

Article

Opportunities and Challenges in the Ethiopian Bamboo Sector: A Market Analysis of the Bamboo-Based Value Web

Jessie Lin ^{1,*}, Saurabh Gupta ², Tim K. Loos ^{3,4}  and Regina Birner ⁴

¹ Department of Agricultural Economics and Rural Development, University of Goettingen, 37073 Goettingen, Germany

² Centre for Development Policy and Management, Indian Institute of Management, Udaipur 313001, India; saurabh.gupta@iimu.ac.in

³ Food Security Center, University of Hohenheim, Wollgrasweg 43, 70599 Stuttgart, Germany; timloos@uni-hohenheim.de

⁴ Institute of Agricultural Sciences in the Tropics (Hans-Ruthenberg-Institute), University of Hohenheim, Wollgrasweg 43, 70599 Stuttgart, Germany; regina.birner@uni-hohenheim.de

* Correspondence: jessie.lin@uni-goettingen.de; Tel.: +49-551-39-20208

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Abstract: Bamboo is one of the more important natural resources in Ethiopia and contributes to the bioeconomy as a potential source for high-value products. While the country is the largest producer of bamboo in Africa, the existing utilization of the bamboo sector in Ethiopia remains under-developed, with little value addition. This study identifies the current market challenges and opportunities for future developments of the northern Ethiopian bamboo sector, with a focus on the Injibara township. This research adopts the “value web” approach to assess the potentials of different product lines that create the bamboo biomass value web. We utilize qualitative data collection methods, in particular, semi-structured interviews and informal focus group discussions with key stakeholders. Our findings suggest that bamboo farmers in Injibara are constrained by a lack of local demand and market for bamboo products with high-value addition, leading to an absence of product diversification and innovation. Furthermore, there is an overreliance on foreign technology and methods that are poorly matched for local needs. We recommend that policymakers invest in targeted and effective training strategies on bamboo cultivation and processing. Furthermore, farmers can benefit from decreasing their reliance on middle men with cooperatives or contract arrangements.

Keywords: biomass; value web; bioeconomy; bamboo; Ethiopia

1. Introduction

Throughout the history of time, the production of food, energy, feed, and other environmental goods has largely depended on both agricultural and natural resources [1]. In many developing countries today, an increasing population, changing diets, and urbanization place immense pressure on these resources [1]. For this reason, increasing attention has been given to what is coined the “bioeconomy.” This term can be defined as an economy in which its basic structure for materials, chemicals, and energy originates from regenerated biological materials from plant or animal sources [2]. When properly implemented, a bioeconomy is able to satisfy many conditions for a sustainable economic and social environment [2].

There are many drivers for the increasing development of a bioeconomy, including rising challenges to respond to issues like environmental degradation, energy, and food security [3]. Both the challenge and advantage for many sub-Saharan African countries, such as Ethiopia, is to transform

biomass resources into products with multiple usages and make use of that extra share of added value [4]. It is expected that through the process of value addition in biomass resources, opportunities for further employment and an increase in income will arise [4].

This study addresses these issues by exploring the marketing opportunities and constraints in the northern Ethiopian highland bamboo sector. We seek to fill this knowledge gap in this context by analyzing the Ethiopian highland bamboo biomass value web. The organization of this article is as follows. We start with a general background of bamboo and its utilization in Ethiopia. Section two presents the conceptual framework that guides the analysis of this study. Section three details our methodology. The results and main bottlenecks are identified and presented in section four and we give conclusions and policy recommendations for the sustainable development of the northern Ethiopian bamboo sector in section five.

1.1. Background

Ethiopia is one of the poorest countries in the world. It has been constantly plagued with problems such as food insecurity and seasonal vulnerabilities. Although poverty reduction rates have been impressive in the last few decades in this East African nation, around 30 percent of the population still lives below the national poverty line, surviving on less than US\$1.25 Purchasing Power Parity (PPP) per day [5]. With a growing population and rising urbanization, Ethiopia, like many other countries in Sub-Saharan Africa, increasingly faces problems related to energy scarcity and food insecurity.

Many rural Ethiopian households depend on non-timber forestry products (NTFP), through their provision of goods and services, as a significant part of their livelihood [6]. However, there has been an annual acute shortage of forestry products due to an expected increase in the demand for lumber and other wood products [7]. This occurrence has brought bamboo into the spotlight as a possible replacement for wood for a variety of usages and purposes. Bamboo is identified as having great potential for poverty reduction, environmental enhancement, and sustainable economic development [8]. Due to population growth and increasing urbanization, forest resources, in particular wood, are facing growing pressure for harvest [9]. Bamboo has increasingly replaced wood for industrial usages throughout the last few decades, thereby lessening the pressure for forest clearings [9].

Ethiopia has the largest resource of bamboo in Africa, estimated at around one million hectares, accounting for 67 percent within the continent and seven percent of the world total [10]. There are two types of bamboo in Ethiopia: highland and lowland bamboo. Highland bamboo, which our study centers on, accounts for around 15 percent of bamboo coverage and is mostly cultivated on a smallholder's own land, whereas lowland bamboo grows in natural groves and forests in the southern parts of Ethiopia. Despite the abundant quantities, bamboo has traditionally been treated as an undervalued resource in Ethiopia in comparison to other forest resources [8]. In contrast, bamboo is a highly valued resource in many Asian countries and has been transformed into more than 1500 products worldwide [10]. Value-addition in bamboo contributes much to the international bamboo market and trade. It is estimated that by 2015, the world market for commercialized bamboo products reached \$20 billion US dollars [11].

In 2009, the United Nations Industrial Development Organization (UNIDO) presented the Bamboo Sector Strategy Framework to the government of Ethiopia with the purpose of strengthening the bamboo sector within a five-year period. Several years have passed, yet the status of the sector remains rudimentary. Little has changed for farmers and communities whose livelihoods depend on bamboo. The absence of an enabling environment and ineffective governmental and institutional efforts remain the main challenges to the development of the sector.

