be linked to a mother nursery at the district level that would receive mother stock for multiplying further. (It is anticipated that the nurseries would be used to multiply and produce other planting materials as well.) The households would raise the plants to planting age and undertake planting and maintenance by themselves. Since the country would benefit from the environmental services provided by planting bamboo, if the households agree to raise more bamboos, this could be counted towards their one-day-per-month public service (a system of social credits would be devised linked to services performed and acknowledged by peers and instituted as a part of the Participatory Stewardship System. At the same time, the households would be free to sell the incremental annual biomass production either directly or after conversion to charcoal.

2. **Bamboo resource supply chain:** The village nursery, bamboo collection and transportation, and sales could be organized by a village cooperative where all participating farmers are members. The cooperative would also manage bamboo depots that will be set up, where bamboos of specific age, form (and species where relevant) would be available for sale.

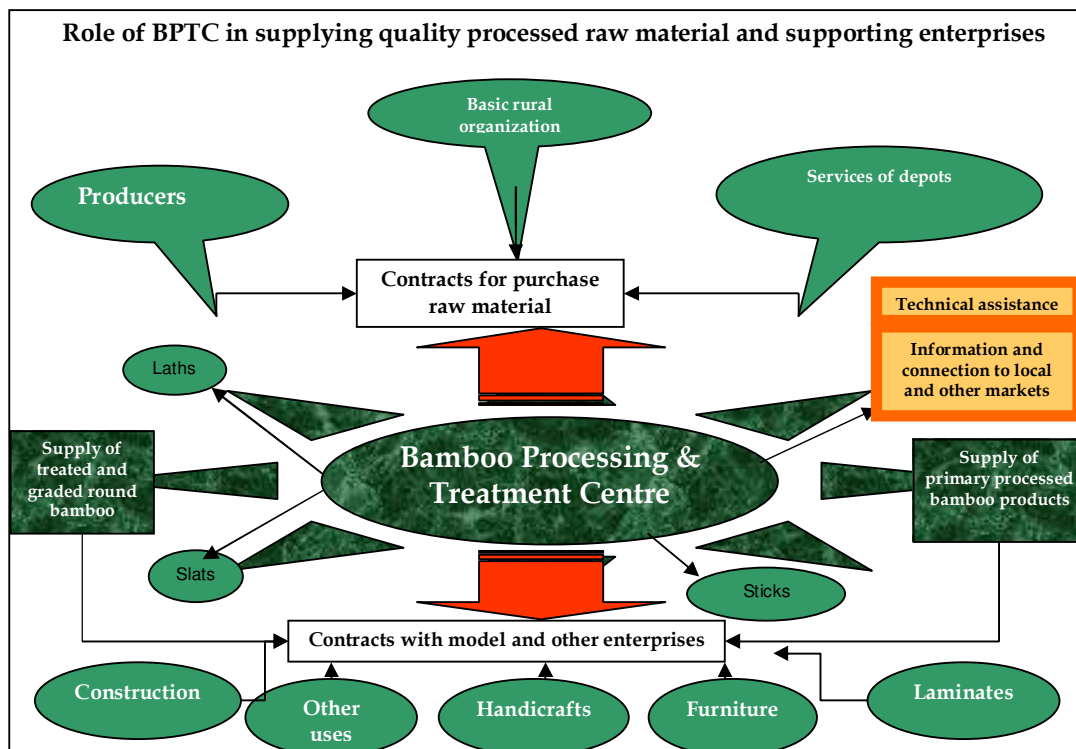
It is important that end-to-end value chains from growing to processing to marketing with support infrastructure and financing are put into place. Doing spot activities such as training, or setting up a processing centre are seemingly visible but wasted investments or investments with poor returns. A processing centre or a trained person without the right resource supply system

that provides the material at the doorstep would not be efficient or workable and have a poor return on investment. These should be located in each district preferably in the same location as the core plantation as the production starts scaling up.

3. **Bamboo Processing and Treatment Centre (BPTC):** One essential and compulsory facility in the districts should be bamboo preservation treatment and processing plants in all bamboo growing areas (BPTC). The treatment is important to assure buyers and users of bamboo that the product is at least as durable as wood and dependable, and the money is well-spent. The supply of treated, graded bamboo will become a commodity, as also that of splits, slivers, planed slats, etc.

