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Promoting Green Growth of Forest Products Industry in Nigeria through Bamboo Development.

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Abstract

Mechanical processing of bamboo is fast becoming a reality in most economies ranging from Asia to Europe and the United States of America. In Nigeria, forest industry which consists of sawmills, furniture, plywood, particleboard, matches and wood treatment subsectors are undergoing difficult times as a result of dwindling wood resources. Capacity utilization in most of the subsectors has been dipping since the last 20 years. Thus, Nigeria is placing heavy reliance on importation of primary and secondary raw materials for use in the sector. In the first quarter of 2010, Nigeria imported wood products which consist of plywood, kiln and air dried lumber that cost the nation about 20 million euro. This development has made a number of industries to close down. To revitalize the forest industry, it is imperative for the government to initiate plans that will encourage investment in bamboo processing locally. The first step should be institute a bamboo policy framework that will provide guidelines for development of local bamboo industry. The establishment of a bamboo development council will accelerate development of bamboo production and processing in line with the practice in some parts of the world. In line with the extant situation in the forest products industry in Nigeria, the bamboo based investments required for optimal growth of the industry include ply bamboo, mat curtain plywood, chipboards, floor tiles, laminated bamboo strips and bamboo composite products. These products would find application in the furniture, houses and bridges construction industries, including internal applications such as in interior decorations, etc. The development of bamboo industry in Nigeria will solve a lot of social, economic and environmental problems locally.

Keyword: bamboo, plybamboo, bamboo composite products, capacity utilization, investment.

1 Introduction

The history of bamboo's utilization can be traced back to 5000 to 6000 years ago (Zhaohua, 2004). Although, most of the earlier developments in bamboo utilization and processing took place in China (Zhaohua, 2004), the increasing realization of the roles of bamboo in climate change Mitigation, Adaptation and Development (MAD) has made it a bride that most countries are depending on for the development of local industries (Schellnhuber , 2009). According to Wooldridge (2012), bamboo is being hailed as a new super material with uses ranging from textiles to construction. With advancement in technology, nearly 4000 commercial products made out of bamboo or its products are available and in use daily in the world (Singh, 2008). Despite this, bamboo usage is still undergoing transformation, making experts to call the plant the timber of the 21st century (Wooldridge, 2012). This coupled with continual development of new technologies and processing techniques enables bamboo to compete effectively with wood products.

The world bamboo market stands at 10 billion dollars today and the World Bamboo Organization observed it could double in the next five years (Wooldridge, 2012). Dayawansa (2012) also estimated the world trade on bamboo resources in 2002 at 12 billion dollars. With an annual growth rate of 2 billion dollars, total bamboo resources trade will increase to about 20 billion dollars by 2015 (Dayawansa, 2012). Globally, bamboo is being targeted for livelihood development and alleviation of both environment and social problems.

In view of the increasing popularity of bamboo in the industrial sector and its role in the MAD challenge (Schellnhuber , 2009), most countries have initiated plans to invest in bamboo production and processing in order to reduce the role of wood in industrial production processes (Pandey and Shyamasunder, 2008). In Sri Lanka, approximately 24 million dollars is being invested in bamboo processing in collaboration with UNIDO, Global Environmental Facility (GEF) and the Ministry of Industry and Commerce (Dole, 2012). The aim of the Sri Lanka Project is to plant 10,000 hectares of bamboo by 2019 in order to generate 150,000 tones of dry bamboo annually (Dole, 2012). This is expected to create 10,000 direct and indirect employment opportunities. The interest in bamboo development and processing has spread across Asia, Europe and the United States of America. Considering the great potentials of the bamboo industry, the Philippine government promulgated Executive Order (EO) No. 879 on 14th May, 2010, to prioritize bamboo production, processing and market access to local bamboo resources (Dayawansa, 2012). By this, the Philippine bamboo project is expected to promote bamboo industry

development and to direct government's initiative aimed at using bamboo for a minimum of 25% of the desks and other furniture requirements of public elementary and secondary schools, fixtures and construction works sponsored by government. In the USA, the idea of growing bamboo for profit has been at play for nearly a century with test plots of bamboo successfully established in Alabama in 1994 (Stevens, 2012). Although, the project was not optimally pursued in view of the ready supply of bamboo from Asia, the race for truly renewable resources and search for solution to climatic change problems have led to renewed interest in bamboo development in the United States (Stevens, 2012). Another major incentive for bamboo development in the USA is the spread in demand across multiple industries, coupled with diminishing timber resources (Stevens, 2012).

