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Review of Bamboo Value Chain in Ethiopia

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Abstract
Ethiopia has greatest bamboo resources (Yushania alpine and Oxytenantheria abyssinica) in Africa representing a significant proportion of Africa's total bamboo resources. The main objective of this review to increase the understanding of problems and constraints facing bamboo production and marketing system, current opportunities and challenges of bamboo marketing, economic, environmental and aesthetic value of bamboo in Ethiopia. Bamboo value chain includes wide range of production to consumption systems and actors. Depending on which market is served, the bamboo products in Ethiopia passes through various intermediary stages until it reaches the final customers. But their value chain linkage is undeveloped. Bamboo agribusiness has worldwide opportunities. Bamboo products currently have very huge demand. It can be utilized at all levels of industrial activity from small craft based industries to modern highly integrated plants. Imbalance between demand and supply is one the core challenges to bamboo agribusiness sector in Ethiopia. Bamboo has huge economic, environmental, aesthetic/cultural values. It is applicable in a variety of engineering fields including landscape, civil and chemical engineering. Bamboo has also culture value in addition to economic and ecological value in Ethiopia. For example Dawuro in Ethiopia; the longest woodwind musical instrument in the world locally called "**Dinka**" (4 to 5 meters long, four in number) which is made from bamboo and other materials. Therefore; bamboo has worldwide uses ranges from medicine to nutrition (has 1500 uses). It is possible to exploit the existing opportunities of bamboo sub-sector through value chain approach by promoting the formation of farmers' associations, provision of appropriate technology and training for pre-processing, facilitating capacity development with technology transfer and upgrading skills in bamboo processing and creation of a network and links with other associations, stakeholders and partners are important to solve challenges of bamboo industry in Ethiopia.
Keywords: Bamboo, Value chain, Challenges, Opportunities, Economic, environmental and aesthetic/cultural value, Ethiopia

1. INTRODUCTION

Bamboo is a fast growing, renewable, widespread, low cost, environment enhancing resource with great potential to improve poverty alleviation and environment conservation (Xuhe, 2003). Bamboo's growth is more rapid than any other tree species on the planet, even faster than Eucalyptus species that can be annually self-renewable and harvestable if managed properly. Bamboo is a high-yield renewable natural resource for agro-forestry and engineering based products' (Oscar H. L, 2003).

Globally there are some 1,250 species belonging to 75 genera (Heinz and Patrick, 2013). Bamboo covers over 36 million ha of world total area. About 43 species and 11 genera bamboo is found in Africa, possesses on over 1.5 million ha (Kigomo, 1988). Bamboo species grow naturally on the mountains and highlands of Eastern African Countries and in the medium lowlands of other African countries (KEFRI, 2007).

There is increasing per capita demand of wood and wood products in the global and local markets, due to the increasing quality of life globally. Therefore, there will be very huge demand for wood and wood products, in which the pressure will be expected to be very high on the existing decreasing natural stand forests. Bamboo can be used to share this pressure since it is fast growing and can be a substitute to almost all wood products (Bereket H., 2008). Because giant bamboo species with most potential for commercialization grow mostly in developing countries, bamboo as a resource provides a lot of opportunities for local income generation in such areas through development of products for local and export markets.

About 2.5 billion people in the world depend economically on bamboo (INBAR, 1999), and international trade in bamboo amounts to about US$2.5 million (INBAR, 2005). Several counties have shown strong growth related from bamboo cultivation and processing and bamboo projects are being encouraged for rural poverty alleviation in several provinces (Zhu, 2006). Bamboo has received increasing attention over the last two decades for its economic and environmental values. It has an enormous potential for alleviating many of the social and environmental problems of the developing world today (Quintans, 1998).

Ethiopia has the greatest bamboo resources in Africa representing a significant proportion of Africa's total bamboo resources. Ethiopia has more than 1 million hectares of bamboo which is 67% of African bamboo resources and more than 7% of the world total area covered by bamboo are found in Ethiopia. Ethiopia has two bamboo species namely, *Yushania alpine* (highland bamboo) and *Oxytenantheria abyssinica* (lowland bamboo) (LUSO Consult 1997).

Bamboo is one of the non timber forest products, which support the livelihood of millions of local people in small cottage industries in Ethiopia (INBAR, 2001). Bamboo is very important to Ethiopia, because of the fact that, the country's high forest coverage estimated is only 3.56% which is still alarmingly decreasing, while bamboo can be a substitute for almost all wood products and share this pressure since it is fast growing.

