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THE PERCEPTION OF GHANAIANS ON THE USE OF BAMBOO AS AN ALTERNATIVE TO TIMBER

BY

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DECLARATION

Candidate's Declaration

I hereby declare that this dissertation is the result of my own original research and that no part of it has been presented for another degree in this University or elsewhere.

Candidate's Signature …… Date …….

Name: ……

Supervisor's Declaration

I hereby declare that the preparation and presentation of the dissertation were supervised in accordance with the guidelines on supervision of dissertation laid down by the Presbyterian University College, Ghana

Supervisor's Signature …… Date…….

Name: ……

ABSTRACT

Cultivation of bamboo is very key in reducing pressure on forest resources which is currently worsening as time goes by. The study evaluated the potential of bamboo and the perception of Ghanaians on bamboo as an alternative to timber in the country. The study employed a qualitative research design because of its appropriateness in understanding and explaining people's attitude. Using descriptive survey, data were obtained from a sample size 50 people which were chosen out from a population of 200 individuals based in the Forestry Commission, Agriculture (plant protection and regulatory services), Environmental Protection Agency and Non-Governmental Organization's from Accra comprising of academics. A 32-item questionnaire was the main gathering tool for acquiring information on the topic. The study revealed that, the knowledge on environmental benefits of bamboo is very high from the field of the four institutions. Social benefits of bamboo are also known to the academia in the study and also the study has revealed that, the respondents have a high knowledge about the economic benefits of bamboo. Yet the perception of Ghanaians (respondents) on bamboo as a substitute for timber in the country is not encouraging. In order to combat these negative perceptions of Ghanaians, it is recommended that, there should be a comprehensive education which entails the potential and benefits of bamboo to the environment, community and the country at large. For more income generation, the public needs to be encourage to buy and use bamboo products.

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DEDICATION

To my beloved husband Mr. Abu Oppong Sidiki and my lovely kids Adelaide Pomaah, Paa Kwesi Oppong, Owura Kwaku Oppong and Maame Adjoa Agyeiwaa Oppong.

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CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Ghana's forest products industry plays a very important role in the country's economy. Ranking third in export value, its exports trail only those of gold and cocoa. The sector contributes about 6% of the country's GDP; 11% of foreign exchange earnings and 30% of export earnings (Bank of Ghana, 2004). Ghana's major export trade goods as reported by the Department for International Development (DFID) and others include agricultural products, timber and mineral resources (mostly gold) (DFID, 2003; FAOSTAT, 2005; World Bank, 2005; 2006a; Ghana Homepage, 2006). Forest products Free on Board (FOB) export value was second to only cocoa in 2004 and 2005 (World Bank, 2006b; Bank of Ghana, 2004).

Bamboo is an integral part of forestry, but it is also widely spread outside forests, including farmlands, riverbanks, roadsides and urban areas. It is quickly changing its image from the "poor man's tree" to a high-tech, industrial raw material and substitute for wood. Bamboo is an increasingly important economic asset in poverty eradication and economic and environmental development. It has always played an important economic and cultural role across Asia. Now, the use of bamboo is growing rapidly in Latin America and Africa as well. In some countries, the processing of bamboo is shifting from low-end crafts and utensils to high-end,

value-added commodities such as laminated panels, boards, pulp, paper, mats, prefabricated houses, cloth and bamboo shoots.

As Ghana progresses steadily towards a middle-income status, the ecosystems are also increasingly approaching their carrying capacity limits. The increasing pressure on the forests resources will worsen in the coming decades as results of rapid urbanization, population increase coupled with rapidly increasing middle class citizens and high rate of urbanization. There will be increasing demands for food, energy, human habitat and transportation; and these have direct implications on the forest timber sector.

In view of these, there has been a paradox in the forestry sector. Indeed, past policies, programs and initiatives coupled with massive development assistance and institutional strengthening and capacity building have neither resulted in the desired change and growth, nor improved the forest timber resource integrity. In fact, over the last three decades, the forestry sector has been characterized by deforestation and degradation. Key among the driving forces of deforestation and forest degradation have been agriculture expansion, illegal logging (chain saw operation) and unauthorized mining (galamsey) operations in the forest areas (Farley, 2010).

Loss of biodiversity due to limited adaptability and adaptability speed of flora and fauna and also health risks through rifting air temperatures and heat waves and increasing pest and pathogens. These growing negative effects of climate change on natural resources and for that matter timber requires a new ecosystem-based

strategy with improved governance in natural resource management. (MOFA, 2007). Hence there is the need to identify and place emphasis on some of the non-timber forest products on a substitute for timber in order to ameliorate the environment, create wealth and a balance between wood production and marketing to satisfy domestic demands. It will also serve as a long-term plan to deal with the intractable weakness inherent in the forest timber sector as well as ensure sustainable natural resource management for the present and future generations.

1.2 Statement of the Problem

The increasing pressure on the timber resources will worsen in the coming decades as a result of rapid urbanization, population increase coupled with rapidly increasing middle class citizens and high rate of urbanization (Anyomi *et al.*, 2011; Hansen *et al*., 2009). The decline of Ghana's forest area has attracted the attention of government, research organizations and educational institutions. To reduce pressure on primary timber species, the government has encouraged the harvest of lesser-used species (Upton and Attah, 2003; Donkor, Vlosky and Attah, 2005) but this is not a sustainable solution to halting deforestation. The Ghana Forestry Commission (GFC) reports that the volume and value of the country's wood product exports prior to 2004 were decreasing at 6% and 10% respectively (GFC report, 2006). This was due to the diminishing trend in raw material availability, and the excessive dependence on commodity products (GFC, 2006). The sale of Teak by the GFC to the industry reversed the trend. Teak has gained great

importance in India and became Ghana's third most important lumber export species in 2005 (GFC, 2006). There will be increasing demand for food, energy, human habitat and transportation and these have direct implications. Already past policies, programs and initiatives as well as massive development assistance and institutional strengthening and capacity building have neither resulted in the desired change and growth nor improved the timber resource integrity. This study seeks to assess the potentials of bamboo; a non-timber forest product (NTFP) as an alternative to timber in the Ghanaian economy.

1.3 Research Objectives

The main objective of this study is to assess the potential of bamboo, a non-timber forest product as a substitute for timber in Ghana.

In achieving this objective, the following specific objectives were studied:

1. To determine the environmental, economic and social benefits of bamboo
2. To assess the importance attached to bamboo as a NFTP in the formulation of forest sector policies in Ghana.

1.4 Research questions

The major research questions that helped the research achieve the objectives of the study are as follows;

1. What are the environmental, economic and social benefits of bamboo?
2. What is the extent of integration of bamboo in the formulation of forest sector policies in Ghana?

1.5 Significance of the study

This study will add more information to the environmental, social and economic benefits of bamboo in Ghana. Furthermore, this study will increase the existing literature about the perception of Ghanaians on Bamboo, as a substitute to timber and it will also serve as a reference material for students and practitioners. Government and the environmental expects, also benefit from the suggestions that will be provided in this research and this will be of benefit to them by taking some ideas from the study and implementing those ideas on the field, also it will contribute to the broadening of academic knowledge of the characteristics of bamboo. The findings of this research would assist government in the integration of bamboo into the policies and programs of the forestry sector of the economy. It will also help in putting measures in place to control the exploitation of bamboo in the forest just like the other species; this way, more attention will be given to bamboo when formulating priority forestry sub- sector policies.

1.6 Justification/Rationale

The diminishing wood resource and restrictions imposed on felling in natural forests, particularly in the tropics, have focused world attention on the need to identify a substitute material which should be renewable, environmentally friendly and widely available. In view of its rapid growth, a ready adaptability to most climatic and edaphic conditions and properties superior to most juvenile fast-growing wood, bamboo emerges as a very suitable alternative. Bamboo has more advantages than wood, such as faster harvest, more sustainable, easier shaping, etc. However, it has not been applied popularly in the construction industry comprising the wood. Hence, the reason for this research need to find out and demonstrate that the bamboo usage to replace the wood is very necessary.

1.7 Scope of study

This study focuses on the perception of Ghanaians on bamboo as an alternative to timber. The research will cover a number of informal self-employed traders engaged in the processing of bamboo and rattan in the country, Forestry Commission staff and the general public.

1.8 Limitations of the study

Inadequate knowledge about bamboo industry as a result of lack of information (e.g., on bamboo plantation management, products, processing, machines and markets) and lack of capital for investment. It is also expected that there are few dealers of bamboo which will limits the amount of data available for this study.

1.9 Organization of the study

The study covers five (5) chapters where chapter one is made up of the introduction of the study, the study's problem statement, objectives of the study, significance, justification, scope and the limitations of the study. Chapter two provides literature on the theories of bamboo.

Chapter three presents the "Methodology", with a detailed description of the research design and procedures that the researcher uses to carry out the research. Primary and secondary data obtained from administered questionnaires are the main fundamental source of data the researcher relied on to the target sample size.

Chapter four deals with the analyzed data on the general knowledge about bamboo, environmental, social and economic benefits of bamboo and its relative discussion and interpretation of the study's result results.

Chapter five provides the summary, conclusions and recommendations.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter consists of three (3) parts. Part one constitutes a brief overview of the forestry sector in Ghana. The overview will throw light on the past and present state of the forestry sector. Part two deals with a review of relevant literature and detail discussions of the characteristic nature of bamboo and its environmental, economic and social relevance relative to the timber species. Part three reviews some of the properties and literature of bamboo that makes it suitable as an alternative raw material for wood composites.

2.2 Overview of the forestry sector

Over the past decade, the Ghana timber industry has experienced major changes that have subjected the industry to severe pressure regarding raw material availability and a struggle for efficient use of limited available timber. After drafting the 1994 Forest and Wildlife Policy, the Ministry of Lands and Forestry decided to develop a Forestry Sector Development Master Plan (MLF, 1994). The plan details strategies and steps for their implementation. The intention is to ensure sustainable forest management, and thus, a sustainable forest product trade.