1.2. Literature Review

To date, only a few studies have looked into the bamboo sector in Ethiopia. Kelbessa et al. found that bamboo is an important commodity, both environmentally and ecologically, for producing regions [12]. At the same time, it is seen as a "poor man's wood" [7]. The present utilization, marketing,

and trade of bamboo products remain under-developed, with minimal contribution to the economy. It is limited to the construction of huts, fencing, furniture, and such [13]. Many households only engage in bamboo production for additional household revenues [12]. The participation of actors in the bamboo value chain remains at a low level of knowledge, skills, and value-addition [7,8]. The current market and demand in Ethiopia for hand-made bamboo products is minimal, and there are few existing enterprises that specialize in processing bamboo furniture with higher value [14].

Despite these limitations, the market for hand-made and highly processed bamboo products has shown positive signs of growth. In a 2014 survey, 85 percent of respondents mentioned a rising demand for bamboo products [7]. There is a big potential for the bamboo market to grow further. These are reasons for advancements and developments in the utilization and marketing opportunities of bamboo in Ethiopia. There have been efforts within the last couple of decades to develop the bamboo sector by numerous international organizations, non-governmental organizations (NGOs), and the government of Ethiopia. Despite these efforts, the performance of the bamboo market remains rudimentary and limited. Little has changed for farmers and communities whose livelihoods depend on bamboo. Due to the natural characteristics and the possibilities for high-value-added production of bamboo, smallholder farmers and producers in Ethiopia can greatly benefit from improved utilization and marketing of bamboo. However, the existing marketing structure of the bamboo sector is informal and there are no connections, coordination, and integration among the product markets and sources at both the local level and at central markets; in addition, the participation of actors in the bamboo value chain remains at a low level of knowledge and skills, with little value addition [7,8].

The aim of this research is to assess the opportunities and constraints of the northern Ethiopian bamboo sector, with a focus on the area of Injibara. We utilize the value web concept to better assess the various dimensions of highland bamboo-based biomass in the north of Ethiopia. We aim to fill the knowledge gap by analyzing the marketing and policy constraints along the biomass value web. This comprises the potentials, relations, and linkages of various stakeholders, including farmers, traders, enterprises, officials, policymakers, and international research and development agencies. The main bottlenecks are identified, and policy recommendations are given for a more sustainable development of the highland bamboo sector.

2. Conceptual Framework

In this section, we present the concepts that guide the study. We first introduce the idea of the biomass value web in the context of bamboo. Then, the conceptual framework for the analysis of this study is presented.

Biomass Value Web

Biomass is defined as a natural substance that is derived from either living or recent living organisms [4]. It can be categorized into food, feed, energy sources, and raw materials [4]. Countries that depend on agriculture can benefit from an increased demand for biomass, especially when there are high levels of value-addition to the biomass raw product in labor-intensive processing sectors [15]. Bamboo is classified as “lignocellulosic biomass”; its composition is higher in inorganic makeup than ash and wood [11]. It contains high levels of biomass productivity and is one of the most sustainable in terms of energy and materials production [11]. This is important for Ethiopia since around 90 percent of the primary energy source comes from biomass [16].

There are many complexities involved when exploring biomass-based economic growth. For many agricultural crops, the value chain approach is suitable. This method details the range of activities involved in bringing a product from its production to consumption [17]. However, in order to address the multiple usages and flow of a biomass resource, such as bamboo, we utilize the biomass value web in order to address these complexities and constraints [4]. The value web provides a holistic approach for the purpose of this study, as it applies a multi-dimensional web perspective to assess the linkages and relationships among the numerous value chains involved and how each is governed [4].

This approach is appropriate for further understanding the interactions amongst the value chains, pinpointing deficiencies in the use of biomass, and identifying the potential for growth in the entire biomass-based value web [4]. To date, there have been studies that have used the value web concept to analyze the opportunities and challenges of the sugarcane case in Brazil [18] and the potential of plantain residues in Ghana [19]. Figure 1 shows a visualization of the value web concept. It has been recreated to incorporate bamboo as a biomass-based product in the value web.