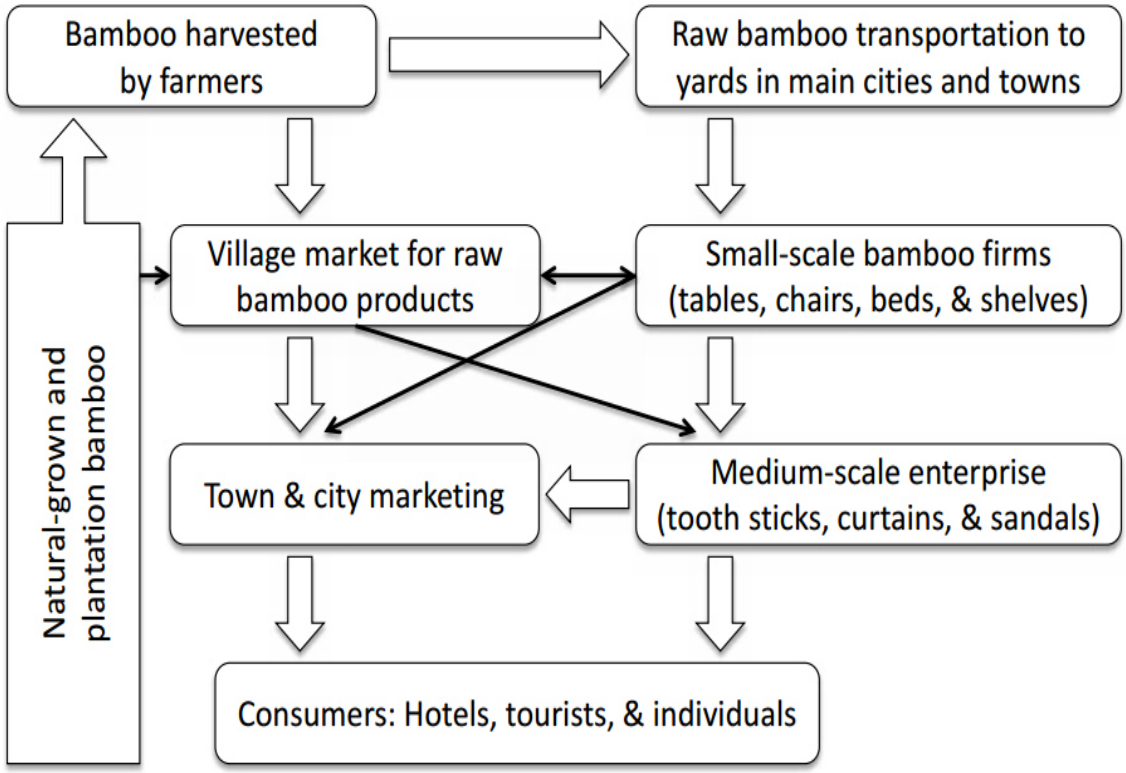
Dawuro zone is one of the 14 zones of Southern, Nationalities, and Peoples Region (SNNPR). Dawuro has 3 medium and 2 high potential highland bamboo potential districts. Cattle fattening, sugarcane production, cotton and oil crops, poultry, coffee plantations and crop production are the main agricultural activities. Forestry activities are also one of income generating ways of most residents in Dawuro. Forest covers an area of about 32000 hectare. Highland and lowland bamboo (Yushania alpine and Oxytenantheria abyssinica) are widely cultivated and covers more than 2008.7 hectares of bamboo which is about 0.43%of total area. Out of total bamboo resource, highland bamboo (Yushania alpine) covers 92% hectare.

2. BAMBOO VALUE CHAIN IN ETHIOPIA

Before looking the detail background of bamboo value chain in Ethiopia, here short concept of value chain is. Value chain includes the full range of activities that are required to bring a product from its conception, through different phases of production, to its final customer. The value chain approach helps to improve the overall productivity of a sector, i.e. all individual actors may benefit from it. Thus, this approach contributes to poverty reduction.

Bamboo value chain includes wide range of production to consumption systems and actors. Depending on which market is served, the bamboo products in Ethiopia passes through various intermediary stages until it reaches the final customer. Bamboo is one of Non Timber Forest Products (NTFP). NTFP value chains may include a number of different activities from harvesting to cultivation of the resource, various degrees of processing, storage and accumulation at different points in the chain, transport, marketing and sale (Kibwage and Misreave, 2011).

The value chain analysis (Zenebe *et al.,* 2014) revealed that there are three major channels/dimensions in the bamboo production-to-consumption chain at the in Ethiopia: (i) the vertical channel that shows the flow of raw bamboo from its production in a natural or cultivated system to the final consumer through various transactions and processes, (ii) the horizontal dimension where bamboo-based firms operating at a particular point in the market chain and the scale of activities and relationships among them, and (iii) the intensity, which relates to the amount of labor and capital that is used to carry out a particular function. Both price and intensity increased at each stage of vertical dimension and each firm level at the horizontal dimension. Market observations show that the vertical channel is characterized by raw bamboo transformation followed by marketing and the product reaching end consumers. In the horizontal dimension, producer farmers sell their bamboo culms to local traders, where the local traders sell it to town or city processors from where the products reach end consumers (Figure1).