In the mid-1990s, Ghana's forests were under excessive exploitation, illegal harvesting was rampant and there was utter neglect for established harvesting procedures. In addition, forestry institutions had become demoralized and inefficient because of continued underfunding. As a result, a working group drawn from Government, the private sector and communities developed the Forestry Sector Development Master Plan (FSDMP) (MLF 1996, Ghana Gazette 1996). Before completion of the plan in 1996, interim emergency measures were in operation up to 1995 because of wanton forest destruction that was taking place. These measures were the setting up of task forces to control illegal felling, introduction of a felling permit system for outside forest reserves and introduction of a log export auction system (FD 1994, Ghana Gazette 1996).

The development activities that took place in the forestry sector since the inception of the 1996 Forestry Development Master Plan has shown that to a large extent the objectives of the master plan were greatly achieved. The Master plan introduced a number of strategic initiatives that improved and developed the forest and wildlife resource base and integrated good governance, transparency, and equity and poverty reduction in the forest and wildlife sector. The plan became the entry point for raising awareness on issues related to forest and wildlife management, preparing or updating forest policies, preparing specific programs and projects, and stimulating financial and political support to implement these initiatives. Some of the sector programs and since 1996 includes enhanced policy and regulating

reforms for forestry development, natural forest protection strategy, and legislature reforms; among others (GFDMP 2016-2036).

In keeping with the limitations and challenges, a new Forest and Wildlife Policy-2012 was prepared as a paradigm shift from the past policies. The new policy placed much emphasis on the non-consumptive values of the forest and sought to create a balance between timber production and marketing to satisfy domestic wood demands whilst ensuring good governance and transparency in the forestry sector. The policy objectives are to:

1. Consolidate good governance through accountability and transparency,
2. Enhance active participation of communities and land owners in resource management,
3. Develop small and medium forest and wildlife enterprises as a means of job creation, for the rural and urban poor,
4. Increase biodiversity conservation and ecotourism development,
5. Increase government commitment to degraded landscape restoration through massive plantation development schemes,
6. Promote sustainable management of the savannah woodland,
7. Improve research and application of modern and scientific technology in resource management,
8. Develop climate change adaptation and mitigation measures, and
9. Secure sustainable financing for the forest and wildlife sector.

With the adoption of the new policy, it has become very necessary to revise the 1996 Forestry Development Master Plan, to align it with the objectives of the new policy. It is also important to take up the responsibility of implementing the unfinished programmes under of the 1996 FDMP and respond to the current challenges in the forestry sector. (Forest and Wildlife policy, 2012). It has been become widely accepted that forestry sector planning needs to be redefined to make it a more iterative process rather than a blueprint of activities, and to involve participation, consultations, and dialogue between various concern groups. Some planning is based on a good knowledge of the current state of affairs as the various options for the future. Such Information is currently far from satisfactory in many developing countries.

Better knowledge is needed on state of the forestry sector and on global, regional and national level, priorities and conditions which affect resource management at levels of governance. Some of the relevant national policies and programs that impinge on forestry sector development are the Ghana Shared Growth and Development Agenda (GSGDA) (2018-2021), National Biodiversity Strategy and action plan, the National Environmental Policy-2014, National Wetland Conservation Strategy, traditional conservation practice, climate change initiative etc. GFDMP, (2016-2036).

The recent forest assessment of the high forest zone estimated the total forest land in Ghana at 9.337 million ha in 2015 GFDMP, (2016-2036). This is made up of

1.556 million ha closed forest and 7.81million ha open forests. The forest degradation rate in Ghana is estimated at 45,931.03ha per annum since 1990 GFDMP, (2016-2036). The size of the close forest has decreased from 2.704 million ha in 1990 to 1.556 million in 2015 indicating a depreciating rate of 38,529.65ha per year GFDMP, (2016-2036). Over the years there has been cumulative excess extraction of timber from the on-and off resources.

2.3 Environmental benefit of forest

Environmental benefits of forest are one of our most versatile renewable resources, and is also an important asset for maintaining a clean environment and reversing the effects of salinity. The main ecological benefit is higher biodiversity in the tropical forests. Cleaning the air research shows the greenhouse effect is caused largely by the burning of fossil fuels, which in turn increases the concentration of carbon dioxide in our atmosphere. Burning wood to produce electricity is carbon neutral, because wood is a renewable resource made largely from solar energy. Vigorously growing trees act as a sink and absorb carbon dioxide from the atmosphere. Trees also have the ability to store carbon in their wood fibers (known as carbon sequestration) until fire or decay releases it back into the atmosphere. As trees mature, they become less able to absorb carbon, so it is important that they are regularly replaced with younger trees through thinning and harvesting. Reducing fossil fuel use the saw logs for items such as building products, ensures the carbon

in the wood remains stabilized for long periods, particularly when the timber is recycled. The manufacturing of products such as steel, aluminum and concrete, releases a large amount of carbon dioxide into the atmosphere, and none of these substances have the ability to store carbon in the manner wood fiber can. Rough sawn timber uses less fossil fuel energy per unit than steel, aluminum and concrete, ensuring better energy consumption. Wood is the most renewable material and the most sustainable of all primary industries. By turning our efforts towards increasing forest coverage and productivity, we can help preserve biodiversity and reduce the amount of carbon dioxide in the atmosphere.

2.4 Social benefit of forest

The social benefits include access to forest products that households rely on for their subsistence, such as firewood, fodder for livestock and timber for housing. Timber has been used as a building material for over 400, 000 years and it is very common and best-known material for house construction including framing of floors, walls and roofs. According to Cunningham *et al*. (2005), timber accounts for about half of worldwide wood consumption. This exceeds the use of steel and plastic combined. The preference of timber may not be unconnected to its renewability, abundance, accessibility, versatility, less energy input required for processing and relative cheapness (Lucas *et al*., 2006).

A commercial forest may also provide many other important benefits, which cannot be easily measured, including social amenities such as: intangible benefits arising from work, that is, human utility and self-fulfillment; psychological benefits and also environmental protection of the land base, recreational opportunities for hunters, fishermen, hikers, etc. Crops are not possible without land to grow them. Therefore, protecting the commercial forest land base from alienation to a competing single use, and committing the land to grow trees will ensure renewable timber crops and jobs for future generations. For instance, a number of persons who serve the industry, who transport forest products to market and who provide basic community services are indirectly employed by the forest industry. Indirect benefits are at least two times direct employment benefits in wages and salaries.

2.5 Economic benefit of forest

Forest provides numerous economic benefits to local economies (e.g., sales, jobs, income), and the ability to practice forestry depends upon access to publicly maintained infrastructure (i.e., road and bridges) to transport harvested and manufactured forest products. However, the economic benefit that results because of forestry-related harvesting and manufacturing is not always understood or fully appreciated. Having access to periodic assessments of the economic contribution of forestry and forest products manufacturing can empower advocates to better communicate the economic importance of forestry to policy makers, elected officials, and the public.

Timber generates direct employment and incomes because they produce crops that can be harvested, manufactured and marketed at a profit. Revenues flow to labor, government, investors, operators, contractors and to supply and service firms that cater to both industry and its employees. The economic value of forest land is based on its crop values: timber and range, which are readily described and quantified, compared with other benefits.

It is used throughout the world for many tasks, from simple structural application to highly finished and ornate decoration and it is the dominant industrial material in Nigeria (Fuwape, 2000). There are approximately 200,000 hardwood species and 1,000 softwood species in Nigeria, of the total number; only 2,300 tree species are commercially important (Oluyege, 2007). Different species of timber are used for different purposes in building and furniture industries.

2.6 Characteristics of Bamboo

Bamboo is one of the most important forest resources. More than 1250 species belonging to 75 genera, are being reported worldwide (Shamma, 1980; Scurlock, 2000), which are mainly distributed in the tropical and sub-tropical zone, and a few in the temperate and frigid zone. It usually grows with other tree species in mixed forest, and also occurs under the main storey. In the past, it did not receive much attention but since the 20th century, it quickly began to appear as secondary bamboo forest in tropical and sub-tropical forests due to its fast growth and strong

propagation after the upper canopy species were out (Ding, Grosser, Liese and Hislung, 1993).

The main structure parts of the woody bamboo consist of the root system, a subterranean rhizome system and the aerial culm system with complex branches which bears different foliage organs. (Ding and Liese, 1995). According to the differences in the origin and the functions, the root of bamboo could be classified in three types. When the young shoot sprouts out of the soil, the numerous adventitious roots also called culm roots develop from the nodes of the basal part of the culm contemporary, which anchor the developing shoot and the mature culm later and provides nutrients for shoot growth and culm development. (Ding Tang and Chao, 1997). The roots from the nodes of the rhizomes, also called the rhizome roots function mainly for water and nutrients absorption from the surrounding soil. For some species, aerial roots develop from the modal part of the aerial culm or from the basal part of the branches (Friar and Kochart, 1971). The rhizomes are underground stems which constitute the structural foundation of the plant (Grasser and Liesse, 1971). The tip of the rhizome where growth takes place is so pointed and hard that it can penetrate into surrounding soil (Friar and Kochart 1971). Just like the other timber tree species, bamboo resources need to be conserved and sustained. Bamboo genetic material decreases and disappears sharply because of excessive damage and utilization and have conservation of bamboo genetic resources is very essential. The key constraint in finding a good conservation

strategy is lack of information for establishing a consummate strategy (YANG Yuming, 2006).

Bamboo forms one of the main sections as forestry, but natural forestry management pay very little attention on bamboo and rattan pay more attention to timber or other products; as protection as such productive forest will be concentrated on species investigation and resources prohibited for utilization, which may not always be good. However, local management will do better in conservation and utilization. At present, lack of planting materials and shortage of industrial systems in providing material have been identified to be the primary obstacles for enlarging bamboo plantations in many countries (Botanical Bulletin Academia Sinica, 1997). Ghana is likely to be no exception in the near future. It is important to enhance bamboo yield by selection of good clones and improving plenty techniques (Yongyan Chen *et. al*., 2009)

2.7 Environmental benefits bamboo

Bamboo occurs naturally in many countries of the world; especially in the South Eastern Asia, East Africa and South America (Zhejiang, 2007). Because of its availability and versality, bamboo has been widely used for many purposes and has been cultivated for countries. Bamboo does not only play important role in rural industrial development but also making increasingly large contributions to environmental protection. Environmental benefits of bamboo include the following;

Soil and water conservation, protection of bamboo forests, carbon storage, Aesthetic value among others.

