ST. MARY'S UNIVERSITY

SCHOOL OF GRADUATE STUDIES

INSTITUTE OF AGRICULTURAL AND DEVELOPMENT STUDIES

DETERMINANTS OF BAMBOO PRODUCTION, THE CASE OF GUAGUSA SHIKUDAD WEREDA, AMHARA REGIONAL STATE, ETHIOPIA

BY

AREGA ADDIS

June, 2021

St. Mary's University, Ethiopia

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THESIS SUBMITTED TO SCHOOL OF GRADUATE STUDIES OF ST. MARY'S UNIVERSITY IN PARTIAL FULLFILLMENT OF THE REQUIREMENTS FOR THE MASTERS OF ART DEGREE IN DEVELOPMENT ECONOMICS

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APPROVAL OF BOARD EXAMINERS

As members of the Examining Board of the final MA open defense, we certify that we read and evaluated the thesis prepared by Arega Addis and recommend that it be accepted as fulfilling the thesis requirement for the Degree of Master of Art in Development Economics.

1. ---------- ---------- ----------

   Name of chairman signature Date

2. ---------- ---------- ----------

   Name of internal examiner signature Date

3. ---------- ---------- ----------

   Name of external examiner Signature Date

4. ---------- ---------- ----------

   Name of thesis advisor Signature Date

DECLARATION

I declare that this MA thesis is my original work, and has never been presented for the award of any degree in this or any other university and all source of materials used for the thesis have been duly acknowledged.

Arega Addis

Signature----------

Date----------

St. Mary's University

Addis Ababa, Ethiopia

June, 2021

ENDORSEMENT

This thesis has been submitted to St. Mary's University, School Of Graduate Studies for examination with my approval as a University advisory.

Adviser's Name and Signature:

MARU SHETE (PHD AND ASSOC.PROF)

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TABLE OF CONSENTS

ABBREVATION ANDACRONMY

EABP=East African Bamboo project

ARARI=Amhara Regional and Agricultural Research Institute

INBARO =International Bamboo and Rattan Organization

UNIDO=United Nations Industrial Development Organization

NWFPs=non-wood forest products

NTFPs= non timber forest products

FAO=food and agriculture organization

CPRs=common property resources

IJHCS =International Journal of History and Cultural Studies

AZARDO =Awi Zone Agricultural and Rural Development Office

CSA =central statistical authority

ABSTRACT

One of Ethiopia's fast growing and most valuable forest, bamboo's role in livelihoods and rural development is poorly understood. Hence, the general objective was to examine economic contributions of bamboo production and marketing for livelihoods of rural households. To attain this objective, both quantitative and qualitative data from 201 households were collected through structured questionnaires, focus group discussion and key informant interviews using multi-stage sampling technique in 2 Kebeles in ShikudadWoreda, Amhara regional state, Ethiopia. Both descriptive statistical tools and Tobit regression model were used to analyze relationship between variables. Tobit regression model was employed to find out the relationship between dependency level of households on bamboo for their livelihood and some selected socio-economic factors. According to the results, the area of land covered by bamboo has been decreasing from time to time and about 80 percent of respondents said that the area of land covered by bamboo has been decreasing. Bamboo culms and products marketing systems were informal. Bamboo producers simply display their products, mostly on road-sides, and interested buyers buy them. Information helps farmers to get better price to their product, to increase quality and quantity of the bamboo product. And only 18 percent farmers have full access for information on how to supply, where to sell and the level of demand for their bamboo products. This shows there was lack of adequate market information on the marketing of bamboo products they produce in this area. Therefore, the focus on the development of conservation and processing methods and appropriate production system and marketing can enhance the utilization of bamboo resources.This study is intended to investigate the economic implications of bamboo production /benefits/ through income improvement and determinants of household income obtained from producing bamboo. The major driving forces for the disappearances of the bamboo forests are conversion to agricultural land and bamboo forest being common pool for all individuals for last times, increase of population growth, environmental change and unsustainable cutting for sale, house construction, fencing and low replanting habit local bamboo in the study area.