In Nigeria, the current patterns of development in the forest industry which rely solely on diminishing forest resources have been observed to be unsustainable (Ogunwusi and Jolaoso, 2012 and Ogunwusi, 2012a). A number of studies (Larinde 2010; Ogunsanwo, 2010 and Ogunwusi, 2012a) have reported the timber resources in the country to be dwindling in availability. There is therefore need to search for more sustainable, climate friendly alternatives that have potentials for alleviating the social and environmental problems the world is currently facing. Despite the high utilization potentials of bamboo in the wood products sector, the forest industry in Nigeria has been on a gradual decline in terms of capacity utilization (Ogunwusi 2011a) as a result of dwindling timber resources. In this paper, the performance of the forest industries in Nigeria is examined. This is followed by the plausible role of bamboo in resuscitating the forest industry in the country. Green bamboo based investments required to prop up activities in the forest products industry in the country are outlined, having taken into consideration the extant situation in the industry. The prospects and challenges of initiating, maintaining and sustaining the green investments are also discussed.

2 The characteristics and status of the forest products industry in Nigeria

The forest products industry in Nigeria was formally extensive and of major importance (Blackette and Gardette, 2008). Lumber and plywood were produced for domestic market and export. For the past thirty years, as a result of resource depletion, the sector has been on decline. Industrial round wood export which was 781, 200m3 in 1964, dropped to 29,900m3 in 1976 (Blackette and Gardette, 2008). FAO (2006) reported that Nigeria has about 1 million hectares of forests which is about 12% of the total land area, but, largely, in savanna woodland with limited potentials. The forest reserves totaled 9.6 million hectares but 75% is located in savanna zone and only 2.0 million ha are in the high forest zone (FAO, 2003). With an estimated population of about 150 million, Nigeria has enormous domestic demand for construction and joinery raw materials (Blackette and Gardette, 2008).

More recently however, there have been changes in the structure of the forestry sector. The forest resources survey, 1996-1998, revealed that the forest cover has decreased by 20% over the preceding 18 years (FORMECU, 1996). Adeyoju (2001) also reported the total forest estate in the country to be less that 6% of the land area. Ola Adams and Iyamabo (1977), estimated that about 26,000 ha of forest land are destroyed annually in the rainforest zone during the conversion of natural forests to plantation forests and other forms of land use. These developments have significant impact on the operations of the forest industry, leading to decline in the contribution of the industry to national industrial development. Recent statistics, (RMRDC, 2009), indicated that the total volume of usable wood down to 30cm cutting diameter in the forest reserves is 239,775,500cm^3. This is not significantly different from 437,507,205.9m^3 reported by Akindele *et al* (2001) and according to Blackette and Gardette, (2008), Nigeria is now an importer of timber.

The forest industry in Nigeria is principally made up of sawmills, furniture, wood based panels, safety matches and wood treatment subsectors. The installed capacity of the sawmill industry has dwindled considerably. It decreased from 15,793,188m^3 in 1992 to 11,734,000m^3 in 2010 (Ogunwusi, 2012a). The sawmill industry is characterized by increasing number of operatives using outdated equipment, chasing dwindling quantity and quality of wood raw materials. The short fall in installed capacity and actual capacity utilization occurred as the saw mills are structured to utilized large diameter logs which are now limited in the natural forests as, small size timber dominate the present composition of Nigeria's forest resources (Larinde, 2010; RMRDC 2003). In Nigeria, round wood processing has reach the limits of available forest resources such that the future increase in wood production and revenue could be derived from further processing of sawn wood rather than expansion in sawmill and exploitation of wood resources (Larinde, 2010).