2.7.1 Bamboo for soil and water conservation

Bamboo forms a thick canopy with ever-green leaves, close underground roof systems with high penetration and thick litters on the ground. In fact, the bamboo stands stem flow, canopy interception, water maintaining capacity and soil and water conservation are higher than in Coniferous stands; broad leaves stand and mixed stands of conifer with broad-leaves trees (Zhixiang, Lou Yiping *et al*).

A study in China has shown that where the precipitation is high in the main bamboo stand (*Phyllostachys pubescen*) with a density of 5,100 culms per hectares, the sum of the stem flow rate and canopy interception rate can reach 25% as the water interception by its litter the existing amount of 6,043 kg per hectares can be 0.7mm (Maoyi, Jianghua & LOU Yiping, 2000). It means that bamboo stands have greatly reduced the through fall and run-off, and have prevented soil from erosion. Pure stands of *Chimonobambusa quadrangularis* is has the highest capacity on all the factors mentioned above as if is an excellent forest ecosystem for water conservation. In very hilly areas, bamboo is able to control erosion better than other tree species. A research in China established that, a scientifically designed standard filed run-off plots with regular observations on rainfall and soil run-off processes occurring during heavy rainfalls in a year, bamboo forests have a great effect in

conserving water and soil in hilly farming areas (Bamboo and rattan in the world, 2007).

The through fall rate in the bamboo plantation is 89.14%, the average stem-flow rate is 1.57% and the canopy interception rainfall rate is 9.29% (Da Zhixiang *et al*., 2007).

The capacity of water conservation in volume by the litter in the bamboo plantation is about 27.54 t/ha; which is equivalent to the water contained by 2.4.33mm in depth in the total area of plots, being 14.46% - 19.88% of the total amount of the rainfall (Da Zhixiang *et al*., 2007). As a result, the average run-off quantity in a bamboo plantation compared with a broad-leaved leaves plant like sweet potato farm lands is reduced by 24.6% and the average soil erosion quantity is reduced by 78.56% (Da Zhixiang *et al*., 2007). The soil erosion quantity in the sweet potato land is about 4.7 times higher than in the bamboo plantation; which proves that a significant beneficial effect for soil and water conservation is performed in a bamboo plantation (Da Zhixiang *et al*., 2007).

2.7.2 Protective function of bamboo forests

Management of natural bamboo forests and establishment of bamboo plantations help reduce deforestation, which is one of the main causes of land degradation, partly because bamboo provides a substitute for the forests that are over-harvested

for fuel wood; and partly because it provides alternative sources of income to limit the conversion of woodland for large-scale crop or livestock production. Some of the characteristics of bamboo that makes it unique for the prevention of degradation and rehabilitation of degraded lands includes its fast growth nature, well developed rhizomes and roots that build soil, high capacity for water catchment and conservation; ability to grow remote mountain and rural poor soils, among others (INBAR, 2007). In Thailand, people are *Thysastachys siamensis* for shelter belts, especially around the shoot garden of *Dendrocalamus aspar*. Whiles in Bangladesh and some other countries, people plant *D. strictus* and *Barundinacea* in their villages for shading wind break and adjusting the micro climate to improve their living environment (FU. Xiao & Lou., 2000). In china, after several times of failure with the use of soil- rock engineering and some other tree species along Dayinsjiang River banks of Yunnam province, it became successful for the intended using bamboo.

2.7.3 Bamboo for carbon storage

Development of bamboo resources and industries world-range promotes economic and environmental growth, mitigates deforestation illegal logging, prevents soil degradation and restores degraded lands. The qualities of bamboo have been well studied and are widely known. However, less is known about bamboo as a carbon sink. Carbon dioxide is one of the major gases in the Greenhouse Gases (GHGs) family responsible for global warming. The Kyoto protocol entered into force in

2005 and promoted the Clean Development Mechanism (CDM) as a powerful vehicle for combating global warming. Bamboo probably can compete with the most effective wood species in terms of carbon sequestration capabilities, but unlike wood species, it is not yet a part of the CDM projects.

A study implemented by the International Network for Bamboo and Rattan (INBAR) jointly with the UN Food and Agricultural Organization (FAO), which objective was to identify opportunities for bamboo within the CDM in conjunction with its role as a resource for poverty alleviation was done in 2007 (Lou and Loborikov, 2007). An immediate impact of the study will be exploring the approaches on integration of bamboo along with the forest wood species under the current framework of the CDM. It is believed that further study and this integration will contribute immediately to the proper carbon dioxide balance as well as to economic and environmental development and global fair trade

2.7.4 Bamboo biomass and carbon stock

Bamboo is one of the most productive and fastest growing plants. It may grow up to 1.2m in height per day. The unique growing capacity makes bamboo a valuable sink for carbon storage. The below ground, bamboo biomass makes up to 25% - 50% of the total stock. Carbon stock comprises usually about 50% of the total biomass. Bamboo biomass varies from species to species. The main types of bamboo have been identified relative to biomass and carbon stock composition. The

sympodial (tropical) and monopodial (sub-tropical type). The monopodial type has spreading rhizomes are more like trees yielding one stem from a shoot and may be invasive. Sympodial biomass grows like a bush and are generally non-invasive and are normally substantially more productive than the monopodial ones. For example, tropical *Bambusa bambas* may produce twice as much biomass compared to monopodial moso bamboo (*Phylostachys pubescens*) 280-290 vs. 120-140t/hm$^{2.}$ The above grow productivity of moso bamboo may reach 18-20t/ha per year. (INBAR report to FAO, 2007).

Bamboo has several advantages over tree species in terms of sustainability and carbon fixing capacity. In fact, available studies conclude that bamboo biomass and carbon production may be 7%-30% higher compared with fast growing wood species (FAN Shaohui *et. al.*, 2006). For instance, the tropical *Bambusa bambas* has been measured and a total above ground biomass of 287t/ha with a mean annual production of about 47.8t/ha per year was recorded (Lou and Loboviko, 2007). This figure is about twice that of the Euchalyptus clones. Interestingly, the total biomass of a mature *Bambusa* at 6 years is in fact higher than that of teak at 40 years; 149tc/ha as against 126tc/ha for teak (Lou and Lobovikov, 2007). The sub-tropical moso bamboo reaches above ground biomass of 137.9t/ha and is generally harvested at 5-8years intervals (Lou and Lobovikov, 2007). Every other 5 years, it will produce at least 86t/hm^2 biomass and sequester 43t/c/ha almost twice as much as a teak plantation under the same condition (Lou and Lobovikov, 2007). This includes the total biomass as well as products. Apart from the biomass, bamboo has

other benefits over wood as in carbon stock. (FAN Shaohui *et. al.*, 2006). That is unlike woody plants, bamboo offers the possibility of annual selective harvesting and removal of about 15% - 20% of the total stock without damaging the environment and stock productivity. In fact, over 90% of bamboo carbon can be sequestered in durable products such as boards, panels, floors, furniture, buildings, cloth, paper and activated charcoal. These products have a very long span and may retain carbon for several decades (Lou and Lobovikov, 2007).

Bamboo can play significant role in linking climate change mitigation to sustainable economic development in the developing world. In fact, carbon credits may trigger the creation of otherwise marginal bamboo plantations for processing, jobs and wealth creation. Unlike tree plant plantations which are facing criticisms regarding an un-clear pro-poor focus, bamboo is highly suitable for cultivation specifically for pro-poor development. This is how bamboo carbon can enhance development. Nearly, half of the global deforestation and illegal logging is due to the harvesting of fuel wood. The situation is deteriorating most developing countries. Africa particularly suffers from deforestation due to energy use. However, with the presence available technologies, bamboo production for energy use may well make a significant contribution to the current and future energy needs of the developing world.

Utilization of renewable fuel from bamboo can save vast natural forest resources and non-renewable fossil fuel such as mine coal, oil and gas. This world allows the

retention of carbon already sequestered in forests and in fossil fuels. (FAN Shaohui *et al*, 2006) studied the mean and total carbon sequestrations of two species of bamboo (Chinese fir and moso bamboo). The total carbon sequestration for Chinese fir was much more than moso bamboo. The average carbon sequestration in all organs of Chinese fir was in the following order: trunk (50.43%)> leaf (49.57%)> bark (48.84%)> branch (48.33%)> root (47.89%) (Fan Shaohui, 2006). The average carbon sequestration in all organs of moso bamboo was not correlated to their age and the carbon sequestration was in the following order; sheath, branch, leaf, stem, rhizome, root. The above analysis explains that average carbon storage varies from species and even in parts of some species of bamboo. That is to say that, in tropical and sub-tropical areas the annual biomass and carbon sink per hectares of many bamboo species are comparative to wood tree plants; such as Eucalyptus or teak. The rotation cycle of bamboo also should be considered when comparing it with such species. Bamboo will be harvested annually (say 20% of the growing stock) and will continue producing new culms throughout its life. Every five years, the amount of carbon sequestered per hectare will be the same and the tremendous productivity of the bamboo will not be reflected in living biomass (LOU Yiping, 2006). After 30-40years (at the age of teak or eucalyptus harvesting) the bamboos biomass will still be as high as it was 5-8years of age. (LOU Yiping, 2006). If continues sequestration in durable products is added to the total carbon sequestration figure, the productivity of bamboo should enable it to reach and exceed long term sequestration levels of the best tree species for carbon

sequestration. However, an accurate estimate of net bamboo carbon cannot be made since there have been no comprehensive studies to design the Clean Development Mechanism (CDM) projects. The figure may vary depending on project design and conditions.

2.8 Social benefits of bamboo

People in developed countries such as Japan, the United States, European countries, etc. with their high living standards have made their environments more beautiful and comfortable (Yuming, 2006). Bamboo has evergreen leaves, a fire canopy and tall straight culms and have been used for improving the beauty of their environment. Some bamboo shapes are like a strong-body guard which others are just like a pretty young lady; giving people a great treat. So, in the well-developed countries mentioned above, particularly Japan, has already established many bamboos stands around houses, bamboo botanic gardens, bamboo parks and bamboo villages for sight-seeing over the whole country.