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Forest plays a significant role to the livelihoods of people. For millions of people living in poverty, forest and tree resources not only provide food, fuel for cooking and heating, medicine, shelter and clothing, but they also function as safety nets in crises or emergencies(FAO,2019). It is one of the integral components of the world farming system. It supplies people with the opportunities of direct and indirect employment. People are earning a part of their livelihood from selling non-timber forest products (NTFPs) available in the forest. Non-timber Forest Products (NTFPs), also known as noon-wood forest products (NWFPs) ,minor forest produce ,special, minor ,alternative and secondary forest products, are useful substances, materials and/or commodities obtained from forest which do not require harvesting (logging) trees(FAO,1999).NTFPs provide a range of products, which incorporated into the livelihood strategies of rural people aid in reducing their vulnerability to risks (Neumann and Hirsch, 2000). These products are used for food, energy, shelter, medicines, tools and fiber. They are used to meet basic needs, are sold in local, regional and national markets to generate cash and, to fill an important gap or safety-net function (Khare*et al*., 2000; Shackleton*et al*., 2002; Angelsen and under, 2003).

Bamboo is an integral part of forestry, but it is also widely spread outside forests, including farmlands, riverbanks, roadsides and urban areas (FAO, 2007). It is a members of large woody grasses of the family & it encompasses with altogether 1575 identified species in 111 different genera.About 100 specious are used commercially,of which 20 are identified as priority specious for thos wishing to start bamboo(www.bambooimport.com).The species are found at latitudes from 46° N to 47° S latitude upto to 4000 m(asl) altitude . (Ohrnberger, 1999;Lobovikov et al.2007). Bamboo is a multi-purpose tree, which is used for construction, furniture manufacturing, firewood, and human and animal foods (FAO,2013;Sath *et al*., 2008). Worldwide, over 2.5 billion people trade in or use bamboo (INBAR, 1999), thus playing important role socially, economically and ecologically (Ensermu *et al.,* 2000). Bamboo is becoming increasingly important in the world since; (1) it is superior wood substitute;(2) it is cheap, efficient and fast growing; (3) it has high potential for environmental protection, (4) it has

,wide ecological adaption; and, (5) the state of forest is shrinking globally (Ogunjinmi et al. 2009, Rana et al .2010) under regular managing agro-economic practice starting from site selection up to product harvesting period.

Almost every product which is now produced from woody species can be effectively produced from bamboo including panels, boards, flooring, roofing, pulp and paper, fabrics and cloth, charcoal, oil, gas and even vegetables - bamboo shoots(www.bamboo.grove.com). With modern processing techniques, bamboo can be transformed into many products that compete directly with wood products in price and performance. Bamboo is also an environmentally friendly plant, for example it serves as net carbon sink, and produces 35% more oxygen than woody plant (www.altenergy.org). Bamboo agro forestry requires only a modest capital investment and generates steady income to producers and retailers. Over 600 million people around the world generate income from bamboo. Hundreds of millions of people in the world live in bamboo houses. In many parts of Africa, the rural poor are dependent on bamboo for their shelter and daily uses (UNIDO 2009). Therefore, it is labor intensive and contributes significantly to employment opportunities. There has been a growing awareness in recent years that bamboo is a vital component of development and an effective means to improve the livelihoods of rural poor people. Despite its important role and good potentials, the bamboo production and marketing system are not adequately market oriented.