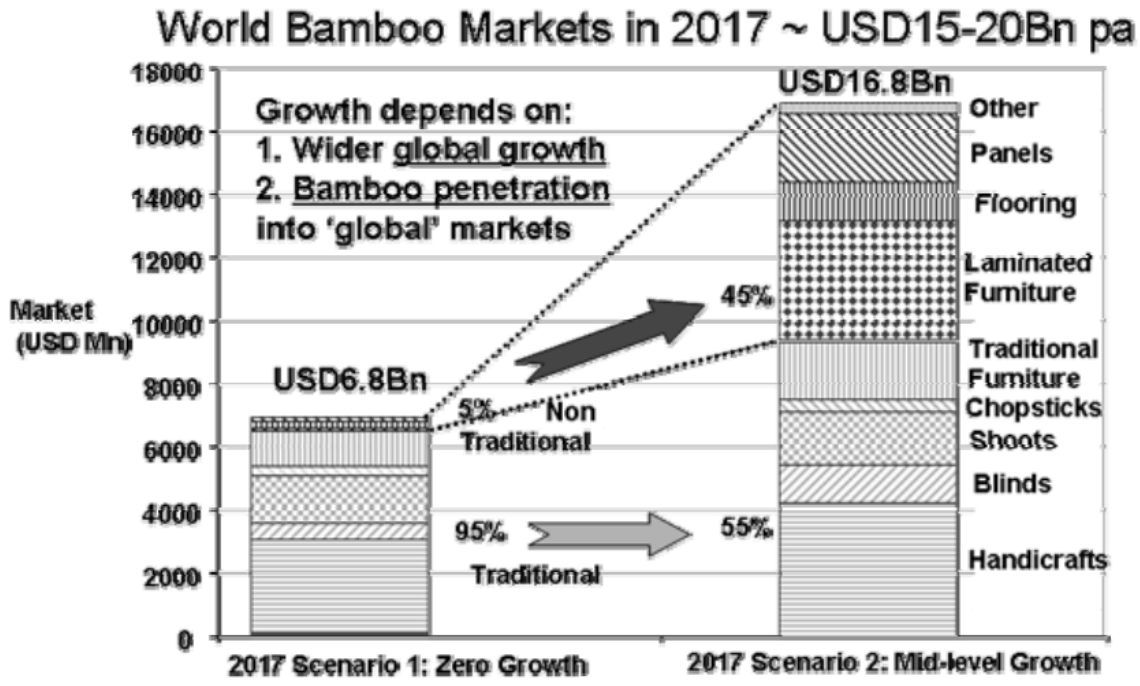
Source: value chain analysis in Ethiopia (Zenebe *et al.,* 2014).
Figure 3: A framework of the bamboo production-to-marketing chain in Ethiopia.

The field survey case study of value chain development and sustainability of bamboo housing in Ethiopia (INBAR, 2011) revealed that the key actors in bamboo market value chains include the following: bamboo farmers/ local community members, bamboo artisans cooperatives, urban housing developers, transporters, bamboo traders/brokers, industrial processors, handicraft makers, furniture mak ers agents/ distributors, trans boundary harvesters, trans boundary illegal harvesters, the regional governments, bamboo research organizations, professional associations, NGOS in rural housing and consumers, but their value chain linkage is undeveloped.

2.1. Opportunities and Challenges of Bamboo Marketing in Ethiopia

2.1.1. Opportunities of bamboo marketing

Bamboo agribusiness has worldwide opportunities. Bamboo products currently have very huge demand. It can be utilized at all levels of industrial activity from small craft based industries to modern highly integrated plants. The global demand for bamboo is increasing. Smith and Marsh in (2005) reported the global market for bamboo products is approximately USD 7 billion which is expected to triple by the year 2017. The worldwide demand for bamboo products rises by double. In its market value was estimated its present size of USD10 billion to over 20 billion by 2015 (Xuhe, 2003). The global bamboo market is growing (today USD7 billion, 2017 estimate USD15-20 billion).



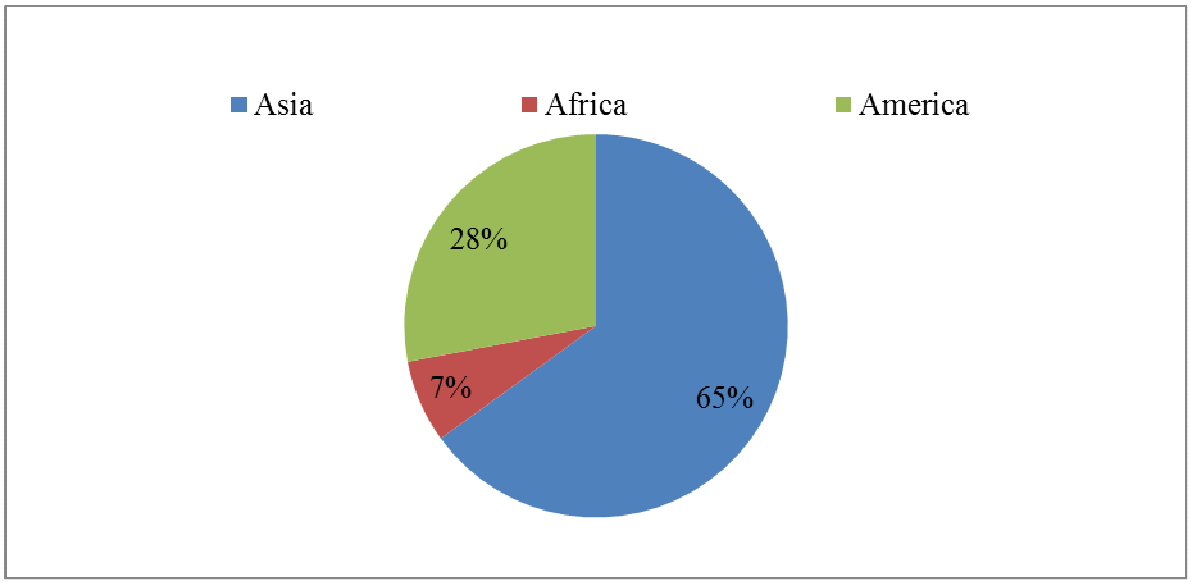
Source: Authors (Marsh and Smith)
Figure 4: The growing importance of the new bamboo markets

Resource availability is other opportunity for bamboo marketing. There are over 1250 species of bamboo in the world, out of which 43 species are found in Africa and two of these species are found in Ethiopia i.e. highland and lowland bamboo with estimated total coverage area of 1 million hectares; in Amharic highland bamboo is commonly known as “Kerekeha”, and lowland bamboo is called “Shimel”. Bamboo is versatile with a very short growth cycle. It is the fastest growing woody plant on this planet; some species can grow up to 1 meter per day. One can almost "watch it grow". This growth pattern makes it easily accessible in a minimal amount of time, and therefore can be harvested in 3-5 years versus 10-20 years for most soft woods. Its size ranges from miniatures to towering culms of 60 meters. Bamboo is a high-yield renewable natural resource for agro-forestry and engineering based products’ (Oscar H. L, 2003).