In the last decade, Germany, France, and the United States have done same (Yuming, 2006). In those gardens and parks, many species of bamboos have been collected where entertainment and rest places have been arranged which are neither used as scientific study and rest base as well as a garden for producing culms and shoots (Yuming, 2006). As countries develop and as the standard of living increases or improves, people have paid more attention to

bamboo utilization to beauty their landscape. In China for instance, bamboo has influenced the development of her history and culture for many years and as a result the Chinese take some properties of as a modest. This means that the Chinese like bamboo and given them some moral meanings and values. In addition, the Chinese and Japanese have a traditional art like potted landscape making, in which the great beautiful natural scenery can be modeled and put into a small pot. Many species of bamboo potted landscape can be laid in the field or in the house; which makes the living environment graceful, comfortable and full of life.

Bamboo also plays a key role in human civilization in some countries. Ancient Chinese started using bamboo about 7000 years ago and many Chinese words created based on bamboo were found from the inscriptions on bones or tortoise shell of the Shang dynasty (16^{th} – 11^{th} century B.C). (FU *et al*, 2000). Chinese history and culture have been recorded on bamboo ships for almost 800 years so that the Chinese characters which are characterized by pictographs and expressing meaning could be fixed (FU *et al*, 2000). Since the production of the writing brush and making of paper from bamboo in china and Jung dynasty, a distinctive Chinese calligraphy art has been formed. Later bamboo paintings, carvings, woven handicrafts were produced, which further developed Chinese "Bamboo culture' (FU *et al*, 2006).

2.9 Economic Benefits of Bamboo.

The economic assessment revealed that bamboo plantation, harvesting and processing have both positive and negative economic effects in the geographical areas of growth. Bamboo cultivation creates an opportunity for income generation activities for rural people and serves as job creation to those who engages in its activities as well as employment to small and medium scale enterprises. The most important economic benefits that most rural dwellers get is when they engage in commercial transaction in their bamboo produce.

Commercial bamboo farmers employ worker from the locality to work on their farms. Findings shows that most communities that bamboo is grown commercially benefit from infrastructures such as houses, roads, electricity, schools, hospitals as well as good pipe borne water. The local community and the people have benefited from community development projects from these industries as their livelihood has improved through these benefits.

However, most farmlands and production forest areas have been negatively being affected as bamboo farming has become lucrative and most farmers are now turning their crop growing farmlands into bamboo farms though they do intercrop between the bamboos when they are young. These have caused the migration and destruction of some species of birds, animals, flies, insects and plants that help in provision of food and medicine to the local people within the community. The spillage of chemicals herbicides from the plantation has contaminated the land which causes

the land to become infertile. Most people have to travel long distance to search for limited lands for crops cultivation and if care in not taken food security will become tenuous in the future. In all, the economic benefits outweigh the negative effects as from the assessment made so far in the communities where they are propagated.

Rural communities and people have experienced great impact in their economic lives, infrastructure and in their livelihood. Income generated from farm produces was seen to have declined in areas where commercial bamboo farming is increasing while other income generating activities, such as trade and wage labor has increased in the bamboo enterprises.

2.10 Bamboo properties and suitability as an alternative raw material for wood composite.

Bamboo is the most important non-wood species which is abundantly grows in most of the tropical and subtropical zone. It has developed as a special valuable and superior alternate for wood composite manufactured, such as for pulp and paper, strip-boards, mat-boards, veneer, plywood, particleboard and fiber board. Moreover, several researches have used it as raw material for structural composites such as Oriented Strand Board (OSB), Glue Laminated Timber (GLT), Parallel Strip Lumber (PSL) and Oriented Strand Lumber (OSL). Nowadays, there are many kinds of bamboo composite are produced and traded in the world. However, there are several differences between bamboo and wood for example macroscopic and microscopic characteristics, chemical composition, physical and mechanical

properties. For this reason, the methods, technology and equipment for wood processing cannot be directly applied in bamboo utilization. Further research is noticeably required on the information on bamboo properties, cost-effective technologies and managements. With modern techniques and adapted technologies, bamboo can be processed into a wide range of products which successfully compete with wood and other raw materials in the future. With the rapid development of the global economy and constant increase in population, the overall demand for wood and wood-based composites is rising, while the available wood supply will decrease due to the global biomass demands for the green energy generation.

Consequently, the search for alternative raw materials in place of wood has been come into focus. A suitable raw material should be inexpensive, fast-growing, easily available having comparable physical and mechanical properties to the wood, and also it should be compatible to the existing processing technologies. Bamboo could be such the alternative raw material. Bamboo is one of the oldest building materials used by mankind in tropical and subtropical regions. The bamboo culms have been widely used in building applications, such as flooring, ceiling, walls, windows, doors, fences, housing roofs, trusses and rafters; it is also used in construction as structural materials for bridges, Water-transportation facilities and skyscraper scaffoldings. In addition, it has also been processed into an extended diversity of products ranging from domestic household products such as food containers, skewers, chopsticks, handicrafts, toys, furniture, flooring, boats, charcoal, musical instruments and weapons. In rural areas, bamboo is called the

poor man's timber due to the entire aspects of bamboo utilization in the human life. Since the 20th century, bamboo has received increasing attention for industrial applications, especially as raw material for wood-based composites such as particleboard (PB), medium density fiber board (MDF), hard fiber board (HB), plywood, oriented strand board (OSB), zephyr board, laminated bamboo lumber, parallel strand lumber (PSL) and oriented strand lumber (OSL), inorganic-bonded board (i.e., cement), wood plastic composites (WPC), because of its fast growing nature, high productivity, quick maturity and high strength with an advancement in processing technology and increased market demand.

This review evaluates the suitability of bamboo as the alternative raw material for wood composite products, and tackles about the fact of bamboo, distribution of bamboo resources, bamboo situation in the world, its extraordinary productivity and uses, etc. These basic data are important in formulating effective bamboo resource policies and its utilization. Moreover, it becomes the substitute materials in place of wood for the wood composite industries. Subsequently, the bamboo properties which are important factors to determine its utilization are below.

2.11 Bamboo utilization as an alternative to wood materials.

Bamboo utilization as alternative wood materials may be divided up into following broad categories:

i. **Construction**

Bamboo is a major building material in many countries, particularly in Asia, Africa and South America, because of its strong characteristics, light weight and flexible properties. It can be used for almost all parts of houses, including posts, roofs, walls, floors, beams and trusses.

ii. **Household products**

These include agricultural instruments, fishing tools, handicrafts, musical instruments, furniture, crafts and woven mats.

iii. **Food**

About 200 species of bamboo, a well-known feature of Chinese and other Asian cuisines can provide suitable shoots for eating. Fresh bamboo shoots are delicious and healthy, with high fibre content.

iv. **Charcoal**

Bamboo charcoal is traditionally used as a substitute for wood charcoal or mineral coal. It can serve as a fuel, for cleaning drinking water, cooking, bathing, improving soil, regulating room humidity, preserving freshness of vegetables, fruits and flowers, deodorizing, for conducting electricity, etc.

v. **Pulp and paper**

Because bamboo fibers are relatively long, thus it can be used for paper production. Bamboo paper has practically the same quality as paper made from wood. Its brightness and optical properties remain stable.

vi. **Composite boards**

The use of bamboo in composite boards overcome differences in quality related to the culms. These allow the production of homogeneous products. The panels are widely used in modern construction as structural elements or as forms for concrete moldings. They are also used for flooring, roofing, partitions, doors and window frames.

Bamboo panels have some advantages over wooden boards due to their rigidity and durability. Bamboo is a lingo-cellulosic material like wood. Moreover, both of them are heterogeneous and anisotropic material. Nevertheless, there are several different characteristics between bamboo and wood. Consequently, the methods, technology and equipment for wood processing cannot be applied indiscriminately in bamboo utilization. Thus, it is necessary to understand and apply them thoroughly for successful utilization of bamboo for wood composite manufacture.

2.12 The Characteristic of bamboo culm

The bamboo culm is the upper ground part of bamboo that contains most of the woody material. The culm is straight, hollow and cylinder-formed with nodes and internodes which are the parts between nodes. In the internodes, the cells are strongly oriented axially. No radial cell elements exist and therefore, the transversal interconnection is provided only by the nodes with their solid cross wall, called diaphragm. The variation between internode and node is not desirable characteristics which have an effect on the penetration of liquid adhesive used for bonding the bamboo elements together. In addition, the node part shows higher specific gravity, less dimensional stability and lower mechanical properties. Moreover, nodes cause damage or rapid wear of equipment. Although nodes are not desirable in bamboo utilization, especially for bamboo composites, they cannot be separated from internodes. In processing and utilization, bamboo culm should be closely considered to this problem.

The bamboo macroscopic characteristics vary with the culm height. The internode length, diameter and wall thickness of bamboo culm vary in accordance to the culm position. The internode length increases from the bottom to the middle part and decreases toward the top part. The maximum internode length is located in the 1st third of the culm. The culm diameter decreases from the bottom to the top. Bamboo culms taper towards the top with a gradual decrease in diameter. The culm wall thickness significantly decreases with height. Due to the thick wall and long culm,

bamboo can be processed into many forms of particles, such as flour, fibers, flakes, chips, excelsior, strips, strands and veneer. Moreover, bamboo has a long straight grain which can compensate the potential shortcoming. It can easily be cut into thin and long pieces, such as excelsior, strips, strands and veneers. The diameter of bamboo culm is smaller than those of wood species. The smallest bamboo species, Raddiella vanessiae, can grow as little as 2 cm in height (Judziewicz & Sepsenwol, 2007) while the largest known *Dendrocalamus giganteus* grow up to 60 m in height and 20 cm in culm diameter (Rao, Ramanatha-Rao, & Williams, 1998). Additionally, the culm diameter extremely varies along the culm length. The culms taper towards the top with a gradual decrease in diameter. Then, the bamboo processing might be applied with the highly efficient method and equipment of woodworking industry. In both case, bamboo culm wall is covered by a special tissue. The outermost skin of the bamboo culm consists of epidermal cells that are covered with a waxy layer poor affinity of water and adhesives. The innermost skin or pith is the part of culm wall next to culm cavity. It is composed of sclerenchyma cells. Such characteristic leads to negative influences on adhesion.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter will describe the research design and methodology involved in the study. The main issues considered under Methodology of the study is the study area, population, research design, sampling frame, sampling procedure, sample size, data collection instruments, data collection procedures, actual data collection, data processing and analysis, and ethical considerations.

