Development of Bamboo Industry in Ghana: A viable Option Toward Green Construction.

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Abstract

The heightened concern about climate change and the need for greener future perspective in all forms of development require mitigation and adaptive measures and actions. Certainly, the concern of a developing country like Ghana, will not halt the use of forest resources especially timber in medium and heavy construction. The use of under-utilized non timber forest products, especially bamboo, has been identified. Its development and sustainable utilization will help minimize the pressure on commercial timber species and help balance the need for wood-based construction materials with the environmental concern because of its environmental and material significance. This has led to the study of essential technical properties of native bamboo species in Ghana. This paper explores the use of a suitable bamboo utilization tool (BuT) in some bamboo growing areas and highlights the outcome of preliminary use of this tool in Ghana to ensure green revolution. It was recommended among other things, that stakeholders should devise appropriate and acceptable tools to help promote the sustainable use of bamboo resources in different regions of the world.

Key words: Bamboo industry, bamboo, environmental concern, green construction
Introduction

There is enough scientific evidence to prove that climate change and its existing and potential impact will shape different sectors of the world’s economy to diverse degrees. The Intergovernmental Panel on Climate Change (IPCC) reports that global climate change is already occurring and has impacted natural and human systems and now threatens to amplify the dangers (IPCC 2007). The state and dynamics of these changes is generating conditions of vulnerability which differs in character and degree from place to place. The need for innovative strategies to mitigate and adapt effectively to the impact of climate change is urgent especially in developing countries like Ghana where vulnerability is expectedly high.

Forest resources in the tropics are important tools to adapt effectively to climate change and hence ensure green future campaign. According to results from a 40-year study, tropical rain forests are absorbing nearly five billion tons of carbon-dioxide released yearly into the atmosphere by burning fossil fuels and other sources. This includes previously unknown carbon sink in Africa that is mopping up 1.2 billion tons of carbon dioxide each year (ITTO 2009). The extractive utilization of tropical forests, either legally or illegally, will continue to be an essential component of economic development for most tropical countries with its attendant environmental impact. In the wake of dwindling forest base and increase concern for the environmental benefit of forest resources, users of timber resources are searching for innovative ways of deriving economic development with minimal environmental damages. This will help conserve the dwindling timber resources and enhances carbon sequestration and eventually slow the climate change at least in these areas.

In the area of built environment, there is great concern to ensure green construction. The design and proper implementation of new adaptation strategies in wood processing and utilization is integral to green construction. The concern of a developing country like Ghana is not to halt the use of dwindling timber species in medium and heavy construction. Rather, the search for underutilized industrial materials like bamboo resources is being intensified.

In many tropical forests the sustainable use of bamboo resources is an important part of forest management. Bamboo has about 1500 documented uses worldwide (INBAR 2006). While its use in Southeast Asia is widespread, the extent of bamboo utilization in Ghana and other African countries is relatively low. This is due largely to a lack of knowledge about the technical properties of native bamboo species and also poor processing techniques (UNIDO 2001). Nevertheless, the creation of a sound bamboo industry would help ease the pressure on Ghana’s natural forests. The development of sustainable bamboo industry will help balance product
diversity with the environmental concern because of its environmental and material significance as efforts are made towards green construction.

Bamboo is a good alternative to dwindling timber species of the tropics. Bamboo utilization and the development of bamboo products can help balance technological advancement with environmental sustainability. Bamboos have played a distinctive role in the forest ecosystems. Worldwide, over 2.5 billion people trade in or use bamboo (INBAR 1999). Considering the full potential of bamboo species and relating it to the extent of utilization in Southern Ghana bamboo resources are underutilized (Tekpetey et al. 2007, UNIDO 2001). They are used for everything from construction to irrigation systems, from musical instruments to food and fuel. Currently, the most important traditional uses of bamboo in Ghana include rural housing, furniture and material for handicrafts.

The development of sustainable bamboo industry entails a thorough knowledge of the technical and technological properties of bamboo, the market strategies for the products and socio-cultural implication of the use of bamboo. In a collaborative effort to develop the industry some essential technical studies of the bamboo species were undertaken in Ghana. Specifically, the ultramicrostructural, physical, thermogravimetric behaviour, chemical and phytochemical properties of bamboo species were studied (Ebanyenle and Oteng-Amoako 2007, Tekpetey et al. 2007, Tekpetey 2006).