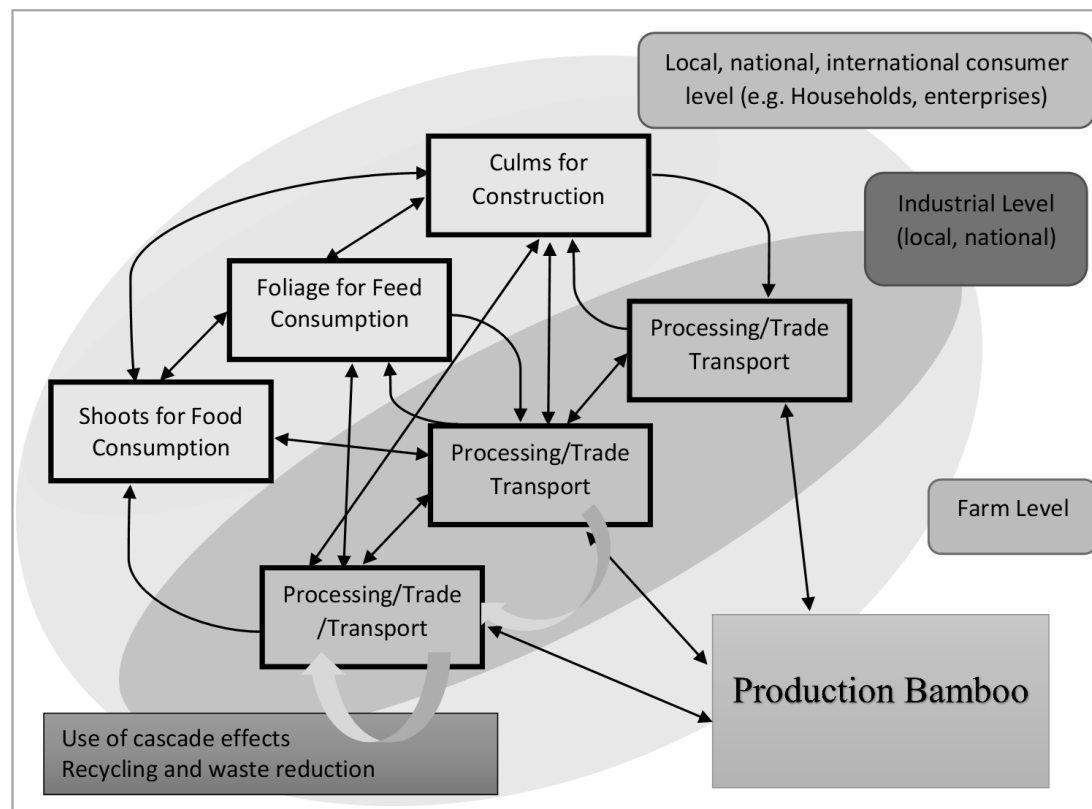


Figure 1. Biomass-based Value Web Concept, recreated for bamboo; Source: adaptation from Virchow et al. [15].

To address and analyze the numerous usages and various challenges of the bamboo sector in northern Ethiopia, we have constructed a conceptual framework, as shown in Figure 2. The framework considers the institutional and marketing aspects of bamboo in this area.

The framework demonstrates the complex process within the bamboo biomass system. First, the production of raw materials goes through the institutional setup of the country before they can be transformed into finished products. The three major outputs mentioned are (1) construction and fencing, (2) furniture and handicrafts, and (3) energy. There are market and institutional challenges within the institutional setup of a country. These aspects influence the cultivation, processing, and trade of bamboo. These three features lead to the production, sale, and utilization of the three main outputs. They also determine the marketing and development of the bamboo sector. Further and more advanced development would upgrade and add value to the three main outputs.

We assess our framework through socio-economic and environmental factors. They take into account the following:

- Socio-economic factors: knowledge regarding the benefits of bamboo, market accessibility, demands for bamboo resources, access to advanced technology, cost of raw culms and such;
- Environmental factors: location of markets, availability of bamboo raw material, seasonal and weather patterns.

These together can identify the entry points to the unexplored potential of bamboo, and the development of the market.

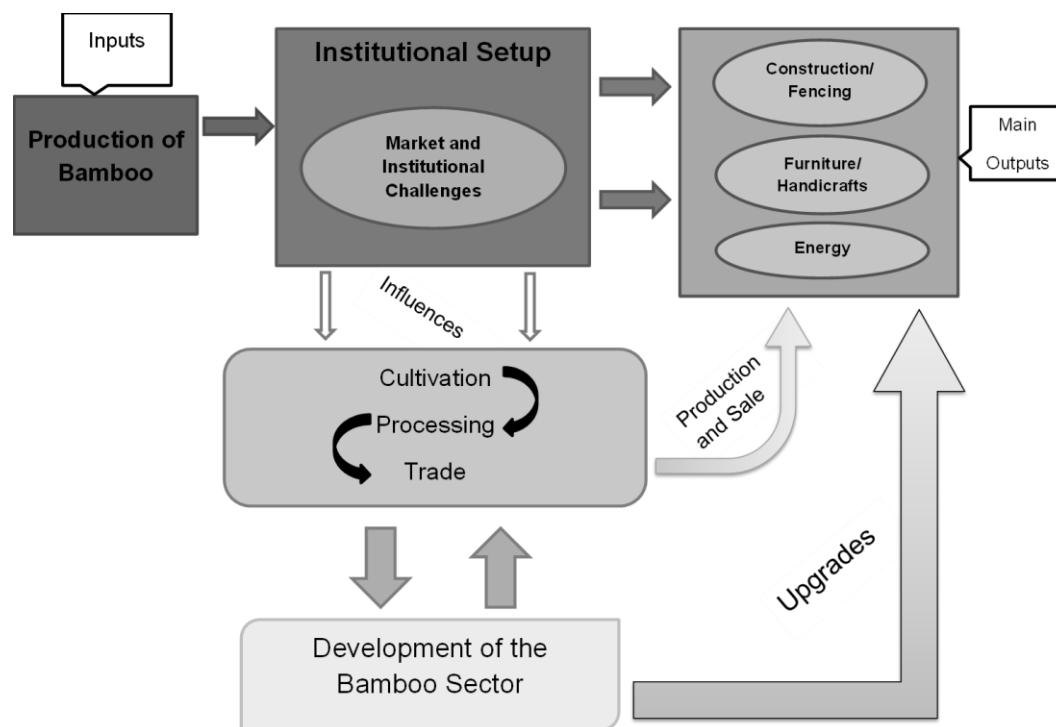


Figure 2. Conceptual Framework of the Marketing Challenges in the Ethiopia Bamboo-based Value Web; Source: own illustration.

3. Methodology

This section presents the research area and data collection methods utilized in this study.

3.1. Research Area

This research explores and investigates key institutions and stakeholders involved in the northern Ethiopian bamboo sector. Interviews and visits with key institutional informants and stakeholders were conducted in the capital city of Addis Ababa. This is where international organizations, research centers, and governmental offices are located. Visits were also made to bamboo workshops, processors, retailers, and factories to better understand the process of marketing, production, and trade, and the diverse products produced, as well as to compare the price differences.

Fieldwork and visits with farmers and small handicraft processors were limited to the town of Injibara and its surrounding regions. The township of Injibara is located in the northern highland of Ethiopia, situated 447 km north of the capital city, Addis Ababa, and 118 km south of Bahir Dar, another major city in Ethiopia. This region receives around 2500 mm of annual rainfall. Due to its high altitude location and climate, the major crops that grow in this area are predominately teff, barley, peas, and potatoes. Injibara is well-connected to nearby towns and markets, with easy access to transportation and well-paved roads for the movements of products from production to consumption [20]. Figure 3 shows a map of the Amhara region. The study area is identified with a red circle.

We have chosen Injibara as the study area since it is one of the major growing regions of highland bamboo in Ethiopia. Bamboo also plays a main economic role in the communities' livelihoods.

