

Bamboo, the Environment and the Economy: Sustainable Future for Nigerian Investors

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Abstract: The global business environment is becoming more competitive as a result of changes in technology and the international market situations. On the other hand, while poverty creates certain kinds of environmental stress, one major cause of global environmental deterioration is found in unsustainable patterns of consumption and production. Investment in bamboo technology becomes more profitable bearing in mind that it is the fastest growing 'tree', which can be repeatedly cut without having to be replanted. Bamboo finds uses in the paper, food, housing, furniture and craft industries. With the fall in price of crude oil in the world today, it has become imperative to develop strategies for strengthening the economy. Thus, from the non-oil sector perspective, as a way forward, investment objectives must be redirected and emphasis shifted to unconventional products/exports.

Key words:

INTRODUCTION

Bamboo is the fastest growing woody plant on this planet [1]. The plant population is becoming fewer all around us and it seems that people are just getting used to this situation rather than doing something about it. It is actually an enduring natural resource. As it naturally occurs, bamboo is used for housing, utility structures and many articles of everyday use: fuel, food and feed. However, bamboo research has not received necessary recognition in any country except Japan and perhaps China. Now research is in progress on the growth and economics of the grass in other countries like Bangladesh and the Philippines [2-4].

Bamboo is a perennial grass belonging to the class *Bambusoideae* of the family *Poaceae*. More than 75 genera and over 1000 species have been proposed in botanical literature [5]. The plant is versatile with a short growth cycle. More than 10 million tonnes of bamboo are produced annually in the world. Almost all these come from Asia. Bamboo grows in tropical, sub-tropical and temperate zones. It is the fastest-growing and highest-yielding renewable natural resource. The growth of the bamboo culms is very rapid; about 70mm per day and can be as much as 350-450mm per day. The culms complete their growth within 4-6 months. Once the maximum height is attained, lignifications of the culms take place during

the subsequent 2 or 3 years. The culms reach maturity after the 5th or 6th year, or even later, depending on the species. Generally, there is a 3-5 years versus 10-20 years for softwood. The plant tolerates extremes of precipitation, from 760-6350mm of annual rainfall [1,2,5,6].

Bamboo culms are generally cylindrical and smooth, with diameters ranging from 29-300mm. Fibre constitutes 60-70% by weight of the wood of the bamboo and fibre content is greater in the periphery than inside. The average length of bamboo is about 100 times its diameter. Propagation is usually by seed and vegetative parts, the common practice of rhizome cuttings, offset, culm cutting, layering and marcotting.

Bamboos and the environment: The diversity of bamboo makes it adaptable to many environments. The widespread destruction of the vegetative cover is a major cause of the rapid increase in the accumulation of CO₂ and N₂O, two major greenhouse gases in the atmosphere [7]. Being the fastest growing canopy for the re-greening of degraded areas, it generates more oxygen than equivalent stands of trees. It is therefore a critical element in the balance of oxygen/carbon dioxide in the atmosphere. It lowers light intensity and protects against ultra-violet rays and is an atmospheric and soil purifier [8].

The bamboo is an exquisite component design. Its anti-erosion properties create an effective watershed,

stitching the soil together along fragile riverbanks, deforested areas and in places prone to earthquakes and mudslides. The sum of stem flow rate and canopy intercept of bamboo is 25%, which means that bamboo greatly reduces rain run-off, preventing massive soil erosion. This development has been exploited in the Philippines and this could be introduced into environmental management in Nigeria. As an enduring resource, bamboo provided the first re-greening in Hiroshima after the atomic blast in 1945 [8].

In West Africa, it is widely reported that forests, woodland and farm tree populations are being rapidly and extensively depleted, sometimes irreversibly threatening their regenerative capacity. In some areas neem tree is used in agro forestry and reforestation projects because of its rapid growth. Bamboo is a viable replacement for wood. Its rapid growth rate and the derivable benefits offer it a first place in afforestation programmes. Interestingly, there is a 3-5 year return on investment on a new bamboo plantation versus 8-10 years for rattan. Hence, the Governments of India, China and Burma with 19.8 million hectares of bamboo reserves collectively, have begun to focus attention on the economic factors of bamboo production [9-12]. Nigeria, perhaps, may not be left out.