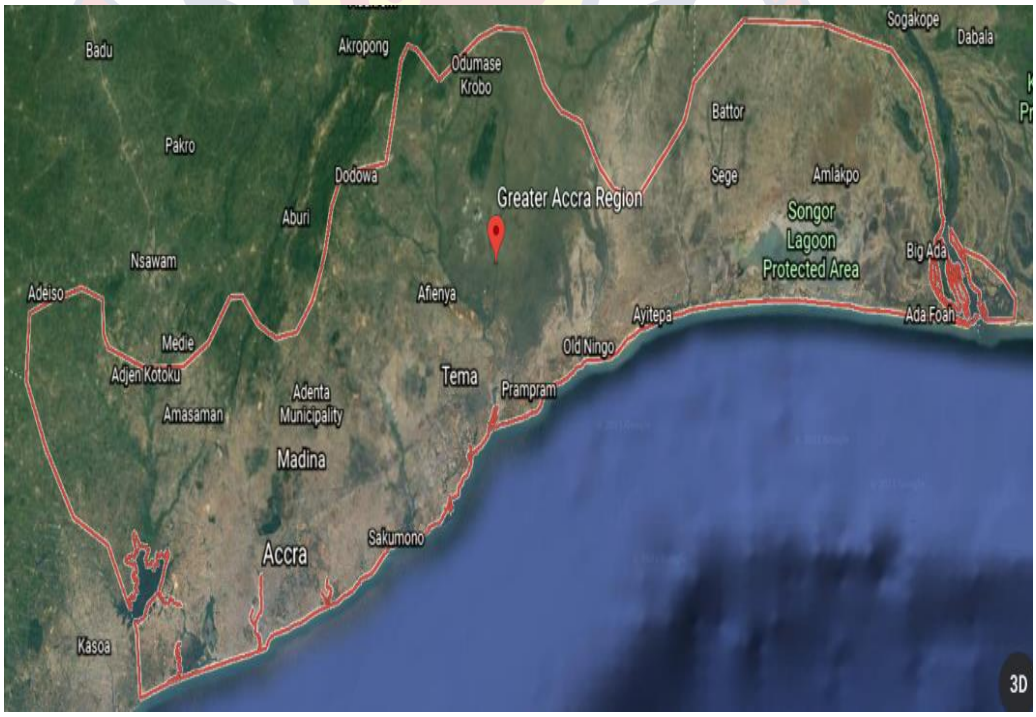
3.2 Study area

The study area is located in the Greater Region of Ghana. The Greater Accra Region which is the gateway to Ghana and home of our vibrant capital city (Accra), is one of the most exciting and distinctive regions. Although the smallest region, it is the most densely populated, containing the two great metropolitan areas of Accra and Tema which are the country's major industrial and commercial centres.

The city of Accra has been Ghana's capital since 1877, and contains fine public buildings reflecting its transition from a 19th century suburb of Victoriasborg to the modern metropolis it is today.

The capital city (Accra) is the largest city, and also the administrative, communications, and economic center of Ghana. It is located on the Gulf of Guinea near the Atlantic Ocean, the city sits partly on a cliff, 25 to 40 feet (eight to 12 meters) high, and spreads north over the Accra plains. According to the Ghana Statistical Service, the population of the Greater Accra Region as at the end of the year 2020 is 5,055,883.

Among the highlights of Accra are the National Museum, with its splendid display of exhibits that reflect the heritage of Ghana from prehistoric times to modern times, the National Theatre with its distinctive modern architecture, the Centre for National Culture, Independence Square, the Kwame Nkrumah Mausoleum, the fishing port at James Town and Makola Market.



Source: Google Earth, 2020

3.3 The Research design

Descriptive survey design is used through the administration of a structured questionnaire. The study focused on the academia for its sample population selected from the MMDAS in selected areas in the Greater Accra Region. It is based in Accra because our target respondents are the academia and all the head offices of the decentralized department are in Accra. It is also as a result of logistical challenges.

3.4 Population of the study

Population of study refers to an entire group of people to which the researcher wishes to generalize the study findings (Burke Johnson, 1997). The population of this study are selected from four areas of academic discipline; which are Forestry, Agriculture (plant protection and regulatory services), Environmental Protection Agency and NGOs. The target population for the study includes 200 staffs emerging from the four institutions in the Accra Metropolis in the Greater Accra region of Ghana.

3.5 Sample size

The sample size for this work depends on the availability of resources. In any case, at least fifty (50) respondents are selected for the study. 48 of these respondents will emerge from the Forestry Commission, Agriculture (plant protection and regulatory services), Environmental Protection Agency and NGOs in the field of

forestry. In other words, 12 respondents each from these institutions and 4 in-depth interviews will be focused on the directors of these institutions.

3.6 Sampling technique

Simple random sampling technique is implemented for this study. Simple random sampling is a subset of a statistical population in which each member of the subset has an equal chance of being chosen (Chaudhury *et.al.* 2007). Respondents are therefore chosen by chance making each member of the population having an equal chance of being selected as a respondent. This is to enable the calculation of sampling error and reducing bias selection of members from the population.

3.7 Source of data

Both Primary and secondary data are collected in this study. The primary data is used in the study to gather information on the environmental, social and economic benefits of bamboo and the perception of Ghanaians on bamboo and its products.

A primary source of data involves first- hand information obtained from the field or a study of the population through the use of structured questionnaires and in-depth interviews. Secondary sources of data are other researchers' works, books from authors, articles and also in addition electronic information especially from the internet. To address the specific objectives of the study, at least fifty (50) copies

of the questionnaire are distributed to 50 respondents in the area of study of which four (4) in-depth interviews will be conducted.

3.8 Data collection instrument

Quantitative and qualitative research instruments of data collection is adopted for the study. The quantitative research instrument constitutes a well-designed questionnaire which is divided into 2 parts; the first part collects the respondents' demographic information whiles the second part collects information that is linked to the research objectives formulated for the study. The questionnaire is administered to the respondents personally, as well as having face to face contact with the respondents. In-depth interviews will used for data collection for the qualitative research instrument.

Journals, newspapers and other related surveys are used for the collection of secondary data.

3.9 Method of data collection

The study uses questionnaire as the primary data collection instrument. This will be collected through a structured questionnaire administered to four institutions; which are Forestry Commission, Agriculture (plant protection and regulatory services), Environmental Protection Agency and NGOs.

Unstructured in-depth interview for managers of these institutions which last for about 10 minutes is used for the collection of qualitative data whereas questionnaire is used to collect quantitative data from respondents.

A 5-pointLikert scale is employed in the administration of questionnaire with scales ranging from “Strongly Disagree” denoted by 1 to “Strongly Agree” represented by 5.

3.10 Data analysis technique

Both the univariate and bivariate Data analysis techniques are applied using the Special Package for Social Sciences (SPSS) version 20 software. The qualitative data content is being analyzed and where necessary, the respondents are quoted verbatim. For the univariate data analysis, simple percentage and frequency distribution are applied whiles the chi-square is used for the bivariate data analysis in order to elucidate information that has to do with relationship in two or more variables.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the analysis and the discussions of the findings of the study based on information gathered from the field. It looks at the research objectives and gives a summary of the survey results that are presented by the tables and graphs in the subsequent pages.

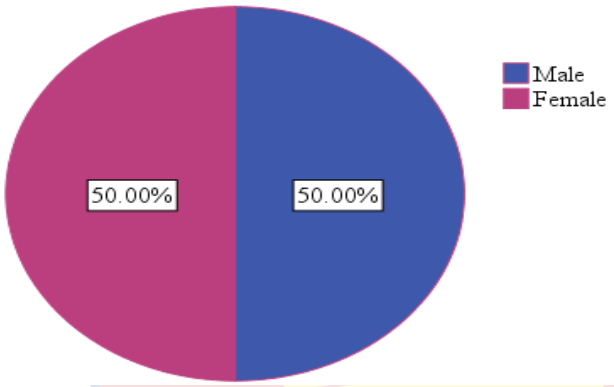
4.2 Demographic Characteristics of Respondents

This section presents the demographic characteristics of the surveyed respondents. This is done to determine competence of people to involve in the study. This specifically looks at the age, gender, and the educational background of the respondents of the respondents. The result is presented in figure 1, figure 2 and table 1 in this section.

Gender

Figure 1 represents the gender of the respondents from the survey. From the data, the total number of males equals the total number of female respondents with a 50% total population size from both sides.

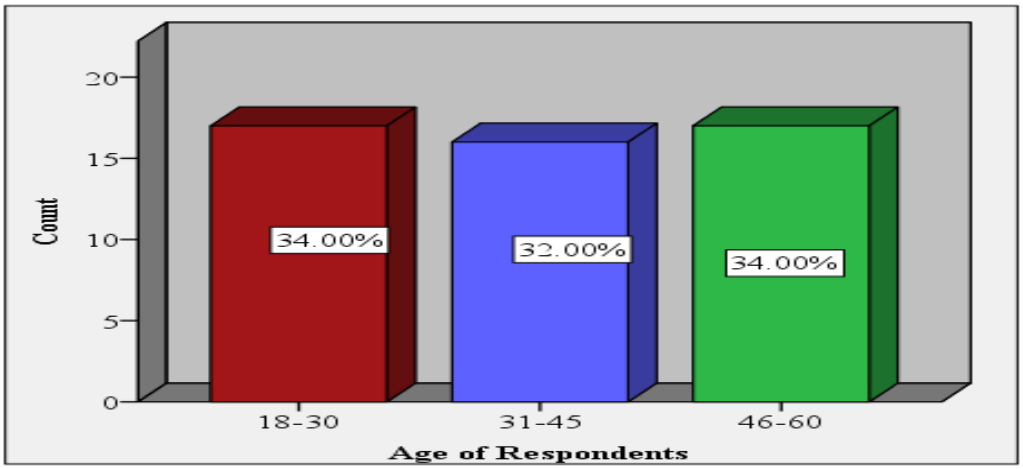
Figure 1 Gender of respondents



Source: Field data, 2020

Figure 2 represent the age of respondents of the survey. It depicts that, majority of the respondents are between the ages 18 – 30 and also 46 – 60 with a count of 17 respondents each making 34% each of the total population. The minority respondents are between the age 31 – 45 with a count of 16 respondents and constituting 32% of the total sample size. With each side having an equal percentage, it however shows that this study has not fully relied on one gender for the collection of data thereby reducing gender bias in the study.