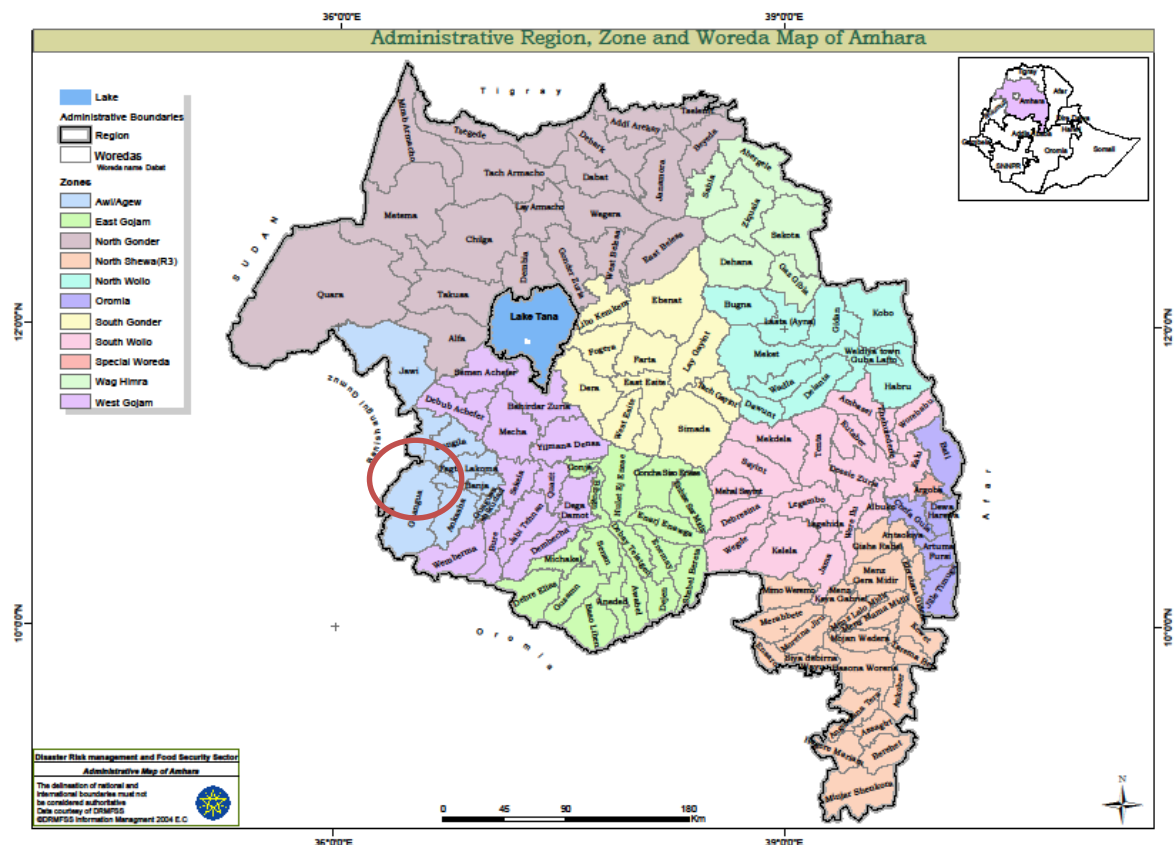


Figure 3. Map of Study Region; Source: DRMFSS (2005).

3.2. Data Collection Method

Qualitative data collection methods were used for the purpose of this study, including semi-structured interviews and informal focus group discussions. In addition, to further complement the bamboo value-web, secondary data were obtained by reviewing published literature, reports by international organizations, and University theses that have been written on the bamboo sector.

Semi-Structured Interviews

Semi-structured interviews were conducted with major institutional actors in the bamboo sector. This interview method mostly involves general questions and becomes the basic structure for other detailed questions which have not been prepared beforehand [21]. Many questions are created on the spot, during the interview, which allows for greater flexibility for both the interviewer and the interviewee [21].

The goal was to explore the different aspects of the bamboo sector with the interviewees in order to gain a better understanding of some specific challenges and other factors that were not foreseen in advance. Various institutions were visited to gain perspectives from different sides. Table 1 lists the institutions that participated in semi-structured interviewees and their respective functions.

Table 1. Institutions that Participated in Semi-Structured Interviews.

Institution	Function
Ministry of Environmental and Forest Research Institute	Governmental
Wood Technology Research Center	Senior Researcher
FEMSEDA	Trainer
GIZ SLM	Deputy Program Manager
Addis Ababa University	Research
Hope College	Research
INBAR	Team Leader
INBAR	Training Coordinator
INBAR	Manager, Development Project
INBAR	National Project Coordinator
ADAL Industrial Plc	Deputy Manager
African Bamboo Factory	General Manager
Ethiopian Tourist Trade Enterprise	Employee

Table 2 lists the number of farmers, small processors, and retailers who took part in semi-structured interviews. It is important to note that many smallholders in Injibara engage in both the farming and processing of bamboo. In this case, they are accounted for in both categories. All of the small processors interviewed in Addis Ababa and Bahir Dar also retail their own products on-site, and are thus also categorized as retailers.

Table 2. Number of farmers, entrepreneurs, and retailers who participated in semi-structured interviews.

Location	Total # Interviewed ¹	# of Small Handicraft Processors	# of Retailers	# of Farmers
Addis Ababa	6	5	6	0
Bahir Dar	3	3	3	0
Injibara and surroundings	14	11	0	9
Total	23	19	9	9

¹ Some interviewees in different categories are counted as one in the total number interviewed.

4. Results

This section highlights the findings of our study. We first present the biomass-based value web to account for the multifunctional aspects of bamboo. Then, we specify the marketing challenges along the value web.

4.1. Bamboo Biomass Value Web Flow Map

Information regarding the bamboo biomass value web was obtained in order to look at the entire Ethiopian sector and as a whole and the actors who are involved. Figure 4 details the different uses of bamboo. As described in the methodology section, our data was compiled through field visits, interviews, and secondary data. We have contrasted the usage of highland and lowland bamboo in the value web, because of their structural differences and their suitability for various utilizations.