There is increasing per capita demand of wood and wood products in the Ethiopia national and local markets, due to the increasing quality of life of most residents. The fashion world is constantly seeking and latching into new materials, bamboo to make hot fabrics. The merits of bamboo for use in textile fiber are its’ breathe ability, the ease of processing them into fabric, their high functionality and their beauty. The fashion world is becoming more and more fascinated with all things oriental and bamboo is attracting the interest of a growing number of designers. With time, it is expected that more of this material will find its way in stores. Characterized by its good hygroscopic, excellent permeability, soft feel, easiness to straighten and dye and splendid color, bamboo fiber fabric is made of 100% bamboo pulp fiber. It is also a new environment friendly raw material that enjoys a splendid prospect for application as its predecessor wood pulp fiber. Towel and bathrobes made of bamboo fiber have a soft and comfortable feel and a special luster. It is highly absorptive to water and is also sparkling and beautiful when dyed. Bamboo foot mats are also popular for their health benefits as they do not provide a suitable medium for bacteria to breed. Bamboo fabrics need fewer dyestuffs than cotton, modal or viscose. It seems that the absorption of dyestuffs is remarkably better. Bamboo absorbs the dye stuffs faster and shows the colors better. Bamboo is considered as a much superior fiber and playing in a category of its own (see detail visit www.eabp.org.et of Eastern Africa Bamboo Project).

2.1.2. Challenges of bamboo marketing

Contribution of world bamboo resources by continent (Africa, Asia and America) are 7%, 65% and 28% respectively (FAO. 2005). Imbalance between demand and supply is one the core challenges to bamboo agribusiness sector. Only few countries supply bamboo products to different markets.



Source: FAO. 2005
Figure 5: contribution of world bamboo resources by continent

Ethiopia has over one million hectares of bamboo resources which corresponds to two thirds of all Africa's current resources. There is high local and international demand for industrial bamboo production. Yet, product diversification and value adding are very limited in the local bamboo industry. Knowledge on the potential of the various possible products is still poor, particularly in regard to industrial goods and as an alternative material in construction. Know-how transfer for skills development, access to appropriate technology and standards is needed. The lack of skill and technological inputs into the production chain, resulting in poor quality products that do not command the attention of potential purchasers, a complete lack of marketing infrastructure to enable products to reach out and find new markets.

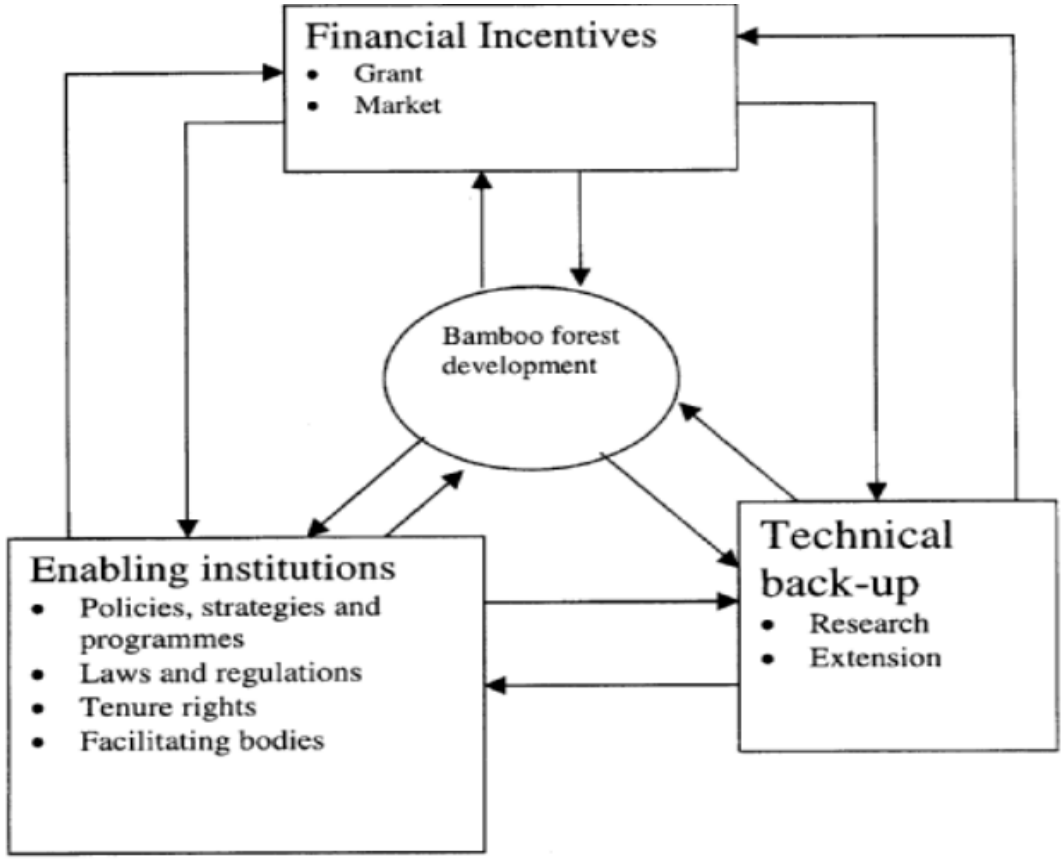
The Eastern Africa Bamboo Project (2006) described bamboo international markets remain still untapped but undeveloped bamboo value chain, low quality of products, very limited availability of processing equipment, lack of storage space and lack of working capital, shortage of raw material supply, the lack of direct access to the raw material, lack of promotion activities and skill, long distance to important markets and lack of effective village group programmes to support activities is hindering the potentials of bamboo agribusiness sector in East Africa.