Bamboo in the paper, printing and paper products industry: Bamboo has an outstanding characteristic as a fibre source for the manufacture of paper, the fibre worth, around 2mm; gives it sufficient strength to be used for 100% of the furnish. For cultural paper it does not need any long-fibre reinforcement and in this respect it is superior to hardwood, *bagasse*, or straw. Another advantage is that it can be bleached to an acceptable degree for cultural papers and the pulping process is similar to what has been developed for other wood used in the paper industry. The estimated total world production of bamboo pulps as at the 1970s was put at 1.36 million air-dry metric tonnes [13].

It is certain that without resources of low-cost labour, bamboo would not be used as fibre for paper manufacture. However, very cheap labour is available in

most developing countries: in India, for example, virtually the whole paper industry of that country has been based on bamboo and the technology has developed most there [14] (Table 1 and 2). Another practical example is in the Philippines [2]. Researchers in the Philippines have shown the suitability of some Philippine bamboo for pulp and paper manufacturing although the paper produced are of slightly lower quality than paper made from wood. These local bamboo with potential for making paper are *Phyllostachys edulis*, *Schozostachyum lima*, *Dendrocalamus latiflorus*, *Bambusa arundinaceae*, *B. multiplex*, *B. blumeana*, *B. vulgaris* var. *striata*, *Leleba florinbunda*, etc.

The principal species for making paper is the male bamboo, *D. strictus* [2, 5]. However, *D. latiflorus* and *B. blumeana* appear to be suitable raw materials for Kraft pulps based on pulp strength, yield and acceptable level of silica content. Research results have been shown that bamboo will feature as a major raw material source of fibre pulp for the paper industry and *P. edulis* and *P. reticulata* are the most useful for pulp manufacture [13, 15].

In the Phillipines paper was made out of a blend of bamboo (*D. latiflorus*, *B. blumeana*, *B. vulgaris* and *S. brachycladum*) and it was observed that 50% short-fibre hardwoods and sawmill slabs have good tear resistance but low burst and tensile properties [16].

Low-cost housing: Bamboo is a strong building material. Its tensile strength is 28,000 per square inch (18.06/m²) versus 23,000 (14.84/m²) for steel. The plant already provides income, food and housing for over 2.2 billion people the world over. As an essential material in earthquake architecture, bamboo can provide some amount of security during quakes. For example, in Limon, Costa Rica, only the bamboo houses from the National Bamboo Project stood after the violent earthquake in 1992. Flexible and lightweight bamboo enables structure to “dance” in earthquakes [2, 12, 17].

Prominent among the Filipinos is the use of bamboo in the construction of low-cost houses. The recent rise in cost of housing in Nigeria may necessitate the use of

Table 1: Raw materials demand and supply in pulp, paper and paper products sector for 1988, 1992 and 1996 (metric tons)

	1988 installed capacity	Consumption	1992 installed capacity	Consumption	1996 installed capacity	Consumption
Long fibre pulp	75250	27110	75250	11808	75250	2678
Short fibre pulp	280000	39000	280000	4013	280000	922
Local pines and bamboo	110000	11153	110000	1863	110000	2368
Waste paper	89895	11318	89895	4554	89895	13567

Source: [14]

Table 2: Raw materials sourcing for paper industries

Raw materials	Local	Imported	Observation
I, Wood trees			
<i>Gmelina arborea</i>	+	-	Underutilized
Pines	+	-	Local production inadequate
Bamboo	-	+	Locally available
ii, Fibre pulp			
Short fibre pulp	-	+	Locally available
Long fibre pulp	+	+	Inadequate. Kenaf can be used as a substitute

Adapted from [14], Key to Table: += Yes, - = No

Table 3: Uses of bamboo

Sector	Uses
Agriculture	Beehives, chicken coops, fishnets, fruit pickers, irrigation, waterwheels and pipes, stakes, oyster cultivation, ox cart beds
Art	Baskets, crutches, hats, jewelry, musical instruments, needles
Building/ construction	Frame houses, beds, ladders, ply bamboo, concrete reinforcement
Domestic	Activated charcoal, antenna supports, baby carriages, laundry poles, food
Environment	Ornamental, windbreak, windmill, erosion control, watershed protection
Fuel	Activated charcoal, diesel fuel, firewood
Industry	Silk (textile) industry, construction, furniture
Science	Culture for bacteria, light bulb filament, medicines, mushroom culture,
Transport	Bicycle frame, boats, boat hoods, wagon, walking sticks, Wheelbarrow frame

Adapted from [12]

bamboo in construction of residential houses, business establishments, restaurants and vacation houses. This would be a welcome development in Nigeria.