In the World about 1.5 billion people depend on bamboo for their daily lives. The same source indicates that over 20 million tons of bamboo are collected and utilized annually. Global bamboo trade is estimated to be between 1.5 to 2.5 billion USD. Bamboo contributes between 4-7% of the total tropical and subtropical timber trade. Bamboo is a versatile and multifaceted non-timber plant. There are around 111 genera of bamboo with over 1575 species. Of all, only two bamboo species the highland bamboo and lowland bamboo are growing in Ethiopia and both are endemic to Africa (Kassahun, 2000).Ethiopia has over one million hectares of highland and lowland bamboo resources, which account for about 67% of African bamboo resources and more than 7% of the world total area covered by bamboo. Despite its area coverage, bamboo's role in livelihoods and rural development is poorly understood.

Awi zone which is found in Amhara region has a high potential of highland bamboo that is suitable for several purposes and uses due to its easy workability, strength, straightness,

lightness, hardness and short period o f maturity. Bamboo has a tremendous potential for economic development but there is little link between nature and pattern of demand, location o f markets, location of products and their characteristics of bamboo sector in Amhara region in general and Awi zone in particular . Guagusa Shikudad wereda is found in this zone which is known by highland bamboo. Households living in this wereda uses bamboo, bamboo products for various uses for many years. But it is underutilized resource as compared to its potential. They did not link it towards investment rather they use for their day to day survival through traditional methods not commercial purpose. So in this paper, the researcher try to show the long run impacts of bamboo production for household livelihood by linking bamboo production up to economic growth through private investment in addition to day to day survival. Bamboo is a poor man's timber, needs low capital for initial investment. As a result, poor's participate more on investment of it. They get revenue within short period of time because Bamboo grows very fast as compared to other forests.

1.2. Statement of the Problem

Majority of the people in developing countries in general and in Ethiopia particularly live under absolute poverty. The increasing human population leads higher demand for survival income. Agriculture and other activities alone could not sustain the overwhelming proportion of the households in the study area, and that support from other activities should complement household livelihoods. To this end, the role and importance of bamboo was found to be crucial in filling income gaps and supplying the needs of households for additional income.

Investing on the production of bamboo would minimize the problem since bamboo is a poor man's timber that needs low capital to invest.Bamboo plantation and utilization currently received increased attention at national level as an alternative crop with multiple uses and benefits. Bamboo is believed to play a significant role in reducing poverty and named as "the Millennium grass" (EABP 2007).

It is self-regenerating natural resource, combat climate change by restoring degraded landscapes, provide sustainable bio-fuel, or provide new income streams for rural and peri-urban economies. Despite these benefits, which have been tried and tested in many Asian countries, bamboo is massively under-used in Africa especially in Ethiopia.

Although Ethiopia has the greatest bamboo resources in Africa, the economic return gained is very low because of limited tradition of cultivating bamboo and manufacturing products. The use of this abundant resource is restricted to the household level and the primary use of raw material is for housing, fencing and household utensils. It represents only 0.02% of the Ethiopia's exports. There only exists a very limited local market for bamboo handicrafts, which is not further developed and organized. In addition Lack of a regular raw bamboo supply in the operating centers. In addition, bamboo areas are characterized by the absence of bamboo based value added processing technologies and manufacturers to boost income and employment from the sector (Ensermu*et al*., 2000; Kassahun, 2003).There is a general lack of technical knowledge on bamboo management and no harvesting regulations presently exist and cutting is seriously depleting the resource base in the areas where extraction is concentrated (Ensermu*et al*., 2000). Besides, bamboo is neglected by research and development programs in the country and not listed as a priority commodity in the development agenda. The public and privet sector including the government wings have little understanding on the potential of bamboo in meeting rural people's subsistence needs and its immense potential in contributing to the growth and transformation of the rural economy. In addition most researchers focus only the short run aspect of bamboo and ignore its long run impact. Bamboo needs low capital and gives return in short period of time for investors. This leads development of private sector which in the long run fastens the overall growth of the economy. Above all, no documentation is found about benefit of highland bamboo at this wereda. Generally, no empirical information or evidence on the contribution bamboo to the livelihoods of local communities, cultural and environmental conservation was known from the area, but few papers are done on the neighboring wereda/Banja For example Sirawdink in 2017 studied on the ecological benefit of highland bamboo. In addition challenges and opportunities of bamboo production is documented by International Journal of History and Cultural Studies (IJHCS) in 2018 in awi zone, Though, local communities use bamboo resources for various purposes such as fencing basketry, house construction, cash income, etc., limited information has been documented with respect to the contribution of bamboo to the livelihood. This study would intend to assess economic benefit of bamboo production to households and the overall contribution of bamboo to the livelihood.