The BPTC will be linked to the above-mentioned bamboo depots. It will have a pressure-vacuum preservation treatment plant, a drying area and a large depot to store the input treated and graded bamboo, as well as the output commoditized products and components. A set of processing machines including a wood-turning machine to produce commoditized bamboo components will be installed in the BPTC. A steam bending unit for producing bent components, a furnace for producing bent laminate products and drying kilns will be installed. A set of sanding machines and a finishing set-up will also be provided for. Several of these can be used for wood processing as well.

4. **Bamboo Enterprise Park (BEP):** Model commercial enterprises will set up production of various products in demand in an area around the BPTC campus in independent or condominium-style worksheds. Marketing linkages and production systems will be designed with emphasis on quality, quantity, delivery schedule and price. The model enterprises and the BEP will work on a for-profit basis.
 - a. **Construction:** Bamboo based construction is self-insulating.
 - Housing, tourist huts, health centers, bus shelters, school buildings, etc.



- Equipment required in BPTC: cross cutting, splitting, preservation treatment
 - Set up enterprises that produce components and stock related inputs
 - Train construction teams people who can build with bamboo
- b. **Furniture:** Bamboo furniture can be produced by anyone having basic carpentry skills. Incremental skills can be easily taught to most people. The requirements for setting up a furniture unit are:
- Institutional markets are strong ranging from the educational market for school furniture, tourism market, consumer markets such as residential houses, hotels, etc.
 - Bent-laminate and bamboo membrane furniture units will be set up.
 - Equipment required in BPTC: cross cutting machines, bamboo processing machines, wood-lath machines, spray paint booth, straightening and broaching machine, steam bending set up, drills etc.
- c. **Craft products:** Handicraft products are the current mainstay of traditional market, and also used in tourism including temples:
- Key products: diverse baskets, mats and products, lamp shades, etc.
 - Commoditized primary processed bamboo inputs
 - Small tools and small machines, sizers, jigs and fixtures
 - Process-flow training to standardize these in terms of quality - uniformity in size and shape, improved finish in terms of color and texture, better design, etc.
 - Development of product identities and branding
- d. **Laminate panels and flooring:** Home-based laminate panel production technique will be introduced as well as in-situ bamboo flooring. Though industrial quality products, these will be produced by communities.
5. **Technology transfer and entrepreneurship training:** The model enterprises will provide on-the-job apprenticeship based training for candidate entrepreneurs and a full understanding of the technology and market. Selected individuals from the community will be employed in the enterprises and earn their income in an on-the-job training mode. The numbers of such trainee entrepreneurs and their product orientation will be linked to market-linked projection of production demand so that supply is matched with demand. The cadre of trained entrepreneurs who will graduate them from the model enterprises will be individually supported to set up their enterprises. A system to provide them continuous support and handholding will be put into place and all of them linked together into a cross-supporting network. Process-flow training to all those involved in primary or secondary processing to improve efficiency, effective use of technology and enable them to produce process-sheets and do product costing.
6. **Construction and other support services teams:** Training will be provided to participating individuals in building with bamboo. They will be organized into teams that would execute construction contracts on site. Technical and supervisory support professionals would be recruited as needed, and others contracted such as structural engineers, architects and landscape designers.
7. **Institutions:** A federation of producer cooperatives managing the nurseries and depots will be set up and its technical and managerial capacity built up to undertake handholding, technical, financial and marketing support.

District programme coordinators; entrepreneurial village stewards as local extension points and rural support enterprises, including participatory GPS mapping of resources, production and processing to enable monitoring and logistical efficiency for production, storage, transport and marketing will give the implantation network the needed muscle. The implementation team will work with the government to help incorporate bamboo production and processing technologies and knowledge in curricula at various schools that train forestry and agriculture related curricula. Supporting research programmes would also be detailed out such that a body of trained and capable staff is available to backstop the bamboo programmes under the Rwanda National Bamboo Policy. This would also make possible the development of innovative applications, new products and efficient production systems.