The principal cause bamboo forests that has led to under-utilization and destruction in Ethiopia is lack of economic incentive to value them as useful commodities, left to decay on the site after flowering, lack of adequate market for sale even at the cost of harvesting, biological and physical deterioration, no various technologies (treatments) available to increase its service life, Knowledge limitations on its propagation, growth and utilization have also contributed to the lethargy regarding its cultivation and poor management indicate the degradation of the bamboo forest (Kassahun, 2003).

Bamboo culm is a preferred material for various applications owing to its straightness, high strength, and light weight, easiness of working with it, suitable fiber for pulp production and absence of bark. But, bamboos have also had various limitations: (1) gregarious flowering and eventual death of all bamboo trees in a forest is a characteristic that may seriously affect the sustainable supply of raw materials for bamboo-based industries. (2) Bamboo culm in storage and use is more susceptible to termites, insect borers and fungal attack than hard- and softwoods, as it does not contain toxic substances unlike the latter species. (3) Bamboo culm preservation is less effective than most hard- and softwoods because bamboo culm does not possess anatomical pathways (ray tissues), which facilitate radial distribution of preservatives unlike in hard- and softwood stems. Moreover, culm skins (outer and inner) are impervious and, thus, preservative penetration through them is limited. (4) A preservative method that is equally effective, cheap and safe as for hard- and softwoods has yet to be developed (Liese, 1985). (5) The maximum attainable diameter is limited by their primary growth, as they do not increase their diameter through secondary growth (wood cambium) unlike hard- and softwood species.

The bamboo value chain in Ethiopia is not targeted to the export market. Almost all bamboo products are produced traditionally and manually and used for the domestic market except some recent efforts to produce a few products by using advanced technology.

Essential factors to be considered in a balanced and realistic way when designing a workable strategy for bamboo forest conservation, development and utilization in Ethiopia are framed below (Kassahun, 2003).



Source: Kassahun, 2003.
Figure 6: Workable strategy for bamboo forest development

3. Economic and environmental value of bamboo

3.1. Economic value of bamboo

Non-Timber Forest Products (NTFPs) are a broad group of products that encompass all animals and plants excluding timber. Two billion of the world's rural poor, as well as many urban dwellers, are dependent on NTFPs for food, medicine, shelter, and livelihoods. The market in NTFPs is valued at US$100 billion annually, with rattan and bamboo alone accounting for US$14 billion. Markets are also expanding rapidly, with increasing demand for NTFPs in both developing and developed countries. However, due to lack of institutional representation, NTFPs have traditionally received little support from government and funding agencies. The sector, as a result, is characterized by poor management and under-utilization of resources.

Bamboo is applicable in a variety of engineering fields including landscape, civil and chemical engineering. Bamboo is a strong raw material for construction. Its tensile strength is 28,000 per square inch versus 23,000 for steel. It is an essential structural material in earthquake architecture' (Oscar H. L, 2003). Bamboo has found uses in manufacturing pulp and paper, panel products, construction material, high strength fiber composites and an array of modern new generation bamboo products, used whole for construction and scaffolding, used as roofs and walls of houses, used as fencing, used as domestic and agricultural implements, such as water containers, such as food and drink containers hats, arrows, quiver, etc, used as livestock shelters and temporary dwellings, used as parts of traditional houses, durable mats for building construction & fencing material.

Extracts of bamboo leaves (Ebl) can be used for lowering concentration of blood triglyceride and cholesterol and acting as a positive control of high blood-lipid. The powdered hardened secretion from bamboo is used internally to treat asthma, coughs and can be used an aphrodisiac. In China and in some parts of Ethiopia, ingredients from the root of the black bamboo help treat kidney disease, roots and leaves have also been used to treat venereal disease and cancer, sap is said to reduce fever and ash will cure prickly heat. Current research points to bamboo's potential in a number of medicinal uses. Bambusa breviflora Munroe or Phyllostachys nigra: clears and transforms phlegm and heat: for heat in the lungs with thick sputum, a stifling sensation in the chest, or coughing up blood. Clears heat and stops vomiting: for vomiting of bitter or sour material due to heat in the stomach with bad breath, aversion to heat and a yellow, greasy tongue. This herb is very effective in stopping vomiting and can be used with other appropriate herbs in treating other types of vomiting including that

associated with morning sickness. Cools the blood and stops bleeding: to stop nosebleed and the vomiting of blood (Oscar H. L, 2003).

Bamboo bio-mass is a potential alternative source for bio-energy and opportunity to pioneer another industrial usage through gasification to produce electricity. As it have very favorable characteristics for gasification and the synthesis of gasoline and diesel. Bamboo has a number of desirable fuel characteristics such as low ash content and alkali index. Its heating value is higher than most agricultural residues, grasses and straw. Bamboo charcoal and active carbon is an item of a new product developed in recent years. Small sized and old tops and roots of bamboo which are not fit for making other bamboo products and residues from bamboo processing industry can be used in the production of charcoal. Bamboo charcoal can be used: for absorbing unpleasant odors; as a deodorant in refrigerators, bathrooms and pools; for refining wines of high grade and edible oil; for purifying water due to its micro-porous structure; to treat drinking water in eliminating organic impurities and offensive smell; for purifying air and to absorb harmful chemicals such as phosphorous dioxide, carbon monoxide and hydrogen sulfide released to the atmosphere.