However, simply knowing technical properties is insufficient for the creation of a viable bamboo-based industry. It was clear that a tool to help determine the most appropriate uses for bamboo resources (both in natural stands and plantations) in a specific area and at particular times was needed in tropical countries like Ghana in which bamboo is common. This paper therefore explores the use of a bamboo utilization tool in bamboo growing areas and outcome of preliminary use of this tool in Ghana to ensure green revolution.

**BuT Analysis**

The Bamboo Utilization Tool (BuT) involves the integration of geographical, technological and socio-cultural information pertaining to the quality, quantity and consumption patterns of native bamboo resources in Ghana. A review of earlier research on bamboo resources was undertaken. This ensured that some commonalities as well as significant variations in bamboo parameters among bamboo-growing countries were identified (Ebanyenle and Oteng-Amoako 2007, Hartter and Boston 2006, Smith *et al.* 2006).

A BuT analysis proceeds in four steps. The first three of these involve the collection of values for three indices:
1) an availability and accessibility’ index;
2) a ‘technological property’ index; and
3) a ‘socio-cultural’ index
Each index is described below.

**AAi**: This index is a numerical summation of the ranking of the extent and quality of bamboo resources in a geographical location at a specific time. It considers both natural and planted stands of bamboo as well as bamboo species diversity and the accessibility of the resource.

**TPI**: This index measures the quality of the bamboo stands, encompassing the evaluation of anatomical properties, type of bamboo, extractive content, cellulose content and photochemical results of extractives. Other components of the index include the physical (basic density and moisture content), morphological and mechanical properties of interest.

**SCI**: This index captures the level of interest and awareness of the communities, their belief systems, and the land tenure issues surrounding bamboo resource use. Other factors include technical know-how, skilled labour and the availability.

For all three indices, rankings are assigned in the range 1–5, where 1 or 2 = high, 3 or 4 = moderate, and 5 = low.

The fourth step in the process involves the use of an integration module. BuT can be represented by the following equation:

\[ BuT = (AAi + Tpi + SCI) \]

Where:

- **AAi** = the availability and accessibility index
- **Tpi** = the technological properties index
- **SCI** = the socio-cultural index.

### Integration Module

The integration module synthesizes and analyzes interactions among the three but indices; it uses the assigned values to select the most appropriate management strategy for a given area. Strategy options include: product diversity and marketing (which would be indicated by a total score of 1–3); industrial processing (premium-value, medium-value, low-value and bulk processing), indicated by a score of 4–7; education and awareness creation, indicated by a score of 8–10; and ecotourism, the conservation of natural resources, and plantation management, indicated by a score of 11–15.
Results and Discussion

The preliminary assessment of BuT at Assin Fosu in southern Ghana indicate marketing and bamboo industry development as the most appropriate strategy. Although a proper bamboo inventory is yet to be undertaken in Ghana, *Bambusa vulgaris var. vulgaris* was identified as the main bamboo species in the area; it is available in Assin Fosu on farmland and in forest reserves.

For Assin Fosu’s bamboo resource, AAi was assigned a value of 4 and, based on earlier technical work (Tekpetey *et al.* 2007) in the area its TPI scored 3. Although the level of awareness about bamboo was generally low among the local people, the region has a bamboo factory with highly skilled staff; the SCI, therefore, received a score of 3. Overall, the BUT value (AAi + TPI + SCI) was 10. This suggests that an appropriate management strategy for the area would be one that creates awareness and diversifies bamboo products.

Conclusion

The development of a viable bamboo industry is integral to attainment of the goal of green construction in Ghana and other places where bamboo resources are being under-utilised. BuT is
a location-specific and time-bound decision-making tool for the sustainable utilization of bamboo resources. It can assist stakeholders in Ghana and other countries to deploy scarce financial resources in a bid to find economically and environmentally viable uses for their bamboo resources. It is hoped that stakeholders in the wood and construction industry would devise appropriate and acceptable tools to help promote the sustainable use of bamboo resources in different regions of the world. Further collaboration among bamboo-growing countries and relevant governmental and non-governmental organizations is recommended to further develop the tool to ensure its wider and effective use.

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