8 FINANCIAL IMPLICATIONS

The implementation of this policy will comprise the following potential financiers' categories:

- (a) Government of Rwanda
- (b) UN agencies
- (c) Grant donors, especially GEF, CFC (through INBAR), etc.
- (d) Loan donors, especially World Bank, IFC, IFAD, KfW, AFDB, etc.
- (e) Bilateral donors, especially China, India, Japan, European Union, USA, UK, etc.
- (f) Public-Private-Partnerships (PPPs).

All these agencies entertain bamboo-based projects under broader mandate of Watershed Management, Agricultural Development, and Promotion of micro Enterprise Sector, and others. They could align their funding mandate as per the proposed policy.

9 LEGAL IMPLICATIONS

1. Land ownership and availability for achieving the 30% permanent green cover as envisaged in the national forestry policy.
2. Adherence to the national policy on wetlands while implementing the buffer plantings.
3. Promote manufacturing and enterprise establishment.

10 IMPACTS ON BUSINESS

Bamboo products of high quality made in Rwanda will be sold to the local market and international market at reasonable price and all chain production of bamboo will create a job opportunities to the Rwandan population. Indeed, the main strategies will be to enhance market opportunities and create new ones by targeting each wood products market segment.

The regional Center for Bamboo Development established in Kigali will be used for training Rwandan population who will be able to make their own products which will be sold and generate money to them. This center will also be open to people from foreign countries who will pay tuition fees to have access to the courses. Meanwhile, they will be paying for various products and services when residing in Rwanda.

Rwanda would become the leading country in plant biotechnology, especially mass-multiplication of plants through tissue culture. With this advantage, it would be able to supply (sell) planting material for plantations of diverse species, such as bamboos, trees, fruit trees, flowers, medicinal plants, etc. that would have significant implications for both national production, export of plant produce and products, and planting material itself.

11 IMPACTS ON EQUALITY, UNITY AND RECONCILIATION

The implementation of the national bamboo policy would make availability of bamboo production chain which will equalize opportunities for individual growth, diversify possible revenue-making activities and allow full expression of potential including entrepreneurship. It will bring the country together through densification and ubiquity of communications and networking. Economic growth and employment opportunities will enhance individual self-respect and standing, and contribute to those affected in the past being able to rebuilt their lives and household economies. Opportunities for training, employment and setting up of enterprises could be made available on priority to all Rwandan. In addition, as different wood product segments are targeted, the production systems would be modified to enable greater numbers of rural poor to participate in them, get employed, and earn income. These are equitable, enabling women, disabled people or other minorities to have equal opportunity to participate in such production systems. Other parameters to be emphasized are the safety and health of the participants and social production labeling.

12 HANDLING PLAN

- 1. Disseminating and implementation of National Bamboo Policy:** The National forestry authority (NAFA) will take the lead in disseminating this policy until to grassroots. It will multiply the policy document and distribute it to the Sector level. In addition to this, broadcasted debates and sensitization workshop will be organized in order to inform the maximum of citizens in different interested groups. NAFA extension group will play key roles in bringing this policy to the grassroots. Front-line extensionist will organize several meetings with farmers and other stakeholders in order to explain them this Bamboo Policy.
- 2. Assess availability of land for planting:** Identification, mapping and classification of lands available immediately and in the future for plantation will be done. Ownership, slope factor, local rainfall, water availability, and like data will be gathered. This will be done using government machinery with the participation of the people. The planting will be done after a detailed planning of the land availability with the government. National Agency in charge of forestry will collaborate with GIS unit / National University of Rwanda.

While an overall plantation programme of 25000 ha is planned, the implementation will be carried out in the framework of intensive afforestation program 2011-2013. This will necessitate the government to support the population to enhance them plant bamboo on their own land. On public land, bamboo planting will be given top priority. To encourage farmers to take up bamboo planting, a buy-back program would be put in place.

3. **Raise awareness of various stakeholder groups:**
 - a. Community groups by ensuring the ownership to the communities
 - b. Banks, microfinance and even government officers dealing with financing should be briefed well enough so that they understand and are prepared as well to take the action plan forward.
 - c. Produce dissemination materials in English and French, and village newspapers in the local language.
 - d. Capacity building: the generic training will be on-the-job in the bamboo enterprise center and on-the-field where bamboo is grown.