Sustainable bamboo plantations provide direct employment for many rural, unskilled people in areas where opportunities for economic development are low, both within the plantations themselves, and within processing facilities. Many of the landless men buy bamboo from farmers and engage in producing mats, and furniture e.g. chairs, sofas, and baskets that they produce and sell along the roadside. For these households bamboo is the major source of income. Several attributes of bamboo such as the abundant availability of commercially useful species of bamboo and their fast growth, adaptability on marginal lands, promising material properties, and potential to support rural development give high priority to the commercialization of bamboo species in Ethiopia. Besides, bamboos have high biomass productivity, self-regeneration, sustainable basis and environmental friendly functions. This means for countries like Ethiopia can exploit their untapped bio-fuel potential from bamboo fully and effectively to propel their economy hence defeating poverty and achieving the Gross Transformation Plan (GTP).

3.2. Environmental value of bamboo

Bamboo can offer innumerable opportunities for environmental improvement by sequestration of carbon (absorb up to 12 tones/ha), lowering light intensity and offering protection against ultraviolet rays, yielding 35% more oxygen than equivalent stand of trees and working as a natural environmental cleansing system. Bamboo is the fastest growing canopy for the re-greening of degraded areas. It holds 100 tones of water per hectares. Because of its critical element in the balance of oxygen/carbon dioxide in the atmosphere, bamboo acts as an atmospheric and soil purifier. Bamboo can be a substitute for wood-base fiber in the future. It can substitute wood in nearly all its uses and can help avoid future shortages and hardships caused by deforestation. Bamboo is an exquisite component of landscape design. Its anti-erosion properties create an effective watershed, forming a kind of soil bundle along river banks (binds 6m3 of soil), deforested areas and in places prone to earthquake and landslides.
The desirable qualities of bamboo are attributed to its excelling capacity in solar radiation interception and conversion into biomass. The whole aerial part of the plant (stem, branches and leaves) is green up to age 2-3 years, maximizing the photosynthetic area for high rate of carbohydrate production during the favorable (rain) season. Bamboo plants have evolved a strategy for efficient biomass production even in localities where most of the months are dry and hot. They complete their growth in one flush within the favorable (rain) season (3-4 months) and survive the subsequent unfavorable period (dry season) at reduced respiration rate, mainly for maintenance, or in a more or less dormant condition. Some of the species like the lowland bamboo of Ethiopia also shed their leaves during the dry season to minimize vapor-transpiration and tissue maintenance costs. Bamboo plants have a strategy for resource sharing to support rather than compete and suppress new shoots, particularly among plants from the same rhizome system. This enables them to produce more or less similar size culms with rare dominant or suppressed individuals in fully stocked natural bamboo forests.

The complex rhizome-root network under the ground surface enables it to out-compete other species and keep its ecological dominance on the site (Tabarelli and Mantovani, 2000). It also helps site productivity by holding soil particles together to prevent soil erosion, providing openings in the soil for water percolation and gas exchange, and creating self-perpetuating environment through nutrient recycling. Bamboo forests usually attain high LAI that could intercept more than 95% of the incident solar radiation (Qui *et al.,* 1982, Isagi et *al.,* 1993). This prevents soil drying and creates a favorable microclimate for beneficial soil organisms that facilitate nutrient cycling by decomposing organic materials. The forest canopy also reduces the erosive energy of rainfall and shelters the soil from wind erosion. All forests possess these qualities, but bamboo forests excel most of them in these desirable characteristics.

Bamboo is widely regarded to have several environmental benefits compared to alternative land use. The main environmental benefits of bamboo include:

- Bamboo is a sustainable cropping system for sloping lands, reducing soil erosion, an delivering sustainable farming systems;

- Bamboo is suitable for the recovery of degraded lands
- Bamboo reduces rain run-off and downstream flooding and retaining additional water in the watershed
- Bamboo's rapid growth rate and selective harvesting sequesters up to 12 tonnes of CO_2 per ha. It releases 35% more oxygen than equivalent areas of trees
- Bamboo may be produced competitively with zero fertilizer and pesticide input

Table 3: General characteristics of the Ethiopian natural bamboo forests

	Natural bamboo forests	
	Lowland	Highland
Mean altitude	1000-1800 m	2200-3200 m
Mean annual rainfall	1150 mm	1950 mm
Total area	850,000 ha	130,000 ha
Stand density (tree ha^{-1})	8000	6000
Percentage of dead trees	34	27
Aboveground biomass t ha^{-1}	20	51
Culm	Semi-solid to solid	Hollow
Ratio of old to new shoots		5:1
Seeds	Viable	Most empty, not viable

Source: Anonymous, 1997

3.3. Aesthetic value of bamboo

Bamboo species are among the most versatile plants with high economic, environmental and aesthetic values (Liese, 1985). Bamboo has also culture value in addition to economic and ecological value in Ethiopia. Bamboo is integrally connected with culture and arts. It is mystical plant known for its symbol of strength, flexibility, tenacity, endurance, luck and comprise. In Asia and ancient African Countries like Ethiopia, bamboo has for centuries been an integral element to religions ceremonies, art, music and daily life. It is the paper, the brush and the inspiration of poems and paintings. Among the earliest historical records, 2nd century B.C. was written on green bamboo strips strung together in a bundle with silk thread. Instruments made of bamboo create unique resonance and melody. Bamboo has significant cultural value in Dawuro. Where is Dawuro located?