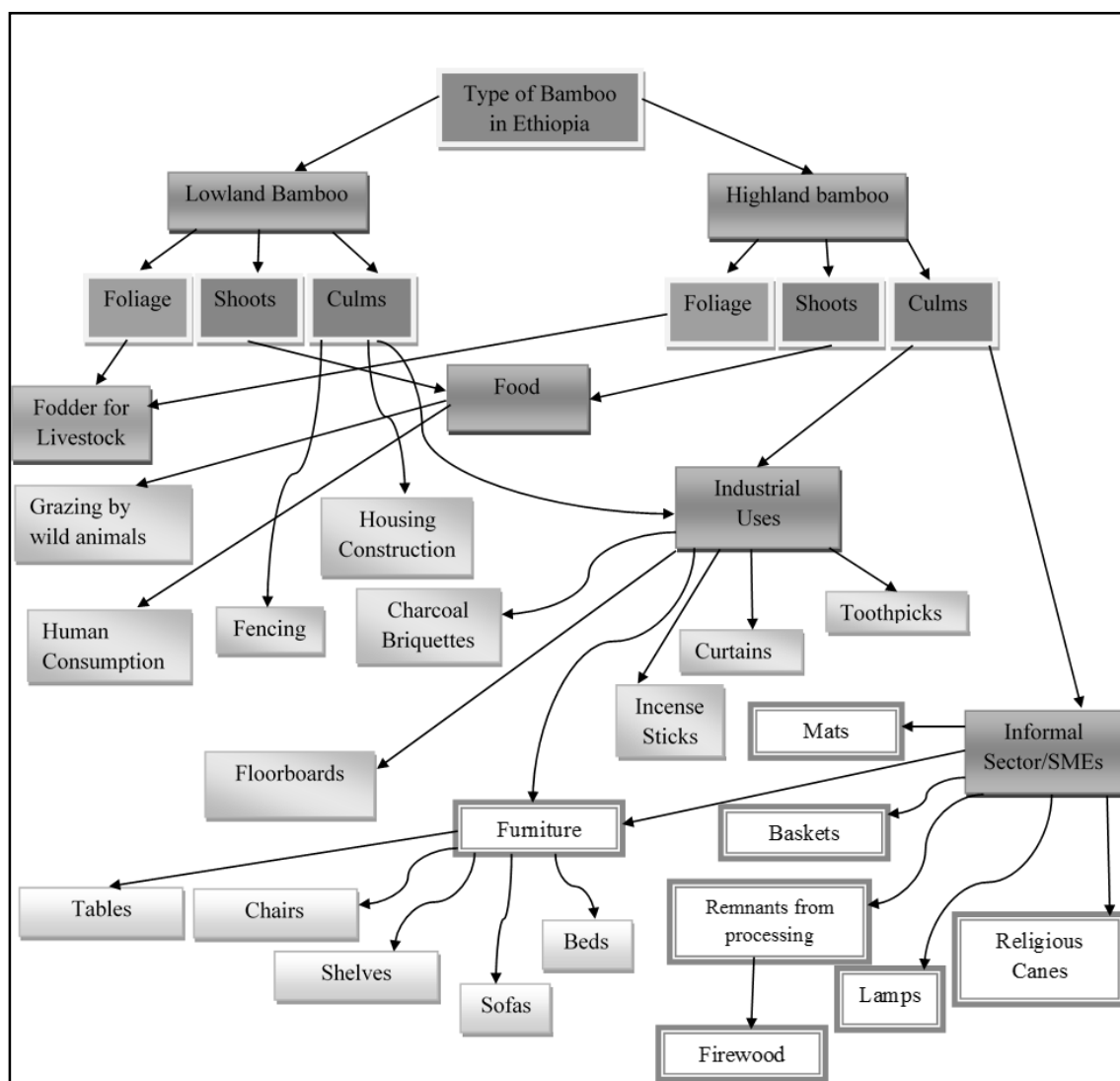


Figure 4. Bamboo-Based Value Web in Ethiopia; compiled from Interviews and Literature Research; Source: own research.

The bamboo value web shows three useable parts of bamboo. They consist of the culm, shoot, and foliage or leaves. There is a clear knowledge gap regarding the extent of usage in the shoots and foliage. The consumption of bamboo shoots by humans remains at a very minimal level and there is a lack of awareness of its edibility and nutritional value. Very few existing studies mention the human consumption of bamboo shoots. An interviewee commented that wild animals consume bamboo shoots in the forests rather than humans (Private Farmer). There is some research concerning the usage of bamboo foliage and leaves as fodder for livestock animals. This was not revealed during the field interviews in this study. The prevalence and details of this usage remain unclear.

The major utilization and potential for economic activities of bamboo come from its culm. Many of the products include items with minimal value addition, such as small handicrafts, basic furniture, mats, and construction. These productions usually involve manual labor and are made by small processors in both cities and rural areas. Products with high-value addition include floorboards, decorative furniture, curtains, and incense sticks. These are produced by factories or by craftsmen who have received training and have access to tools and machinery.

Lowland bamboo predominately grows in nature and has a larger area coverage in Ethiopia. It is predominately used in the southern regions of the country for housing construction and fencing. This type of bamboo is also more suitable for the production of bamboo charcoal

briquettes. However, this potential remains largely untapped. Highland bamboo is for the most part homegrown by smallholder farmers as an additional activity on top of agricultural farming activities. Many smallholders use this species to make mats, furniture, and other more delicate handicraft items for commercial purposes. In addition, highland bamboo is used more for furniture than lowland bamboo.

In small productions, the scraps and remnants from bamboo production are either used by farmers or craftsmen themselves as a source of firewood, or they are left at the working site for people in the community for collection. One craftsman commented that he reuses residuals to fix holes and mend other disfigurements on furniture items (Production employee, private firm). The actual extent of residual usage, however, is unclear. At the ADAL factory, the residuals from bamboo production are used to produce charcoal (Production manager, private firm).