As reinforcement for cement and concrete: As reinforcement for cement, mortar and concrete, bamboo is gaining acceptance in developing countries. Its wider use in lieu of other materials will be greatly influenced by the understanding of its mechanical properties, physical behaviour and the ability of engineers to quantify these rationally, using simple engineering principles [2, 18].

Worldwide inflation, scarcity of steel and the critical housing shortage in developing countries have accelerated the search for alternative materials as suitable reinforcement for cement and concrete [19]. As a result of the difficulty of providing low-cost

housing for the rural poor, it is important to emphasize and encourage the use of cheaper and abundantly available indigenous material such as bamboo for structural components, such as slabs, beams, walls and roofs.

Other uses: There are many other uses of the bamboo (Table 3). Baskets, beads, ashtrays, bracelets, buttons, combs, flutes, etc can be made out of bamboo and sold out. Other artifacts, better imagined, can also be made. For example, the nearly solid culms of *Dendrocalamus strictus* and similar species are locally used for walking sticks and lance shafts. The quantity of bamboo furniture exports in 1990 (in the Philippines) amounted to 45,501 articles valued at \$1,665,411.00 [2, 5].

Some bamboo species are edible. The antioxidant properties of pulverized bamboo barks have been used to prevent bacterial growth and are also used as a natural food preservative in Japan [20]. Bamboo litter makes fodder for animals and food for fish. *Bambusa blumeana* is greatly utilized in the Philippines. Taiwan alone consumes 80,000 tonnes of bamboo shoots annually constituting a fifty million dollar industry.

The bamboo can be used as potting containers for growing tree seedlings that are not intended for asexual propagation. Some species have been implicated in the production of culture for bacteria and in mushroom cultivation. Interestingly, Thomas Edison successfully used a carbonized bamboo filament in his first experiment with the light bulb [21].

Consideration in the nigerian economy: The Nigerian environment offers promising opportunities in the establishment of bamboo plantation. The need for diversity in raw material acquisition for the resource base industries will go a long way to encourage conservation of our scarce “over exploited” natural (especially timber) resources.

The continuous loss of the nation’s forest ecosystem has serious implication for the *in situ* preservation of the genetic viability and it is a major cause of environmental degradation problems encountered in the country.

Although concerted efforts are being made annually to increase forest cover through tree planting campaigns, the amount of afforestation occasioned by this exercise has remained insignificant [3]. The paper industry in Nigeria has suffered a major set back most especially because of the unavailability of raw materials for the industry. For example, the demand for long fibre pulp in 1989 was 23,000 metric tonnes [14]. The pulp was not

Table 4: Sourcing for raw materials by pulp, paper and paper product manufacturers

Jan-June 1987		Jan-June 1988		Jan-June 1995	
Foreign	Local	Foreign	Local	Foreign	Local
60.10	13.70	84.70	15.30	69.04	30.96

Source: [4]

produced locally. The same situation was experienced in 1993 and 1995 [4, 14]. There is therefore need to step up alternative means of replenishing the local supply (Table 4). The bamboo could be a suitable replacement.

Four genera of bamboo have been identified in Nigeria, namely, *Bambusa*, *Dendrocalamus*, *Guaduella* and *Oxytenanthera* [22, 23]. Worthy of note is a recent market survey carried out by RMRDC which placed a tonne of Indian bamboo, *Bambusa arundinacea*, at =N=5,000. Ordinarily, it is sold at about =N=40 for 6 metre length [18]. Technology already exists in whole-plant equipment for bamboo ware and woodenware making and packaging in Taiwan [24] and this could be adapted to the Nigerian environment.

Bamboo is not only an appreciable plant by the rural poor, but even to the nation as a whole. The demand for bamboo products in both domestic and overseas markets has been on the increase steadily [21]. Bearing this in mind, it is hoped that efforts in boosting agro-based raw materials for industrial use would be extended towards bamboo production and exploitation. Nigeria could be a net exporter of bamboo products if its cultivation is pursued with zeal. Research and development in bamboo technology should also be encouraged in related research institutes and agencies.

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