4. DAWURO IN ETHIOPIA

The name "Dawuro" represents both the land & the people. Dawuro people belong to Omotic family. The language of Dawuro people is 'Dawurotsuwa' (in Latin orthography). Dawuro zone is one of the SNNPR of Ethiopia about 500 km South West of Addis Ababa. Total coverage is about 466,082ha (Tigicho et al., 2012). The global position of Dawuro is lies between $6^0.59'–7^0.34'$ latitude and $36^0.68'–37^0.52'$ longitudes, with elevation ranging 500 to 3000 meters above sea level. Current total population of more than 608,947 (projected from 2007 Ethiopian Census result). Tercha' is the capital town of Dawro zone situated at a distance of 282 km. from Hawassa

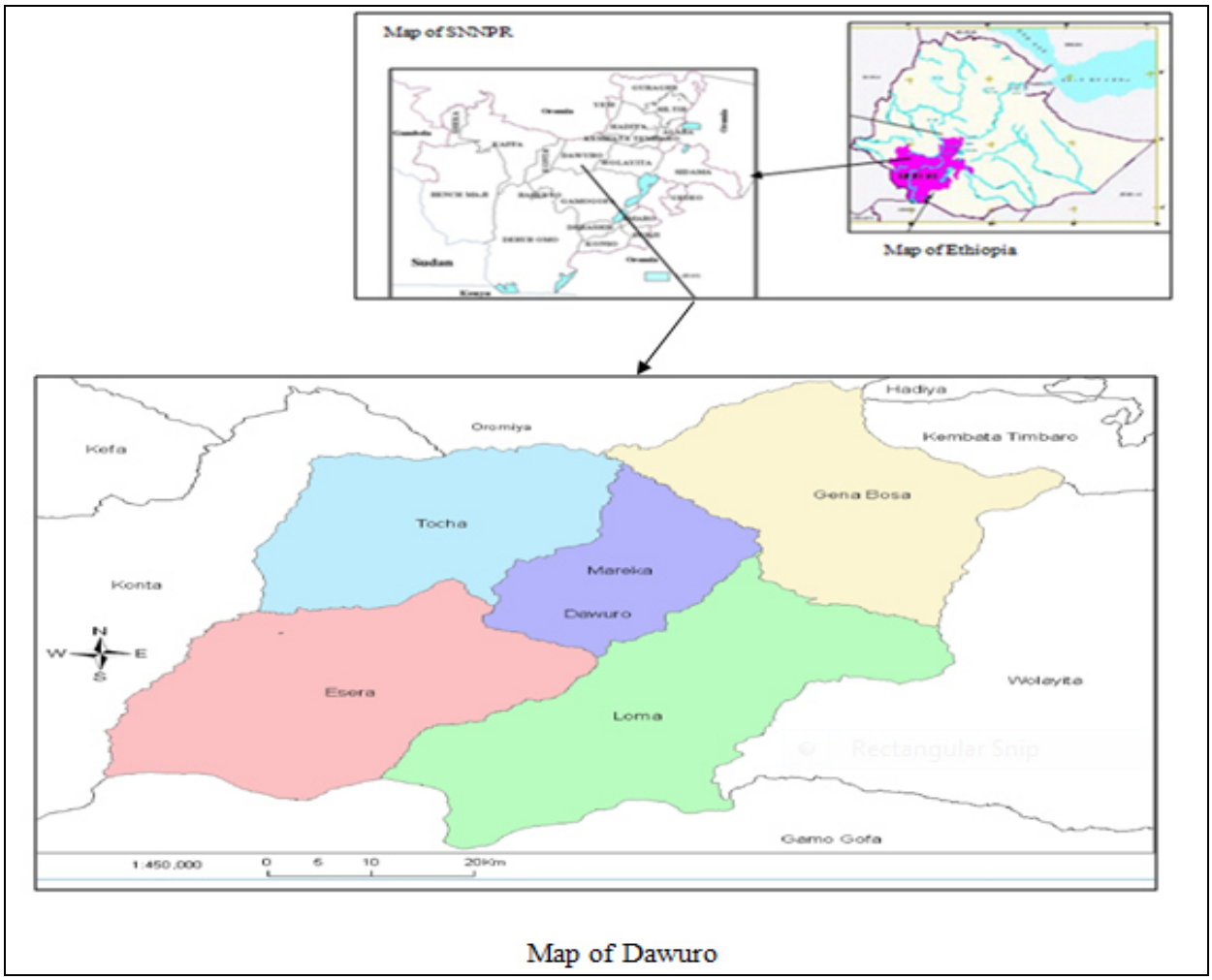


Figure 7: Administrative map of Dawuro (has five districts)

Regarding the Agro-Ecology of the zone, out of the total land size 55.6% is kolla, 41.4% Weinadega and 3% Dega. These include; Kola (500-1500m), Weyna Dega (1500-2500) and the rest is Dega (> 2500m). The annual mean temperature ranges between 15.1^{0}c to 27.5^{o}c and the annual mean rainfall ranges from 1201mm to 1800mm. According to the land utilization data of the region, 38.4% is cultivated land, 13.39% grazing land 16.81% forest bushes and shrub land, 17.09 % cultivable, and 14.31 is covered by others.