There is a lack of knowledge on the management of bamboo throughout the value web. For example, the timing of bamboo harvest is crucial in determining the quality of culms. Many farmers harvest when they need income. In addition, without proper storage, especially in the rainy season, culms become prone to insect attacks. The suitability of bamboo to make products, such as furniture, also differs by the age of the culm. For example, younger bamboo contains a higher starch and glucose content than mature bamboo, leading to pest infestations (University Professor, academia). These occurrences often lead to inferior quality of the end product.

The biomass value web demonstrates the diverse possibilities of the usage and flow of bamboo. This confirms that further efforts in marketing and policy-making must address and assess the usage and flow of bamboo in Ethiopia.

4.2. Marketing Challenges for Small Farmers and Processors

From the semi-structured interviews and focus group discussions, we were able to identify the marketing challenges in the northern Ethiopian bamboo sector. As mentioned, only the highland bamboo species is found in Injibara and its surrounding areas. Unlike lowland bamboo, which grows naturally in the forest in the Assossa region of Ethiopia, highland bamboo is mostly planted, cultivated, and harvested on the homestead by smallholder farmers. In Injibara, not only do smallholders engage in bamboo planting, but many in towns and areas in its vicinity also take part in making rudimentary bamboo products. The products are primarily traditional furniture, such as benches and stools, and also bamboo mats. Only one entrepreneur we encountered produces a different product, bamboo canes, which are used in religious events and ceremonies. Due to the lack of machines and tools required to make the products, the production process relies largely on manual labor. Entrepreneurs in Injibara have a limited market base. Bamboo products are seen as inferior compared to other timber products; therefore, people are unwilling to pay a higher premium. The quality of bamboo products is inconsistent due to the lack of knowledge on the timing of harvest. There are certain times when bamboo should not be harvested during the year. However, because of this lack of knowledge, many farmers harvest bamboo, even when it is not suitable. The government puts the focus on value addition, skill management, and training in the development of the bamboo sector (Government Official), but little attention is given to the cultivation and propagation (University Professor, academic sector). In addition, bamboo needs proper treatment and drying time after harvest to better prevent problems, such as insect infestation. The lack of adequate storage facilities and space exacerbates this problem. These are major challenges that might have been overlooked by organizations that provide merely skills training to the craftsmen.

Both the Ethiopian Federal Micro and Small Enterprises Development Agency (FEMSEDA) and the International Network of Bamboo and Rattan (INBAR) provide skills training to bamboo craftsmen to make more “modern” and advanced furniture with decorations that require higher levels of processing. However, customers, especially those in rural areas, are not willing to pay a high price premium for products made out of bamboo. Since these products have no market, many craftsmen go back to making the basic traditional furniture with little value addition. Even though the profit margin

is much lower for traditional furniture, at least they are able to sell a number of them to obtain some sort of income. Furthermore, one could argue that trainings targeted at value-addition are only for show. For example, farmers are trained in facilities with machines and electricity. However, when they return home in rural areas, the equipment is not accessible to them.

Table 3 gives an example of the price differentiation and daily profits between a rural area and a city close by.

Table 3. Price Comparison of a Traditional Bamboo Bench Between Injibara and Bahir Dar (City).

Place	Price per Culm	# of Culms per Bench	Price per Bench	Total Profit	# of Benches Produced per Day	Estimated Profit per Day
Injibara	~25 birr	2	60 to 70 birr	10 to 20 birr	3 to 4	30 to 80 birr
Bahir Dar	~25 birr	2	Up to 120 birr	Up to 70 birr	3 to 4	Up to 280 birr

In contrast to the usages of bamboo in rural townships, increasingly, in Addis Ababa, there are workshops that produce bamboo products with higher value addition. In the capital city, there is a much broader market base, due to foreigners who have higher incomes and higher regards for bamboo products. The Ethiopian Tourist Trading Enterprise (ETTE) is a government-supported institution that engages in bamboo production. There, workers produce highly decorated furniture and small ornamental products. They are sold at much higher prices. When asked, the employee stated that most customers who buy bamboo products are foreigners and not local Ethiopians (Production Employee, public firm). Established and formal means of marketing bamboo products seem to not exist for both the northern countryside and cities. In all three sites visited during field work, most bamboo products were both produced and sold on the same premise. In Injibara, customers walk pass production sites and buy products directly. Some processors in the cities receive orders from their customers. For example, in Addis Ababa, areas near the church of Urael and the Kazanchis area are known for bamboo production. Customers know beforehand that bamboo products are being produced and sold there. The more skilled small- and medium-sized enterprises have a photo album of the type of products available, in addition to a few pieces of furniture on display. A good portion of the production is done by order. Customers can pick out items from the photo album and place their orders. At the same time, there remains a lack of a proper marketing channel for bamboo products. There are no investments in small enterprises and rural handicrafts beyond basic skill training. Even with good quality finished end products, there is no place to sell them. This limits the potential for the sector for further growth and opportunities.

5. Discussion

This section discusses and analyzes the marketing challenges and constraints throughout the bamboo value web as presented in the results section.

5.1. Socio-Economic Challenges

Our results confirm what Kelbessa et al. [12] describe in their study; areas covered with bamboo play an important role in the livelihoods of the local communities. At the same time, there is a lack of awareness regarding the proper cultivation management of highland bamboo at both the farm and market level, as Mulatu and Kindu [22] also note in their research.

As previously noted, the quality of bamboo products largely depends on the harvest time and proper storage of culms. These factors combined can severely impact the quality of the culms and the products that come out of it. Many of the bamboo retailers in Addis Ababa have mentioned customer complaints due to insect problems. This paints a negative image for the already under-valued bamboo products and serves as a major constraint for the development of the bamboo market.