Figure 2 Age of respondents



Source: Field data, 2020

Educational background

Table 1 represents the educational background of the surveyed respondents. From the table, a minority of 18% of the respondents have other certificates and this could include PhD, WASSCE, HND, etc. The majority, 36% of the total population size have attained their first degree and also with a Diploma certificate, a 26% percent of the total population size. 20% of the total population attained a Master's degree. This however shows the degree of intellects that have answered the questionnaires and therefore it is expected that, they have some general knowledge about bamboo and its benefit when it comes to the environment, social and economy.

Table 1 Educational background

Description	Percent (%)
Diploma	26.0
First Degree	36.0
Master's Degree	20.0
Others	18.0
Total	100.0

Source: Field data, 2020

4.3 General knowledge of bamboo

This section presents the general knowledge of bamboo. The fundamental reason is to determine whether or not, respondents know a little about bamboo.

Table 2 represents the percentage of the general knowledge of bamboo by the respondents in the survey.

Table 2 General knowledge about bamboo

Description	1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
1. Bamboo charcoal burns more efficiently and cleanly than wood.	(4%)	(10%)	(34%)	(38%)	(14%)
2. Bamboo regrows after harvesting, just as grass regrows after cutting.	(4%)	-	(14%)	(44%)	(38%)
3. Bamboo is grown without pesticides or chemical fertilizers.	(4%)	(6%)	(6%)	(54%)	(30%)
4. Bamboo grows faster and yield up to 20 times more than wood.	(4%)	(6%)	(8%)	(62%)	(20%)
5. Bamboo requires less or no irrigation for its growth.	(4%)	(20%)	(14%)	(42%)	(20%)

Source: Field data, 2020

Table 3 illustrates the descriptive statistics of the statements “bamboo charcoal burns more efficient than wood”, “bamboo regrows after harvesting”, “bamboo grows without fertilizers”, “bamboo grows faster than wood”, “bamboo requires no or less irrigation” on the general knowledge about bamboo by the surveyed

respondents with their respective mean score and standard deviation using the Likert scale with a minimum of 1 and a maximum of 5.

From the Table, it could be seen that, bamboo charcoal burns more efficient than wood has a mean of 3.4800, bamboo regrows after harvesting has a mean of 4.1200, bamboo grows without fertilizers has a mean of 4.0000, bamboo grows faster than wood has a mean of 3.8800 and lastly, bamboo requires no or less irrigation has a mean of 3.5400. With a careful look, all the mean values assigned to each question is more than 3.0000 and this means that, majority of the respondents have positive knowledge about bamboo per the questioned asked. This shows the knowledge degree of the surveyed respondents on bamboo.

Table 3 Descriptive statistics of general knowledge about bamboo

	N	Minimum	Maximum	Mean	Std. Deviation
Bamboo charcoal burns more efficient than wood	50	1.00	5.00	3.4800	.99468
Bamboo regrows after harvesting	50	1.00	5.00	4.1200	.93982
Bamboo grows without Fertilizers	50	1.00	5.00	4.0000	.98974
Bamboo grows faster than wood	50	1.00	5.00	3.8800	.93982
Bamboo requires no or less irrigation	50	1.00	5.00	3.5400	1.14660
Valid N (listwise)	50				

Source: Field data, 2020

4.4 Environmental benefits of Bamboo

This section focuses on the environmental benefits of bamboo. This reason is also to determine whether or not, respondents are knowledgeable of the benefits bamboo gives the environment.

Table 4 represents the relative percentages of question asked concerning the environmental benefits of bamboo that have been answered by the surveyed respondents.

Table 4 Environmental benefits of bamboo

Description	1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
1. Bamboo sequesters carbon dioxide and its carbon neutral.	-	-	(34%)	(48%)	(18%)
2. Bamboo can help improve overall soil condition in the area.	-	(8%)	(28%)	(38%)	(20%)
3. Bamboo groves also helps prevent onset of erosion especially in sloppy areas	-	-	(8%)	(36%)	(56%)
4. Bamboo helps reduce emission in the atmosphere.	-	(4%)	(14%)	(18%)	(28%)
5. Bamboo can be used as a tool to mitigate climate change.	-	-	(20%)	(48%)	(32%)

Source: Field data, 2020

Table 5 illustrates the descriptive statistics of the statements 'bamboo sequesters carbon dioxide", "bamboo help improve soil", "bamboo grooves help prevent soil erosion", "bamboo helps reduce emission", "bamboo can mitigate climate change", to determine the environmental benefits of bamboo by the surveyed respondents.

Bamboo sequesters carbon dioxide has a mean of 3.8400, bamboo help improve soil has a mean of 3.8200, bamboo grooves help prevent erosion has a mean of 4.4800, bamboo helps reduce emission has a mean of 3.9200 and with a mean of 4.1200, bamboo can help mitigate climate. The mean values assigned to each question is higher 3.0000 and this means that, majority of the respondents agreed on the surveyed questionnaires about the environmental benefits of bamboo. This means that, the knowledge of the surveyed respondents on the environmental benefits of bamboo is relatively high per questions asked.

Table 5 Descriptive statistics of environmental benefits of bamboo

	N	Minimum	Maximum	Mean	Std. Deviation
Bamboo sequesters CO2	50	3.00	5.00	3.8400	.71027
Bamboo help improve soil	50	2.00	5.00	3.8200	.91896
Bamboo grooves help prevent erosion	50	3.00	5.00	4.4800	.64650
Bamboo helps reduce emission	50	2.00	5.00	3.9200	.66517
Bamboo can mitigate climate change	50	3.00	5.00	4.1200	.71827
Valid N (listwise)					

Source: Field data, 2020

4.5 Social benefits of bamboo

This section focuses on the social benefits of bamboo. This is to determine whether or not, respondents are knowledgeable of the benefits bamboo gives the society. Table 6 represents the relative percentages of questions asked concerning the environmental benefits of bamboo that have been answered by the surveyed respondents.

Table 6 Social benefits of bamboo

Description	1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
1. Bamboo is readily available, so accessible and is of lower cost to the poor.	(8%)	(10%)	(14%)	(28%)	(40%)
2. Bamboo can be used as housing materials for the rural communities.	-	(4%)	-	(34%)	(62%)
3. Bamboo has several applications and creates lots of employment opportunities	-	-	(10%)	(38%)	(52%)
4. Bamboo has increased the traditional skills of construction and provide income generation opportunities.	-	-	(6%)	(66%)	(28%)
5. Bamboo is very light weighted and easy to use thus women can also be employed to work with it.	-	(4%)	-	(66%)	(30%)

Source: Field data, 2020

Table 7 illustrates the descriptive statistics of the statements "bamboo is available and cheap", "bamboo can be used as housing materials", "bamboo creates lot of employment", "bamboo has increased traditional skills", "bamboo is light weighted" to access the social benefits of bamboo by the surveyed respondents with their respective mean score and standard deviation using the Likert scale with a minimum of 1 and a maximum of 5.

The table shows that, the mean value for bamboo is available and cheap is 3.8200, the mean value for bamboo can be used as housing materials is 4.5400, bamboo creates lots lot of employment has a mean value of 4.4200, bamboo has increased traditional skills has a mean value of 4.2200 and the mean value of bamboo is light weighted is 4.2200. since the mean for all the questions is above 3.0000, the social benefits of bamboo asked is being known to the surveyed respondents because, majority of the surveyed respondents agreed to each of the social benefits of bamboo question that has been asked.

Table 7 Descriptive statistics of social benefits of bamboo

	N	Minimum	Maximum	Mean	Std. Deviation
Bamboo is available and cheap	50	1.00	5.00	3.8200	1.28873
Bamboo can be used as housing materials	50	2.00	5.00	4.5400	.70595
Bamboo creates lots of employment	50	3.00	5.00	4.4200	.67279
Bamboo has increased traditional skills	50	3.00	5.00	4.2200	.54548
Bamboo is light weighted	50	2.00	5.00	4.2200	.64807
Valid N (listwise)	50				

Source: Field data, 2020

4.6 Economic benefits of bamboo

This section focuses on the economic benefits of bamboo. This reason is also to determine whether or not, respondents are knowledgeable of the benefits bamboo gives the economy at large. Table 8 represents the relative percentages of questions asked concerning the environmental benefits of bamboo that have been answered by the surveyed respondents.

Table 8 Economic benefit of bamboo

Description	1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
1. Income from bamboo products adds to the country's GDP.	-	(6%)	(10%)	(66%)	(18%)
2. Bamboo planting has low initial cost, reducing investment burden for farmers.	(4%)	(4%)	(24%)	(56%)	(12%)
3. The investment return on bamboo is high.	-	(12%)	(28%)	(42%)	(18%)
4. Fresh bamboo leaves are used for wrapping materials.	(4%)	(10%)	(44%)	(38%)	(4%)
5. Dried bamboo leaves are used for organic fertilizers.	-	-	(30%)	(52%)	(18%)

Source: Field data, 2020

Table 9 illustrates the descriptive statistics of the statements "bamboo income adds to GDP', "bamboo planting has low initial cost", "bamboo investment return is high", "bamboo fresh leaves are used for wrapping materials", "bamboo dried

leaves are used for organic fertilizers" to access the economic benefits of bamboo with their respective mean score and standard deviation using the Likert scale with a minimum 1 and a maximum 5.