Capacity utilization in the furniture industry in 1988 was 217,700m^3 . This increased to 326,172m^3 in 2010. More than 400 companies exist in this sector, while over 10,000 outlets operates at cottage and small scale levels in the informal sector (Ogunwusi, 2012b). The furniture industry in Nigeria dates back to 1872 when commercial logging commenced in the country. The industry depends on simple technologies, low technical knowhow and low capital input. They are mostly made up of outfits with crude hand tools and equipment

(RMRDC, 1991; 2003 and 2009), resulting in poor quality products (GWV Consultants, 1994). The small scale furniture producers are technically inefficient as they fall below efficiency level of 60% (Ako and Kuye, 2010). The implication is that the average furniture producer need 48% cost saving devices to attain the status of efficiency, while least furniture producer need about 88% cost saving devices to become an efficient producer. Most of the small scale operators in this subsector are more interested in quick profit rather than quality control and expansion (NACETEM, 2010).

Plywood production in Nigeria has reduced drastically as a result of high reduction in the volume of economic wood species (RMRDC, 1991; Arowosoge, 2010, Ogunwusi, 2012a). In 1988, the total capacity utilization was 126,000m^3. This decreased to 106,000m^3 in 2010 (Ogunwusi, 2012a). Face veneer is in short supply as one of the major producers, the government owned African Timber and Plywood has closed operations. Currently, a considerable volume of face veneer is being imported from Ghana and various parts of Europe (GWV Consultants, 1994).

From the above, it can be observed that the forest industry requires a change in policy orientation and direction in order to bring it back to its former position. Currently, Nigeria depends almost entirely on imported plywood, particle board, etc, for use in the industry. Also, wood is being imported for use in the sector. Thus, a policy option directed at promoting available, fast growing and climate friendly bamboo in the sector cannot be over emphasized. Most of the requisite raw materials in the sector can be produced locally if the bamboo industry is developed and stabilized. The major bamboo bases investments required in the industry to make it more competitive are subsequently discussed.

3 Green bamboo based investments required in the forest industry in Nigeria.

The importance of promoting bamboo based investment in the forest industry can no longer be overemphasized. According to Dogbevi (2012), Nigeria imported 80% of Ghana's wood products export in the first quarter of 2010 with a total import bill of about 20 million euro. The major items imported from Ghana during this period are plywood and kiln and air dried lumber. In view of the need to reduce Nigeria's dependence on wood products importation, the deployment of bamboo as basic raw material in line with developments in most parts of the world has become imperative (Ogunwusi, 2011b). The processing of bamboo in Nigeria can be built on existing skills rather than entirely new technology (INBAR, 2012). A multitude of different products can be made from bamboo, thus giving investors' a wide range of options and increasing their flexibility and access to market. The last 15 years has seen a dramatic growth in commercial bamboo products such as flooring, laminated building panels (similar to timber based plywood, chipboard and MDF), high quality yarns and fabrics, activated carbon and bamboo extracts (Marsh and Smith, 2012). As a substitute to timber, steel and plywood, a new generation of bamboo plywood products has emerged for use in the building industry. The products feature high strength and rigidity, water and corrosion resistance and low costs of production (Yan, 2006). Marsh and Smith (2012) subdivided bamboo based products into three distinct groups which includes handicrafts, bamboo shoots and premium industrial processing which involves semi mechanical and mechanical processing of bamboo culms.

In the current situation in Nigeria, premium processing of bamboo into industrial products is the most important in order to reduce foreign exchange expenditure on importation of wood products. As observed earlier, nearly all subsectors in the forest industry are in distress as a result of decreasing capacity utilization brought about by old equipment, decreasing availability of economic wood species and low demand for products produced with lesser used wood species (Jayanelti, 1998; Eastin *et. al.,*2003; and Barany *et. al.,*2003). In view of these, stakeholders within the industry have to re-strategize, accept and utilize plant species such as bamboo with high acceptability globally, fast growing potentials and with proven processing equipment and technology. The utilization potentials of bamboo products cut are across multiple sectors and can successfully be used in the furniture, housing, bridges and vehicles construction industries.