The majority of smallholder farmers and processors lack means for transportation and access to the market. Their only option is through middlemen or traders. They are also the ones who can

obtain licenses to sell finished products. This reliance, combined with a lack of product diversification in concentrated cluster areas, gives them very limited bargaining power in terms of pricing for raw bamboo and for finished bamboo products. If one refuses to sell at a lower price, then the middlemen have many different options in the same area. Throughout the value chain, it is the middlemen who have the most to gain. As a result, many smallholders end up receiving income that can only sustain their livelihoods at a bare minimum.

Bamboo products are seen as inferior by the Ethiopian society in general. This is partly exacerbated by the problem of the inappropriate storage of bamboo culms. For products with high value and labor addition, people are unwilling to pay a higher premium. This brings up an important point that skill training has little effect when there is a very minimal demand and market for more expensive bamboo products.

Because of these types of challenges, there is no incentive for local small processors to innovate new bamboo products for the market. For example, we asked why locals do not produce kitchen utensils out of bamboo, as many Asian countries do. The response was that it simply is not in their culture to do so, and no one has ever thought about it (Production Employee, private firm). The absence of a proper market leads to a lack of incentives to innovate.

One of the biggest differences that has been found in terms of pricing of bamboo products is the location of the products being sold. As shown in the results section, the same bamboo bench sold in the city of Bahir Dar can bring in twice as much as income as a bench sold on the roadside of Injibara. The high value-added furniture in the ETTE is sold at a high markup price because they have access to the expatriate market in Addis Ababa. As foreigners tend to prefer bamboo products more than the local population, it will be interesting to see how the bamboo market will be altered as the expat community grows in Addis Ababa.

Another factor is related to the seasonal variabilities in bamboo cultivation, process, and trade. First, because bamboo requires additional time for drying during the rainy season, space becomes a big issue for small processors as they have limited space for storing excess culms. Demand for bamboo products decreases in the rainy season while the price of raw bamboo culms increases. Theoretically, an increase in raw culm price should benefit the bamboo farmers. However, harvest is much more difficult in the rainy season, and several farmers also remarked that they do not cut bamboo during the rainy season. At the same time, the increase in culm pricing strains the small handicraft sectors. For families, whose entire livelihood largely depends on bamboo, the rainy season becomes especially difficult for them.

It is also a major constraint there are no factories set up in places where bamboos are cultivated and harvested. It is currently difficult to set up factories near bamboo forests. Problems, such as a lack of electricity and inconvenience for factory owners, make it unappealing to have an operation on site. In addition, there is a lack of policy support for the investments of these purposes. If bamboo factories were actually set up near the resources, then this would cut out the middlemen problem, with possibly more income going directly to the farmers. Factories would also have more capacities to store and dry the bamboo culms after harvest.

5.2. *Main Challenges Throughout the Bamboo Value Web*

There is a clear lack of diverse bamboo products on the market. In Injibara, identical products are being produced in clusters. The same types of products that require similar skills are produced in the same area. For example, on the same road that stretches for many kilometers, mats are the only products available. Once in a while, craftsmen receive special product orders from customers. For the most part, traders come and collect the mats to be sold in other markets and cities. Because smaller processors have no means of transporting the finished mats elsewhere, they depend on the traders to provide them with their source of income. If traders do not come to collect the mats, then they have limited access to other means of selling or they do not sell at all. Since everyone is producing the same product, the middlemen have much more bargaining power to negotiate lower prices. If one family is

unwilling to sell at a certain price, the traders still have many other people from whom they can collect the mats. In this case, it is hard to foresee how the livelihoods of families can improve dramatically without a means of transport to markets. According to Mulatu and Kindu [22], the experiences of the utilization of bamboo in many countries have resulted in significant financial gains and environmental protection. They note that in order to have sustainable bamboo utilization, there must be “a function of bamboo resource development availability of new technologies and scientific information, production of bamboo products using the technologies, and marketing” (p. 80). A combination of suitable institutions, policies, and strategies must be implemented in order for these to occur [22]. It is clear from this value web analysis that there is much room for improvement in each of these façades.

Policy makers and international institutions involved in training and research should put the focus on bamboo propagation in addition to value-addition. While the utilization of bamboo is an important aspect to develop the sector, it is also crucial for bamboo farmers to obtain adequate cultivation skills and knowledge in order to avoid low quality bamboo for production. Better managed training can facilitate this process.

Governments can assist bamboo processors in Injibara to gain markets by setting up government bazaars. Awareness campaigns can be a useful strategy to make the public more knowledgeable about bamboo products. Setting up cooperatives could be an option for farmers and craftsmen to gain stronger bargaining power in the process of trade and access to markets.

6. Conclusions

This study focused on the current utilization and future potential of the bamboo market in Injibara, Ethiopia, within the framework of the biomass value web in the forthcoming bioeconomy. As our research suggests, there is a set of complex and multifaceted hindrances that has kept the market for bamboo in northern Ethiopia under-developed, despite the many efforts that have been made in the last decade. There have been some improvements and signs for a positive outlook in the future.

For local consumers, there is a general lack of demand and market for products with high-value addition. This is due to the mindset that bamboo products are of low quality. The phenomenon is further exacerbated by the lack of proper cultivation and management.

The value-addition training given by governmental and international organizations has been ineffective. There is neither a sufficient demand nor market for more sophisticated bamboo products. Therefore, the effects of value addition training are minimal. Furthermore, the majority of the given training requires the use of large and expensive machinery that smallholders simply do not own nor have access to. If processors have the skills, but no tools to utilize the given knowledge, then the training given is of little use and value. Finally, there are no established means of bamboo marketing. Other than through word of mouth, government bazaars and such, small bamboo processors have limited access to the market both in the promotion and the transportation of the finished products.

Further research in the bamboo sector to fill a wide knowledge gap is needed. There is currently very little research and literature that exist in the bamboo sector in Ethiopia. The last document that surveyed bamboo in Ethiopia was the LUSO Consult in 1997. Almost 20 years have elapsed and both the sector and the country have developed rapidly. Therefore, a new set of research should explore the current state of bamboo in both the north and south of Ethiopia.