1.3 Objective of the Study

The general objective of the study is to identify economic contribution of highland bamboo households annual income in Guagusa Shikudad wereda, Awi Zone,the specific objectives are

- To analyze major factors that affect bamboo production in the study area
- To asses of the contribution bamboo production on households income in the study area

1.4. Research question

To achieve this objective the writer put the following research questions

- What is the impact of bamboo producers in household income?
- How does bamboo benefit the society economically?
- How does bamboo use as source of income?
- What are factors that affect bamboo producer participants?

1.5. Scope and Limitationof the Study

Bamboo production has a wider scope with varied dimensions. But for the purpose of this study the researcher would give emphasis on highland bamboo. Due to the limitation of time and resources, it focuses on the highland bamboo of a single wereda, which excludes the other highland bamboo areas. Therefore, this research must be applied taking the stated limitations into consideration. Understanding of the whole highland bamboo existed in the country requires a wider study than presented here. In this paper the writer tried to link bamboo production and household income conceptually in the short run and livelihood in the long run. Both primary and secondary data would be employed to accomplish this paper. Secondary data would be collected from previous papers and various written materials while the writer was collect primary data through questionnaires. In addition, the researcher was employ both descriptive and econometrics methods to analyze the data that would be collected.

This research has been faced by certain drawbacks during the course of conducting this study. One of the difficulties that the researcher was faced, some respondents were unwilling to spend

their time to fill the necessary data, and they believed sharing information leads to disclosing and may lead to negative effect on their way of life. This limitation was, however, resolved in dealing with and developing friendly relationship with and gaining trust from respondents.

1.6. Significance of the Study

Bamboo is the most valuable NTFs in the world in general and developing countries in particular. As a poor man's timber bamboo needs low capital to invest and gives return within small period of time for majority of poor that participated on production of it. Therefore investment on bamboo production would assist in the quest for poverty alleviation in the country.

This paper would be helpful for any private investor that needs to participate on bamboo production, government as well as non-governmental organizations. It can also used as source document for other potential researchers on this area.

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1.7.Organization of the Study

In addition to the above contents, the thesis is organized as second part consist review of related theoretical, conceptual framework and empirical literature. The third part describes the methodologies employed in conducting the research. The fourth part presents the results of the data collected through the various tools described in the methodology. The final part comprises conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Theoretical Literature

2.1.1. Non-Timber Forest Products and their Contribution to Livelihood Security

Non-timber forest products (NTFPs) are crucial for meeting the food, housing and income needs of millions of household throughout the world (Ambrose-Oji 2003, Vedeld and Sjaastad 2014). Population growth and unsustainable forest management have resulted in deforestation and reduced availability of NTFPs in many regions (Dessie and Kleman 2007). Millions of people, particularly in developing nations, rely upon NTFPs each day for "food, fuel, health, and income security" (INBAR 2014). Of all NTFPs, bamboo is considered to the most important and widely used (INBAR 2014).

The underlying role and importance of NTFPs to rural households were synthesized by Belcher et al. (2005) in a comparative analysis of the literature. They found that: 1) NTFPs are widely accessible and crucial to the rural poor, 2) harvesting NTFPs is less ecologically harmful than timber harvesting, and 3) as NTFPs become more valuable, local harvester are incentivized to conserve resources to sustain the supply and future income earnings.