To optimize development of the forest industry, production facilities have to be established to produce bamboo based panels which are manufactured under high temperature and pressure with the aid of adhesives. The thickness of bamboo based panels varies from 2-40mm and the dimensions depend on the manufacturing equipment adopted. However, before green investments can be embarked on, it is imperative that government in collaboration with international donor agencies sponsor preparation of feasibility studies to determine the optimal scale of operations and profitability of various bamboo investments (Ruiz Perez et al , 2001; Ruiz Perez et al, 2004). Some of the important green investments appropriate in Nigeria as a result of the present situation in the forest industry are discussed below:

3.1 Production of ply bamboo

Ply bamboo is a special category in a wide variety of bamboo based panels. The main feature of its manufacturing technology is high temperature softening and flattening (Qisheng *et al*, 2001). Softened at high temperature and flattened, bamboo material is processed by a continuous method that maintains its thickness and width resulting in production of veneers of maximum thickness. Ply bamboo has high strength, rigidity and wear-ability and can be used for engineering construction purposes (Gonzalez-Belten 2003). The production process is simple. It entails cross cutting to predetermine length in accordance with the size of the required final products. After this, is the removal of the outer joints with a cutter. The bamboo sections are then split into two or three fragments with a splitting machine and the inner joints removed. Softening of the bamboo material can be achieved in four ways. These include treatment with chemicals, increasing the water content of the bamboo material, raising the temperature of the bamboo material and changes in surface structure and conditions (Qisheng et al, 2002). However, soaking bamboo in lime water, caustic soda, sodium sulfite, ammonia and other alkali solutions, results in changes and softening of the chemical structure of bamboo. However, chemicals change the interior structure of bamboo and damage the mechanical strength. This process also turns the bamboo black and yellow, thereby affecting the quality of final product. Under the present technical conditions, raising the water content and temperature of bamboo fragment are the most effective measures of increasing plasticity of bamboo (Qisheng *et al*, 2002). The softened bamboo fragments are pressed and flattened into strips 60-120mm thick. They are assembled lengthwise and crosswise alternately and made into plybamboo by means of hot pressing after application of a suitable resin. Most of the products have between 3-5 layers and their density varies from 0.8-0.85kg/m^3, resembling the density of deciduous hardwoods.

Ply bamboo is used in making floor of trucks. As high rigidity and high wear ability of bamboo is high, ply bamboo retains these strong points and reduces the short comings associated with small diameter, hollow culms and the differences in strength properties in both longitudinal and radial dimensions. It can be sawn, planed, milled, dried and used for further processing; thereby making it an ideal material for engineering structures (Qisheng et al, 2002). In Nigeria, this product can reduce the dependence on wood planks. Ply bamboo is used in truck floors as weight of steel materials is too high. In addition ply bamboo has high friction coefficient and it does not rust.

Ply bamboo is also used in the building industry in view of its high strength, rigidity and attrition resistance (Gonzalez and Beltran, 2002). Concrete forms of ordinary ply bamboo are produced by covering with phenol resin after pressing and solidification. This type of ply bamboo can be used to make concrete form. Also concrete form of ply bamboo covered with wood veneer and paper can be used in building of bridges, power stations and tunnels (Qisheng et al, 2002).

3.2. Laminated bamboo board (planed)

Bamboo materials are cut into square edge strips of even thickness and width. The strips are bleached or carbonized. They are arranged in one direction during assembling and pressed. The products are multilayered and of great dimension. The surface is fine grained and can be applied in furniture production and in inner decoration, just as in laminated high grade wood.