The Table depicts the mean values of bamboo income adds to GDP to be 3.9600, bamboo planting has low initial cost to be 3.6800, bamboo investment return is high to be 3.6600, bamboo fresh leaves are used for wrapping materials to be 3.8200 and lastly, the mean value of dried bamboo leaves are used for organic fertilizers is 3.8800. From the table, majority of the surveyed respondent agreed to all the questions on the economic benefits of bamboo. This has also shown a high knowledge degree of the surveyed respondent on the economic benefits of bamboo

Table 9 Descriptive statistics of economic benefit of bamboo

	N	Minimum	Maximum	Mean	Std. Deviation
Bamboo income adds to GDP	50	2.00	5.00	3.9600	.72731
Bamboo planting has low initial cost	50	1.00	5.00	3.6800	.89077
Bamboo investment return is high	50	2.00	5.00	3.6600	.91718
Bamboo fresh leaves are used for wrapping materials	50	1.00	5.00	3.2800	.85809
Bamboo dried leaves are used for organic Fertilizers	50	3.00	5.00	3.8800	.68928
Valid N (listwise)	50				

Source: Field data, 2020

4.7 Perception of Ghanaians on bamboo

This section focuses on the perception of Ghanaians on bamboo. This is to determine whether or not, respondents have a positive perception on bamboo. Table 10 represents the percentages of questions asked concerning the environmental benefits of bamboo that have been answered by the surveyed respondents.

Table 10 Perception of Ghanaians on bamboo

Description	1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
1. I believe bamboo can be substituted for Timber.	-	(18%)	(6%)	(42%)	(34%)
2. I believe bamboo is stronger than wood.	(8%)	(40%)	(14%)	(22%)	(16%)
3. I believe bamboo has so many benefits than wood.	(6%)	(14%)	(14%)	(40%)	(26%)
4. I believe income generated from bamboo plantation is higher than wood.	(4%)	(46%)	(10%)	(26%)	(14%)
5. I believe the establishment of bamboo is highly encouraged in Ghana.	-	(32%)	(40%)	(24%)	(4%)
6. I believe there are laws that governs bamboo as a forest product.	-	(28%)	(32%)	(40%)	-
7. I believe policy makers are very effective in enforcing those laws.	(10%)	(34%)	(32%)	(22%)	(2%)
8. I believe bamboo is for poor people	(28%)	(48%)	(10%)	(14%)	-

Source: Field data, 2020

Table 11 illustrates the descriptive statistics of the statement "I believe bamboo can be substituted for timber", "I believe bamboo is stronger than wood", "I believe has so many benefits", "I believe income from bamboo is higher", "I believe bamboo establishment is highly encouraged", "I believe there are laws that governs bamboo", "I believe enforcing those laws are effective", "I believe bamboo is for the poor people", to assess the perception of Ghanaians on bamboo by the surveyed respondents with their respective mean score and standard deviation using the Likert scale with a minimum of 1 and a maximum of 5.

From Table 11, the mean value of I believe bamboo can be substituted for timber is 3.9200, I believe there are laws that governs bamboo has a mean of 3.1200 and also, bamboo has so many benefits has a mean of 3.6600. Since the mean values are more than 3.0000, it means that majority of the surveyed respondents agreed to the questions whereas, the mean value of I believe bamboo is stronger than wood is 2.9800, I believe enforcing those laws are effective has a mean value of 2.7200 and lastly, the mean value of I believe bamboo is for poor people is 2.1000. The mean values are less than 3.0000 which means that, the majority of the survey respondent agreed to the statements. Lastly, some respondents are uncertain about the statement, I believe income from bamboo is higher than wood and I believe bamboo establishment is highly encouraged. With each statement having a mean value of 3.0000, respondents neither agree nor disagree to these statements.

Table 11 Descriptive statistics of perception of Ghanaians on bamboo

	N	Minimum	Maximum	Mean	Std. Deviation
I believe bamboo can be substituted for Timber	50	2.00	5.00	3.9200	1.06599
I believe bamboo is stronger than wood	50	1.00	5.00	2.9800	1.26958
I believe bamboo has so many benefits	50	1.00	5.00	3.6600	1.18855
I believe income from bamboo is higher	50	1.00	5.00	3.0000	1.21218
I believe bamboo establishment is highly encouraged	50	2.00	5.00	3.0000	.85714
I believe there are laws that governs bamboo	50	2.00	4.00	3.1200	.82413
I believe enforcing those laws are effective	50	1.00	5.00	2.7200	.99057
I believe bamboo is for poor people	50	1.00	4.00	2.1000	.97416
Valid N (listwise)	50				

Source: Field data, 2020

4.8 Perception of Ghanaians on bamboo products

This section focuses on the perception of Ghanaians on bamboo products. This is to determine whether or not, respondents have a positive perception on bamboo products. Table 12 represents the percentages of questions asked concerning the environmental benefits of bamboo that have been answered by the surveyed respondents.

Table 12 Perception of Ghanaians on bamboo products

Description	1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
1. Bamboo is not durable for housing construction	(10%)	(60%)	(8%)	(18%)	(4%)
2. Bamboo products are not durable	(22%)	(50%)	(14%)	(10%)	(4%)
3. Bamboo products are for poor people who can't afford wood products	(24%)	(56%)	(4%)	(16%)	-
4. Income from bamboo is much more lesser than wood	(10%)	(22%)	(22%)	(38%)	(8%)

Source: Field data, 2020

Table 13 illustrates the descriptive statistics of the statement "bamboo is not durable", "bamboo products are not durable", "bamboo products are for poor people", "bamboo income is much lesser than wood" to access the social benefits of bamboo by the surveyed respondents with their respective mean score and standard deviation using the likert scale with a minimum of 1 and a maximum of 5.

From the Table, bamboo is not durable has a mean score of 2.4000, bamboo products are not durable also has a mean score of 2.2400 and lastly, bamboo products are for poor people has a mean score 2.1200 whereas bamboo income is much lesser than wood has a mean value of 3.1200. This means that, majority of the surveyed respondents agreed that, bamboo income is much lesser than wood whereas majority of the respondents disagreed to the statements, bamboo is not durable, bamboo products are not durable and bamboo products are for poor people.

Table 13 Descriptive statistics of perception of Ghanaians on bamboo products

	N	Minimum	Maximum	Mean	Std. Deviation
Bamboo is not durable	50	1.00	5.00	2.4600	1.03431
Bamboo products are not durable	50	1.00	5.00	2.2400	1.04119
Bamboo products are for poor people	50	1.00	4.00	2.1200	.96129
Bamboo income is much lesser than wood	50	1.00	5.00	3.1200	1.15423
Valid N (listwise)	50				

Source: Field data, 2020

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter represents a summary of the study and draws conclusions from the study findings and provides relevant recommendations.

5.2 Summary of Findings

Due to the dwindling nature of timber, it is considered to have an alternative which can serve timber's purposes and therefore reducing the pressure on timber. To attain this vision, we need to assess the potentials of bamboo which is a non-timber forest product (NTFP) as an alternative to timber in the Ghanaian and economy determine the perception of Ghanaians on bamboo and its products.

Based on the study, there is an equal number of male and female respondents in which 66% of these respondents are within the age range from 18 to 45 years. Majority of these respondents attained a first-degree certificate. Most of the respondents are aware that bamboo charcoal burns more efficiently and cleanly than wood. This could be because they have test and see the efficiency and how cleanly is burns thus, they are certain it does burns more efficiently than wood. Most of the respondents also knows that, bamboo regrows after harvesting just as grass regrows

after cutting. They expressed their knowledge whereby they believe bamboo grows without the application of chemical fertilizers and also, they confirmed that, bamboo requires less or no irrigation for its growth. Bamboo growing faster and yielding up to 20 times more than wood is being attest by most of the respondents. The respondents therefore have a positive knowledge about bamboo.

With the environmental benefits of bamboo, most of the respondents agreed that, bamboo sequesters carbon dioxide and its carbon neutral and also, bamboo helps reduce emission in the atmosphere. Moreover, most of these respondents also believe that, bamboo can be used as a tool to mitigate climate change and bamboo can help improve the overall soil condition in an area. However, with the concern of erosion, most of the respondent believes that, bamboo grooves help prevent onset of erosion especially in the sloppy areas.

The respondents laid down some of the social benefits of bamboo whereby most of them have agreed that, bamboo has created lots of employment opportunities for the youth in the community because of its several applications. They are able to afford bamboo which is readily available and so accessible and they are able to use it as housing materials in the community. Due to it light weighted nature, women can easily be employed to work with and it has increased the traditional skills of construction and also provide income generation opportunities.

The economic benefits according to the respondents are vast and all could not be said. They believe that, bamboo products add to the country's GDP since it has a

low initial cost for planting but has a high investment return. The investment burden of farmers has been reduced and therefore, other investors can easily venture into bamboo planting which will later generate more income for the country. The fresh leaves of bamboo are used to wrap materials whereas the dried leaves are used for the production of organic fertilizers. This makes bamboo a special type of wood because, all the part of bamboo is useful in our everyday lives.

Due to the numerous benefits of bamboo, the respondents perceived that, bamboo can equally be substituted for timber although they believe timber is stronger than bamboo. There is an uncertainty with the fact that, income generated from bamboo is highly encouraged in the county and also the establishment of bamboo is highly encouraged in Ghana. They are aware of some laws that governs bamboo as a non-timber forest product but they expressed their dissatisfaction of the effectiveness in enforcing those laws. They also believe bamboo is for the rich and the poor.

When asked of about the perception on bamboo products, the respondents mentioned that, bamboo is a durable product for housing construction and its relative products are also durable. They dispute the fact that, bamboo products are for poor people who can't afford wood products but they made it known that, the income generated from bamboo is much more lesser than wood.

5.3 Conclusion

The knowledge degree of bamboo is high in the Forestry Commission, Agriculture (plant protection and regulatory services), EPA and NGOs that are forestry related. The low level of knowledge is therefore exhibited among people who are not related in forestry and therefore perceive bamboo to be a non-useful plant. The institutions that venture into forestry have a brilliant idea of the benefits of bamboo in the environment. Nonetheless, most of the respondents agreed to the all the questions asked concerning the environmental benefits of bamboo. However, the misuse of bamboo is being portrayed by community members with low level of knowledge on the benefits of bamboo to the environment.