NTFPs directly and indirectly contribute to livelihood security by providing a variety of consumable or profitable resources (Arnold and Townson 1998, Babulo et al. 2009). Many on-farm livelihoods, such as crop cultivation or cattle rearing, require sizeable inputs such as money or land; households without these fundamental inputs cannot easily participate in such livelihoods. Instead, they rely on wild NTFP harvesting to provide crucial domestic/nonmarket and cash income resources. Harvesting NTFPs poses relatively few entry barriers and are often an important contribution to households that have limited income earning opportunities or few assets. NTFP harvesting often complements a multitude of other livelihood activities to ensure

household needs are met year round (Babulo et al. 2009, Tesfaye et al. 2011). Without access to NTFPs, it has been estimated that over a billion people in developing countries would be unable to survive (INBAR 2014). Therefore, sustaining forests and the NTFPs they support is crucial for social resilience (Belcher et al. 2005, Nygren et al. 2006).

Extensive research has documented the significance of NTFP harvesting among rural households, particularly in developing nations. These studies show that harvesting NTFPs is an essential livelihood activity for many rural Africans (Babulo et al. 2009, Cavendish and Campbell 2008, Nygren et al. 2006). Forest products are utilized both in the home or sold and traded as needed (Awadh 2010, Belcher et al. 2005). It has been argued that NTFP harvesting results in less ecological damage than timber extraction (Belcher et al. 2005) because many NTFPs regenerate quickly and/or reproduce vegetatively, and occur in the understory where their removal does not alter forest cover, structure or fundamental biophysical conditions and processes (e.g., nutrient cycling). Bamboo has great potential to be managed and harvested sustainably for benefit by rural households, much like rattan in SE Asia, as documented by Siebert (1995).

NTFPs are often managed as communal resources and are available to individuals as desired or needed. Babulo et al. (2009) states that forest resources help rural households meet their subsistence needs, provide a security net, and potentially alleviate poverty through increased and sustained household income. Many rural African communities rely on local NTFPs, but their contribution to individual households ranges widely (Arnold and Townson 1998, Shackleton and Shackleton 2004, Tesfaye et al. 2011). Cavendish (2000) studied the intensity and variation of forest product use among rural households in Zimbabwe and found that NTFPs are not relied upon and do not profit all households equally. Some research has documented that cash income from NTFP harvesting can reduce the income gap between the poorest and better-off households in a community (Cavendish and Campbell 2008). These results are found when forest products are harvested by poorer households, but not as much by wealthier households as they have alternative livelihood strategies not accessed by the poor (i.e. formal employment, cash crop farming, migrant remittances) (Babulo et al. 2009). Also commonly noted in NTFP research is that wealthier households appear to harvest greater quantities of NTFPs, even though they are

less dependent on that income for survival than poorer households (Cavendish and Campbell 2008, Godoy et al. 1995).

Understanding household extraction rates is imperative to ensure management of common property resources (Ambrose-Oji 2003). Additionally, identifying what influences individual and household interest in and capacity to harvest NTFPs helps bridge income gap disparities (Cavendish and Campbell 2008), increase livelihood security and income generation for rural households (Belcher et al. 2005), and facilitate sustainable resource management.

2.1.2. Bamboo: the "Green Gold" of NTFPs

Bamboo is a member of the grass family, Poaceae, and is the fastest growing plant on earth (Desalegn and Tadesse 2014, Lucas 2013). It grows natively in five continents and includes over 1,200 species in tropical and subtropical regions worldwide (Kleinhenz and Mid more 2001). Bamboo's fast growth, wide availability, and diverse social, ecological and economic uses underlie its importance and popularity. Due to strong market demand and diverse uses (over 1,500 documented), bamboo is traded worldwide (Desalegn and Tadesse 2014, Lucas 2013) and sometimes is referred to as "green gold" (Singh 2008).