As the findings and analyses in this study demonstrated, the untapped potential of the bamboo biomass is a multi-faceted and complicated problem. The development of the bamboo sector needs to be a holistic approach. The outlook for the future to develop the sector needs to be a long-term investment with an emphasis on every stage, from propagation to production. By far the most difficult aspect would be to educate and have people accept knowledge that they did not know for most of their lives. However, with enough interest and motivation to commit long-term to this development, there is no reason why the bamboo sector cannot develop as a major contribution to the bioeconomy. If that is the case, this would definitely mean an improvement in the many lives and communities that

depend on bamboo as a part of their everyday livelihoods and for bamboo to play a major role within the context of the bioeconomy.

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References

1. Swinnen, J.; Riera, O. The Global Bio-Economy. *Agric. Econ.* **2013**, *44* (Suppl. 1), 1–5. [[CrossRef](#)]
2. McCormick, K.; Kautto, N. The Bioeconomy in Europe: An Overview. *Sustainability* **2013**, *5*, 2589–2608. [[CrossRef](#)]
3. Rosegrant, M.W.; Ringler, C.; Zhu, T.; Tokgoz, S.; Bhandary, P. Water and Food in the Bioeconomy: Challenges and Opportunities for Development. *Agric. Econ.* **2013**, *44* (Suppl. 1), 139–150. [[CrossRef](#)]
4. Virchow, D.; Beuchelt, T.D.; Kuhn, A.; Denich, M. Biomass-Based Value Webs: A Novel Perspective for Emerging Bioeconomies in Sub-Saharan Africa. In *Technological and Institutional Innovations for Marginalized Smallholders in Agricultural Development*; Gatzweiler, F.W., von Braun, J., Eds.; Springer International Publishing: Basel, Switzerland, 2016; pp. 225–238.
5. World Bank Group. *Ethiopia Poverty Assessment 2014*; World Bank Group: Washington, DC, USA, 2015.
6. Melaku, E.; Ewnetu, Z.; Teketay, D. Non-Timber Forest Products and Household Incomes in Bonga Forest Area, Southwestern Ethiopia. *J. For. Res.* **2014**, *25*, 215–223. [[CrossRef](#)]
7. Mekonnen, Z.; Worku, A.; Yohannes, T.; Alebachew, M.; Teketay, D.; Kassa, H. Bamboo Resources in Ethiopia: Their Value Chain and Contribution to Livelihoods. *Ethnobot. Res. Appl.* **2014**, *12*, 511–524. [[CrossRef](#)]
8. Adnew, B.; Statz, J. *Bamboo Market Study in Ethiopia*; UNIDO: Addis Ababa, Ethiopia, 2007.
9. Phimmachanh, S.; Ying, Z.; Beckline, M. Bamboo Resources Utilization: A Potential Source of Income to Support Rural Livelihoods. *Appl. Ecol. Environ. Sci.* **2015**, *3*, 176–183. [[CrossRef](#)]
10. Embaye, K. The Indigenous Bamboo Forests of Ethiopia: An Overview. *AMBIO A J. Hum. Environ.* **2000**, *29*, 518–521. [[CrossRef](#)]
11. Poppens, R.; van Dam, J.; Elbersen, W. *Bamboo Analyzing the Potential of Bamboo Feedstock for the Biobased Economy Colofon*; NL Agency: Utrecht, The Netherlands, 2013.
12. Kelbessa, E.; Bekele, T.; Gebrehiwot, A.; Hadera, G. *A Socio-Economic Case Study of the Bamboo Sector in Ethiopia: An Analysis of the Production-to-Consumption System*; PHE Ethiopia Consortium: Addis Ababa, Ethiopia, 2000.
13. Embaye, K. Ecological Aspects and Resource Management of Bamboo Forests in Ethiopia. Doctoral Dissertation, Swedish University of Agricultural Sciences, Uppsala, Sweden, 2003.
14. Desalegn, G.; Tadesse, W. Resource Potential of Bamboo, Challenges and Future Directions towards Sustainable Management and Utilization in Ethiopia. *For. Syst.* **2014**, *23*, 294–299. [[CrossRef](#)]
15. Virchow, D.; Beuchelt, T.; Loos, T.K.; Hoppe, M.; Gmbh, C.S.P. The Value Web Approach—So That the South Can Also Benefit from the Bioeconomy. *Rural 21* **2014**, *48*, 16–18.
16. Seboka, Y. Charcoal Production: Opportunities and Barriers for Improving Efficiency and Sustainability. In *Bio-carbon Oppor. East. S. Afr.*; UNDP: New York, NY, USA, 2009; Chapter 6; pp. 102–126.
17. Kaplinsky, R.; Morris, M. *A Handbook for Value Chain Research*; IDRC: Ottawa, ON, Canada, 2001; Volume 113.
18. Scheiterle, L.; Ulmer, A.; Birner, R.; Pyka, A. From Commodity-Based Value Chains to Biomass-Based Value Webs: The Case of Sugarcane in Brazil’s Bioeconomy. *J. Clean. Prod.* **2018**, *172*, 3851–3863. [[CrossRef](#)]
19. Loos, T.K.; Hoppe, M.; Dzomeku, B.M.; Scheiterle, L. The Potential of Plantain Residues for the Ghanaian Bioeconomy—Assessing the Current Fiber Value Web. *Sustainability* **2018**, *10*, 4825. [[CrossRef](#)]

20. Endalamaw, T.B.; Lindner, A.; Pretzsch, J. Indicators and Determinants of Small-Scale Bamboo Commercialization in Ethiopia. *Forests* **2013**, *4*, 710–729. [[CrossRef](#)]
21. Case, D. *The Community's Toolbox: The Idea, Methods and Tools for Participatory Assessment, Monitoring and Evaluation in Community Forestry*; FAO: Bangkok, Thailand, 1990; pp. 1–146.
22. Mulatu, Y.; Kindu, M. Status of Bamboo Resource Development, Utilisation and Research in Ethiopia: A Review. *Ethiop. J. Nat. Resour.* **2010**, *1*, 79–98.



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