The Forestry Commission, Agriculture (plant protection and regulatory services), EPA and NGO's have a high degree of knowledge on the social benefits of bamboo as a non-timber forest product. These institutions also have a high degree of knowledge when it comes to the benefits bamboo gives to the economy. However, since these benefits are not known to the community members and other non-forest related institutions, the hindrances in ensuring bamboo is rightly used to gain monetary benefit for the economy is high. These members only use bamboo as pillar support in the construction of houses, fencing of their houses and also as a firewood for cooking and these acts leads to the indiscriminate cutting of bamboo culms in these communities thereby limiting the use of bamboo to other people.

Moreover, bamboo can be substituted for timber since it has many benefits when compared to timber. The establishment of bamboo is very much not encouraged in the country and although there are laws that govern bamboo, enforcing those laws are very weak making the laws valid but invalid to people. Furthermore, it cost so low to start a bamboo plantation but however, the income generated from the plantation of bamboo is relatively low as compared to timber. This makes investors allocating their inputs into timber and less focus is given to bamboo.

5.4 Recommendation

From the numerous research findings, there are lot of recommendations regarding human skills and policies to ensure bamboo has a high perception among Ghanaians at large and ensuring bamboo serves it purpose to be the next alternative to curb the dwindling situation of timber.

The government through the Forestry Commission of the Ministry of Lands and Natural Resources need to start taking seriousness in the cultivation and protection of bamboo in the country. This could be done by passing laws and policies to back this cause to prevent indiscriminate harvest of bamboo. However, existing policies (if any) should be revised and the enforcement of those policies should be made effective.

There is a need for a comprehensive education to be provided on the potentials of bamboo to communities that are endowed with bamboo and the general public at large by the Forestry Commission and other NGO's. This could be included to the curriculum studied in school as it is already done in some topics in Social Studies for other resources in the basic level and other forms for other the class of people.

Bamboo factories could be established by potential investors in collaboration with the one (1) district one (1) factory (1D1F) in communities that are bamboo endowed whereas the use of efficient and effective technology could add value to bamboo products during processing. Encouraging the general public to buy and use bamboo products could increase the income artisans generate from bamboo.

Registration of artisans who are keen to use bamboo culms for bamboo products could be achieve through the use of technology whereas each artisan has a unique code, licensing them to use bamboo in an efficient and effective way for income generation for the economy.

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APPENDIX

QUESTIONNAIRES

Bio-Data

1. Gender Male ☐ Female ☐
2. Age ☐ 18-30 ☐ 31-45 ☐ 46-60
3. Level of Education ☐ Diploma ☐ First Degree ☐ Master's Degree ☐ Others

4. Respondents are being asked about their General Knowledge about Bamboo using a likert scale of 1=5 where, 1 = "Strongly Disagree" 2="Disagree", 3="Neutral", 4="Agree", 5="Strongly Agree", respondents are to pick one based on their knowledge and perception.

General Knowledge about Bamboo

Description	1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
1. Bamboo Charcoal burns more efficiently and cleanly than wood.					
2. Bamboo regrows after harvesting, just as grass regrows after cutting.					
3. Bamboo is grown without pesticides or chemical fertilizers.					
4. Bamboo grows faster and yield up to 20 times more than wood.					
5. Bamboo requires less or no irrigation for its growth.					

5. Respondents are being asked about the Environmental Benefits of Bamboo using a likert scale of 1=5 where, 1 = "Strongly Disagree" 2 = "Disagree" 3 = "Neutral" 4 = "Agree" 5 = "Strongly Agree", respondents are to pick one based on their knowledge and perception.

Environmental Benefits of Bamboo

Description	1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
1. Bamboo Sequesters carbon dioxide and its carbon neutral.					
2. Bamboo can help improve overall soil condition in the area.					
3. Bamboo groves also helps prevent onset of erosion especially in sloppy areas					
4. Bamboo helps reduce emission in the atmosphere.					
5. Bamboo can be used as a tool to mitigate climate change.					

6. Respondents are being asked about the Social Benefits of Bamboo using a likert scale of 1=5 where, 1="Strongly Disagree" 2="Disagree", 3="Neutral", 4="Agree", 5="Strongly Agree", respondents are to pick one based on their knowledge and perception.

Social Benefits of Bamboo

Description	1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
1. Bamboo is readily available, so accessible and is of lower cost to the poor.					
2. Bamboo can be used as housing materials for the rural communities.					
3. Bamboo has several applications and creates lots of employment opportunities					
4. Bamboo has increased the traditional skills of construction and provide income generation opportunities.					
5. Bamboo is very light weighted and easy to use thus women can also be employed to work with it.					

7. Respondents are being asked about the Economic Benefits of Bamboo using a likert scale of 1=5 where, 1="Strongly Disagree", 2="Disagree" 3="Neutral" 4="Agree" 5="Strongly Agree", respondents are to pick one based on their knowledge and perception.

Economic Benefits of Bamboo

Description	1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
1. Income from Bamboo products adds to the country's GDP.					
2. Bamboo planting has low initial cost, reducing investment burden for farmers.					
3. The investment return on Bamboo is high.					
4. Fresh Bamboo leaves are used for wrapping materials.					

5. Dried Bamboo leaves are used for Organic fertilizers.					

8. Respondents are being asked about their Perception on Bamboo using a likert scale of 1=5 where, 1="Strongly Disagree", 2="Disagree" 3="Neutral", 4="Agree", 5="Strongly Agree", respondents are to pick one based on their knowledge and perception.

Perception of Ghanaians on Bamboo

Description	1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
1. I believe Bamboo can be substituted for Timber.					
2. I believe Bamboo is stronger than wood.					
3. I believe Bamboo has so many benefits than wood.					
4. I believe income generated from Bamboo plantation is higher than wood.					
5. I believe the establishment of Bamboo is highly encouraged in Ghana.					
6. I believe there are laws that governs Bamboo as a forest product.					
7. I believe policy makers are very effective in enforcing those laws.					
8. I believe Bamboo is for poor people					

9. Respondents are being asked about their Perception on Bamboo Products using a likert scale of 1=5 where, 1="Strongly Disagree", 2="Disagree", 3="Neutral", 4 = "Agree", 5="Strongly Agree", respondents are to pick one based on their knowledge and perception.

Perception of Ghanaians on Bamboo Products

Description	1 (Strongly Disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
1. Bamboo is not durable for housing construction					
2. Bamboo products are not durable					
3. Bamboo products are for poor people who can't afford wood products					
4. Income from Bamboo is much more lesser than wood					

PRESBYTERIAN UNIVERSITY COLLEGE, GHANA

FACULTY OF DEVELOPMENT STUDIES

Name of Department: Environmental and Natural Resources Management

Programme of Study: M.Sc. Natural Resources Management

Topic: The perception of Ghanaians on the use of bamboo as an alternative to timber

Name of Student: Faustina Baffour-Awuah

Student's ID: 18040011

RESPONSE MEMO

NO	COMMENTS	STUDENT'S RESPONSE TO COMMENTS
EXAMINER		
Suggested corrections in thesis in red pen		
	ABSTRACT	
1.	The abstract is appropriate.	
2.	No paragraph.	. • The paragraph in the abstract has been deleted
3	Attend to other comments made in red ink	• There has been proper arrangement of the declaration, abstract, acknowledgement, dedication and table of content according to the guidelines. • The heading of the Table of content is bolded.
	CHAPTER ONE	
1.	All Latinized words should be italicised. E.g. *et al.* is Latin and therefore, should be italicised. The appropriate notation for *et al*. should be followed. E.g. Omari *et al*. (2020) or (Omari *et al*., 2020).	• All Latinized words have been italicised.
2.	The font size should be 12" (throughout except for the Chapter title and subheadings), and style should be Times New Romans throughout the work.	• Font size has been corrected to 12 throughout the work except for the Chapter title and subheadings and the style is Time New Romans throughout the work.

3.	Make use of the guidelines.	• Guidelines followed
4.	The subheading and the accompanying write-up are missing. There should be Organisation of the study	• Organisation of the study has been added.
5.	Attend to other comments made in red ink.	• All other comments made in red ink have been attended to.
	CHAPTER TWO	
1.	Stick to the guidelines for the title of each chapter. LITERATURE REVIEW should be REVIEW OF RELATED LITERATURE	• LITERATURE REVIEW has been corrected to REVIEW OF RELATED LITERATURE
2.	All Latinized words should be italicised. E.g. *et al.* is Latin and therefore, should be italicised. The appropriate notation for *et al*. Should be followed. E.g. Omari *et al*. (2020) or (Omari *et al*., 2020).	• All Latinized words has been italicised. • Appropriate notation for *et al.* has been followed.
3.	Attend to other comments made in red ink.	• All other comments made in red ink have been attended to.
.		
	CHAPTER THREE	
1	All Latinized words should be italicised. E.g. *et al.* is Latin and therefore, should be italicised. The appropriate notation for *et al*. Should be followed. E.g. Omari *et al*. (2020) or (Omari *et al*., 2020).	• All Latinized words has been italicised.
2.	The information of the study area is missing.	• Study area has been added.
3.	Map of the study area missing.	• Map of the Greater Accra Region has been added with details of its districts.
4.	Attend to other comments made in red ink.	• All other comments made in red ink have been attended to.

	CHAPTER FOUR	
1.	Link demographic characteristics to the objectives of the study. What is the use of the demographic characteristics of the respondents in the study?	• Demographic characteristics has been linked to the study.
2.	The font of the charts and tables should be Times New Romans.	• Font of chats and tables have been corrected to Time New Romans.
3.	Attend to other comments made in red ink.	• All other comments made in red ink has been attended to.
	CHAPTER FIVE	
1	Attend to other comments made in red ink.	• There are no comments made in red ink in this chapter.
	REFERENCES	
1.	A number of references and citations did not follow the APA referencing style.	• References corrected and updated to APA referencing style.
2.	Names of Journals should be written in full.	• All names of journals have been written in full.
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Declaration by Candidate:

I declare that I have attended to and incorporated the comments made by the examiner in the dissertation.

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Signature: …….. Date:……

Approved by:

Name of supervisor: ……..

Signature: …… Date: .....