3.3 Mat plybamboo

Slivers between 8 to 1.2mm in thickness are weaved into mats. The mats are dried and glued. They are then assembled and pressed. The products have between 2 to 5 layers. Both thick and thin boards can be produced. The thin boards are used as packaging materials while the boards can be used as concrete forms and bottom board of trucks.

3.4 Curtain plybamboo.

The strips are arranged in parallel order and connected with strings to convert them to curtains. After gluing and drying, curtains are assembled and pressed. The thickness of products can be regulated according to requirements in the final products. The product can be diversified by means of adjusting thickness and width of strips, assemblage patterns and processing methods to various end uses.

3.5 Laminated bamboo strips

Strips are glued and dried. They are then assembled and pressed into laminated bamboo strips. The strips are soaked in phenol formaldehyde and arranged in parallel order. Most of the products are thick and are used as structural materials. Bamboo laminates can replace timber in many applications such as in furniture, doors, windows, window frames, partitions, wardrobes, cabinets, etc. production. In most cases the slivers are treated for

starch removal and prevention of termite borer attack. They are then subjected to hot air drying followed by four side planning to ensure uniform thickness. They are coated with hot glue on the surface and arranged symmetrically. They are subjected to curing in a hot press at about 70^{o}C using steam and pressure of about17kg/cm^{2}. The pressed laminates are trimmed, sanded, grooved and packaged.

3.6 Mat curtain plywood.

Here soaked mats are used as surface layers and glue curtains as inner layers. They are arranged in lengthwise and crosswise order alternately and pressed under pressure. The mats can be covered with papers soaked in melamine resin or phenol formaldehyde. The product is mainly used to make concrete forms.

3.7 Bamboo chipboard.

This product can make use of stems of smaller diameter, less known bamboo species, stem, tops and all bamboo residues. The process is the same as those of wood particleboard. Production of this product has been recommended as a way of improving utilization ratio of raw materials and economic performance of enterprise. Bamboo chipboard manufactured with phenol formaldehyde resin has comparatively high strength and Modulus of Elasticity, low expansion rate and low rate of water absorption compared with wood particleboard. The products can also be strengthened by adding curtain or bamboo mat to the surface.

3.8 Bamboo floor tiles

High quality floor tiles can be produced from bamboo. The products can be more durable than wooden floors. The production process is simple and consists of cutting of bamboo into slats to extract the premium part of the culm. The slats are laminated with adhesives under high pressure to produce planks. The slats are boiled in a solution of water, hydrogen peroxide and borate solution to eliminate pests and mildew. They are then kiln dried to a minimum of 5% moisture content. They are carbonized by heating the fibre in order to darken the sugar components. After this, the strips will be divided into groups on the basis of colour and members of each group pressed together under pressure. The dried strips will be glue together either in vertical or horizontal grains. After pressing the products will be sanded, tongued or grooved. The products will then be stored in a humidity controlled warehouse for about 2 weeks to enable the moisture content stabilized at 7-9%. The products are then coated with sealer coat followed by aluminum oxide to protect the fibre. This treatment is followed by aluminum oxide sealer coat and scratch resistant poly urethane for ease of finishing.

3.9 Other products

Apart from the products highlighted above, a number of other products can be produced for use in the forest industry in Nigeria. There are prospects for improving projects quality and to decrease production costs by using composite materials to make durable products. The production technology of bamboo-wood composite board combined the features of ply bamboo and plywood. According to Qisheng *et al* (2002), the production efficiency is higher than ply bamboo and the production cost is lower. In addition, the physico-mechanical properties of composite boards are better than those of plywood. Composite board of industrial importance include bamboo wood sandwich composites, laminated bamboo wood sandwich composite, bamboo wood composite floor tiles, strengthened bamboo chipboard, overlaid bamboo chipboard and overlaid bamboo (Oisheng et al, 2002).