4. **Develop good indicators and incentives:** This will be very important as a means of assessing progress. Indicators should be both quantitative and qualitative. This will involve developing ratings on villages, districts, enterprises, cooperatives etc. Medals and cash prizes for excellence will be awarded, and airing of success stories on television and national newspapers will be enhanced. Role models are critical for emulation.

5. **Regular review and updating of the Policy:** It is necessary to make the policy a living document, one that evolves. Such updating which captures experiential learning should be frequent.

13 ANNEXES

ANNEX 1: ROLES OF KEY PLAYERS IN THE BAMBOO SECTOR

INSTITUTION	RESPONSABILITIES
Ministry of Forestry & Mines	Spearheading and coordinating the entire bamboo effort and policy implementation. The Ministry should coordinate an inter-ministry Executive Council, responsible for providing regular strategic and advisory support for implementation of the policy.
Ministry of Agriculture	Explore opportunities for synchronization of the Ministry of Agriculture programmes with that of the bamboo mission of Rwanda based on the proposed policy framework which comes under Ministry of Forestry and Mines
Ministry for Environment and Lands	Work with above ministries for the joint endeavor to overcome soil erosion. It should put in place policies for ensuring that only long-term vegetation/crops are cultivated on slopes steeper than 30 degrees.
Ministry of infrastructure	Having developed the BEST Strategy for Rwanda, the Biomass Wing would be an important linkage to take forward the agenda of addressing the wood deficit in the country. The unit could lead a movement for legitimising charcoal-making, when done using specified renewable resources and methods that enable higher conversion efficiency.
Ministry of Education	Institute a policy for institutional purchases of bamboo school desks for public schools, and the use of bamboo in school buildings.
Ministry for Trade & Industry	Devise incentive systems for bamboo-based micro and small-scale enterprises: micro-enterprises. Popularize the linkage between the Mountain Gorillas, Rwanda's world-famous attraction, and its favourite food, bamboo. Use this to enhance the branding of bamboo and its image in the eyes of the people.
Ministry of Finance	Facilitate the tapping of internal and external financial resources to make the planned implementation of the plan a reality.
NAFA	Coordination of the bamboo development and implementation of the national Bamboo Policy.
REMA	Mainstreaming environment
International Organizations like INBAR	Partner of the Government of Rwanda. Criteria need to be developed for identifying local implementing partners. It is recommended that community-based organizations (CBOs) are set up in each target location to undertake implementation. These should be facilitated by specialized and technically-able NGOs, both from within the country and from others who have the required expertise and experience. It will be essential to bring in technical expertise from abroad to build local capacities, and help implement the action plan since the technical capacity of the Rwandan NGOs is currently limited.

ANNEX 2: DETAILED IMPLEMENTATION FRAMEWORK

This implementation framework shows the main activities which will be carried out for the period of this national bamboo policy and shows the main key responsible organizations as well as the cost of the policy.

Programs	Activities	Responsible	Budget RWF	Time frame				
				2011	2012	2013	2013	2014
Increase economic opportunities of Rwandan population as well as diversifying forests products and promoting export-capacity building	Seedlings supplying	NAFA	10,000,000,000	■	■	■	■	■
	Plantation (ha)	NAFA, private sector, NGOs	2,500,000,000	■	■	■	■	■
	Maintenance	NAFA, Districts, NGOs	1, 750,000,000	■	■	■	■	■
Capacity building shall be strengthened	Establishment of a Regional Center of Bamboo training	NAFA, RDB	72,000,000	■				

	Capacity building in bamboo propagation	NAFA, China Bamboo project	90,000,000					
	Capacity building in bamboo handcraft	NAFA, China bamboo project	133,333,334					
	Capacity building in bamboo furniture	NAFA, China Bamboo project	100,000,000					
Bamboo research reorganized	Capacity building in bamboo modern processing	NAFA, China Bamboo project	99,999,900					
	Conduct different researches	NAFA, ISAR, IRST, NUR	300,000,000					
TOTAL BUDGET			15,044,999,900					