Dawuro has a variety of tree species and natural vegetation/forest. Some of natural gift in Dawuro are **Churchura-Chabara National Park** (between Konta special districts and Dawuro zone), natural forests along Gojeb & Omo rivers valleys, perennial rivers (springs) and bigger rivers (Zigna, Dalta, Buk'a, Mantsa, Shata, Wogayi, Dibirsa, Yarda, C'awa, Zo'a, Kotoro, Panta, Koma, Karetsa hatsa, Mawula, Wuni and Zayiri). All these rivers and others of Dawuro are tributaries of Gojeb and Omo rivers. The 2nd biggest hydroelectric power generation dam in Ethiopia now, **Gibe III**, is being built on Omo River between Dawuro and Wolayita zones.

The current (2014) report of Dawuro zone agricultural department show; the forest covers an area of about 32000 ha. From this bamboo covers an area about 2008.7 ha. Out of 2008.7 ha highland bamboo (Yushania alpine) covers 1851.2 ha.


Figure 8: Highland bamboo (Yushania alpine) in Dawuro


Figure 9: Current bamboo stands

4.1. Aesthetic/ Cultural Value of Bamboo in Dawuro

Bamboo has high economic, environmental and aesthetic values in Dawuro. Among the aesthetic value; the longest woodwind musical instrument in the world locally called "**Dinka**" (4 to 5 meters long, four in number) which is made from bamboo and other materials (Figure 8).

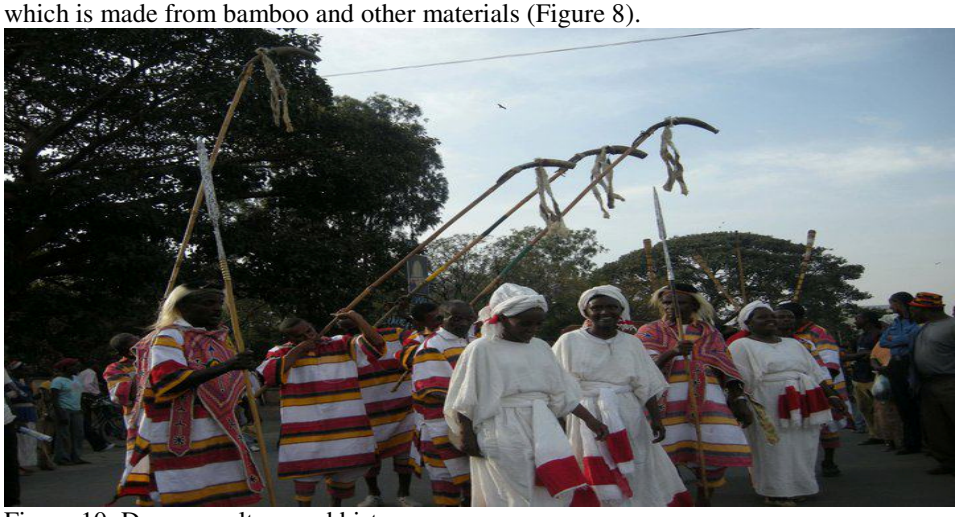


Figure 10: Dawuro culture and history

5. Conclusions and Recommendations

5.1. Conclusions

Bamboos are multipurpose plants of high economic and environmental value. Bamboo is one of NTFP that has, especially in industrial form, considerable potential as a wood substitute because of its high growth rate, good mechanical properties and broad range of applications. Bamboo has become a high tech industrial raw material and substituting for wood.

Bamboo value chain development is very important to Ethiopia; because bamboo has a tremendous potential for economic and environmental development and international trade. Bamboo now is using as bamboo raw materials, bamboo charcoal, bamboo housing, bamboo pulp, paper and cloth, bamboo panels, bamboo weaving products and crafts, bamboo fuel, bamboo shoots for food purpose, bamboo furniture. Bamboo is an abundant resource in Ethiopia and has a great potential for commercialization, which can drive rural development.

Ethiopia has two indigenous bamboo species (Yushania alpine and Oxytenantheria abyssinica) are found scattered in the south, south-west and central parts of Ethiopia that have multiple environmental significance. Dawuro has high potential highland bamboo that suitable for several purpose and uses due to their easy workability, strength, straightness, lightness, hardness and short period of maturity. Bamboo value chain enabling environment linkage in Ethiopia is too weak. There is little link between nature and pattern of demand, location of markets, location of products and their characteristics to guide bamboo agribusiness sector in Ethiopia.

5.2. Recommendations

To exploit the existing opportunities of bamboo sub-sector of Ethiopia, all stakeholders of those sectors should be linked to gain the current global opportunities of this sector. Bamboo producers should apply bamboo silvicultural management such as methods of rising of bamboo planting materials, plantation types, nursery techniques and management, field planting and establishment and plantation maintenance and selective cutting of mature culms.

Attention should be towards the value adding process which will result in creating additional jobs to citizens and increased return from the bamboo sector. Value chain analysis research should be approach concerning the current value chain activities of bamboo and its challenges and constraints facing bamboo agribusiness sub sector opportunities in Ethiopia

Developing countries like Ethiopia that are aspiring for better welfare and faster rate of development, therefore, need to preserve their remnant bamboo forests and expand their resource base. They must also ensure the steady increase, stability and sustainability of bamboo forest production and utilization activities. This requires careful strategic planning based on adequate knowledge on the availability and potential use of the bamboo resources for society and environment, and their production technology and growth behaviors.

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