4 Prospects and challenges of promoting green investment in the forest products industry in Nigeria

The simplicity of bamboo processing machines is a major prospect for the development of a virile bamboo industry in Nigeria. Since 1980's a number of research and development exercises have been carried out on bamboo processing machineries. Presently there are nearly 100 factories that produce more than 1,200 types of bamboo processing machines in China (Zhaohua, 2004). In general the machinery involve in the mechanical processing of bamboo consists of cross cutting, splitting with circular saws, width sizing, knot removal and planning machines (one side planning and four side planning machines), slab making machine, etc (Damodaran, 2005). Most of the equipment is cheap and affordable. Also in the last twenty years, the dramatic growth in the variety of commercial bamboo products has led to expansion in scope of machinery development for bamboo processing (Marsh and Smith, 2012). The revolution in industrial bamboo processing permitted transportation, and handling of waste shavings, 100% utilization rates and zero wastage, leading to maximum resource utilization.

The low cost and low sophistication of bamboo processing equipment should promote the development of the industry in the country. The cost of importing primary and secondary raw materials in Nigeria has been on the increase. Apart from this, there is high demand for wood products in the country coupled with wide availability of

virgin bamboo forests. The demand for plywood materials is high and increasing. Demand is currently met through imports. As the market for bamboo products is increasing globally, new industries have high growth potentials.

To complement the above, four bamboo general have been identified in Nigeria, namely, Bambusa, Dendrocalamus, Guaduella and Oxytenanthera (Lowe, 1989; Mensah, 1997). The properties of these bamboo species have been investigated and reported to be able to support a virile bamboo industry in locally (Ogunwusi, 2011b).

Another major issue that will facilitate development of bamboo processing in Nigeria is its availability and wide expanse of distribution. RMRDC (2004) reported that bamboo is widely distributed in the south and middle belt regions of Nigeria. According to the report, distribution of bamboo is related to ecological conditions with the rainforest areas having the most abundant. Bamboo is found in abundance in all the States of Southern Nigeria except Lagos and Bayelsa where the distribution is considered relatively less. The most endowed states in terms of bamboo occurrence are observed to be Ogun, Oyo, Osun, Ondo, Edo, Delta, Rivers, Akwa Ibom, Cross River, Abia, Ebonyi, Enugu, Anambra and Imo States. The report indicated that at least 10% of the natural vegetation in these states is dominated by bamboo, with existing bamboo clumps showing appreciable gregarious growth that is contiguous over large areas. In Lagos, Ekiti, Bayelsa, Kogi, Kwara, Benue and Nasarawa States, bamboo distribution was observed to be frequent, indicating that between 6.0 to 9.0% of the natural vegetation is occupied by bamboo. Pockets of bamboo clumps were also reported in Niger, Taraba and Plateau States as well as within the Federal Capital Territory. There are 12 states where bamboo occurrence is rare. These are Adamawa, Bauchi, Borno, Gombe, Kano, Kaduna, Katsina, Kebbi, Sokoto, Jigawa, Yobe and Zamfara.

The distribution pattern indicated that bamboo is particularly adapted to the rainforest belt where it is found in abundance due to the high mean annual rainfall and length of the rainy season. The mean annual rainfall is highest in the southern parts of country where mean annual rainfall is in excess of 1000mm compared to the north central zone with mean annual rainfall of 600-1000mm and north west and north east zone where mean annual rainfall is between 400-600mm (Aribisala, 1993). In the North West Zone, bamboo is found in Taraba state in view of sub-temperate climate (RMRDC, 2004).

The average diameter of bamboo culms in Nigeria varied from 29mm to 200mm while the largest sized bamboo was observed to occur in the South-South and the smallest in the North-East (RMRDC, 2004). The report indicated that the relative diameter of bamboo that exists in Nigeria is lower than some of those reported in literature. For instance, Naixum (2001) reported the average diameter of *Dendrocalmus sinicus* growing in India as 30cm. The average diameters of *D. giganteus* and *Phyllostachys heterocycla* were also reported as 30cm and 10-20cm respectively. The diameter of the Nigerian species is however, larger than what was reported for *Shibataea chinesis (0.2-0.3cm)*, *Brachystachyum densiflorum* (1-3cm), respectively. As some of the small diameter bamboo resources such as those observe in Nigeria are currently being used at industrial levels, the bamboo resources of Nigeria can adequately be used as industrial raw materials (RMRDC, 2004). Already, an industrialist in Asaba, Delta state Nigeria, is already producing bamboo floor tiles from indigenous bamboo species in Nigeria (RMRDC, 2008)

According to RMRDC (2004), the major uses in all the states are as scaffolding materials. Other uses include fencing, yam stakes, environmental amelioration, handicrafts and fuel wood. In the construction of story buildings, bamboo culms are used as pillars to provide temporary support for the decking. The use of bamboo for this purpose has opened up domestic trade for bamboo culms. In many of the rural areas, especially in Cross River and Awka Ibom States, bamboo is also used in the construction of mud houses. In these areas, bamboo culms are used as frames to provide the skeleton for building. The mud is then used to cover the entire skeleton. Houses built this way usually have very straight walls, and they are stronger than mud houses built without bamboo. Apart from the above, several other uses exist, though on a relatively small scale. For instance, there are some situations where bamboo is used as poles for aerial antenna, electrification, rafters, fishing traps, etc. RMRDC (2004) further reported that the current uses of bamboo in Nigeria represent only a fraction of economic activities in the country.

The commencement of a bamboo processing industry in Nigeria will also facilitate bamboo cultivation. More recently, Ondo, Ekiti, Osun and Edo states of Nigeria have indicated interests in bamboo cultivation (RMRDC, 2011). The cultivation and harvesting of bamboo has a number of environmental benefits which include erosion control, recovery of degraded lands reduces runoff and protects watershed, low fertilizer requirement and high biomass generation due to rapid growth rate (Marsh and Smith, 2012; Ogunwusi and Jolaoso, 2012; Alfonso, 1987; Cleaver, 1993)

Among the major challenges a bamboo industry may have in Nigeria is the absence of necessary policy framework for the protection of bamboo producers and processors. Ogunwusi (2012c) observed the need for a national bamboo policy in Nigeria. Among the objectives of the policy is the establishment of a National Bamboo Development Council to midwife bamboo production, processing and protection of bamboo industry (Ogunwusi, 2011b). Closely allied with this, Ogunwusi (2012c) observed the need to treat bamboo processing industries as pioneer industries to qualify them for tax exemption in order to encourage influx of direct foreign investment in the bamboo sector.

The need for government to drive the initiative is also imperative. According to Ogunwusi (2012b), the private sector in Nigeria is weak in terms of funding of projects. This necessitated heavy government investments in import substitution industries in the country in the 1960's to 1980's. Most of the companies became moribund and are now being privatized as a result of mismanagement (Aribisala, 1993). In view of this, and for the success of this initiative, there is need for motivation of industrial giants with necessary capital and the local banks to invest in bamboo processing ventures. Currently, faced with dwindling returns and slow growth in Europe and United States of America, some foreign banks are increasing their stakes in Nigeria and other African countries (Nwokoji, 2012). Such investments could be directed towards this area with adequate planning and motivation. Finally, there is need for a detail study on socio cultural acceptability of bamboo products (Mulraleedenharan *et al,* 2004). This is important as adequate market must be available for investments in bamboo production and processing to be sustainable.

5 Conclusion

The forest industry in Nigeria requires urgent policy intervention to enable it run profitably. The decreasing availability of commonly used species and the dwindling forest resources are already taking their toll on the industry. To promote sustainability of this industry, investments in bamboo manufactured products in the country have become important. The successful achievement of this initiative will however require adequate policy intervention in the sector. Government should encourage private sector operatives, multinationals and investing public to partake in this initiative. One of the ways this can be achieved may be to promote utilization of bamboo based products in government institutions, offices and projects. Any investment in this area should be treated as pioneer investment and exempted from payment of tax for ten years as enunciated in the industrial policy of Nigeria. Also, any investor that plant bamboo should also be treated the same way. Finally, government should create a body to be charged with the responsibility of overseeing bamboo development initiatives locally.

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