Bamboo habitat distribution overlaps with many economically impoverished developing nations (Kigomo 1988). Bamboo occupies about 1% of global forest land or approximately 40 million hectares (FAO 2005). Asia has the most bamboo coverage with 25 million hectares, an area that continues to increase due to ongoing cultivation efforts. In Latin America, bamboo occupies 11 million hectares. Africa holds 3 million hectares of bamboo (Midmore 2009) with over 1 million hectares in Ethiopia (Embaye et al. 2005). Historically, African bamboo has not been widely exported, but commercial interest has recently increased and research has documented potential socio-economic benefits of African bamboo harvesting (Tadesse 2006).

The commercial bamboo sector in Africa is considered to be inefficient due to a lack of laborer skill sets, poor infrastructure, and weak and inconsistent market demand (Ingram et al. 2010). Government involvement in the commoditization process greatly influences the market's potential and benefactors. Restricted resource access and tenure insecurity also constrain market potential and encourage unsustainable resource extraction (Arnold 1993).

Studies from Kenya suggest how government restrictions can influence bamboo livelihoods. Awadh (2010) documented bamboo production and trade among urban micro-enterprise agents who have taught themselves how to manufacture bamboo into small household items and construct furniture. Although bamboo harvesting from native forests is illegal in Kenya, the trade is widespread due to household needs and market opportunities. According to Sigu (2006) estimated that 88% of bamboo harvested in Kenya was illegally extracted. Legal harvesting is not easy for poor rural households who must obtain a government issued license or own land to cultivate bamboo.

Entry requirements to harvest bamboo legally are more readily available to wealthy and politically powerful individuals or companies, and have led to the promotion and establishment of private bamboo plantations using native and non-native species for processing, product manufacturing and export. Foreign plantations are formalizing a bamboo market, but in doing so they compete with and often exclude local residents who lack the political power, skill sets and assets to enter the legal bamboo market (Awadh 2010, Sigu 2006).

In Ethiopia, bamboo harvesting is legal, but the market is weak due to low quality products, and poor coordination among agents involved in the marketing chain (Andargatchew 2008). Inaddition, few incentives exist for sustainable management of native bamboo forests; degradation and land conversion have resulted in a significant loss of bamboo forests and resources throughout Ethiopia (Andargatchew 2008, Kelbessa et al. 2000). In Kenya and Ethiopia, two nations with the most bamboo resources in Africa, product marketing and demand is growing (Brias and Hunde 2009), but the market potential is restricted because local entrepreneurs and rural households have not been successfully incorporated into this emerging market (Awadh 2010, Sigu 2006).

The International Network of Bamboo and Rattan (INBAR) and the East African Bamboo Project (EABP) have been collaborating with the Ethiopian federal government agencies to promote bamboo as a renewable resource that can diversify rural household livelihoods and reduce poverty (Briasnd.,Chaomao et al. 2006). These organizations have knowledge about the African bamboo trade and cultivation (Tadesse 2006). They also organize and sponsor craftsmen workshops to teach cultivation and management techniques, and value addition opportunities (Brias and Hunde 2009, Chernet 2009). The East Africa bamboo market is projected to grow in

response to international market demands (Brias and Hunde 2009, Chaomao et al. 2006) which suggests potential exists for Ethiopian households and communities with bamboo to utilize an existing renewable resource, generate jobs and potentially reduce rural poverty (Awadh 2010). 9

Bamboo offers Ethiopia the opportunity to utilize an abundant, renewable resource to generate local and state-level benefits (Desalegn and Tadesse 2014). Many stakeholders are optimistic about the potential of Ethiopia's bamboo market (McKenna 2013, Ogunjinmi et al. 2009). Well managed bamboo provides ecological and social benefits to strengthen household livelihoods (Brias and Hunde 2009), but documentation about rural household and community-level reliance upon native bamboo resources is lacking.

2.1.3 Bamboo AS Common Property Resources

Many NTFPs, including bamboo, are managed as common property resources (Beck and Nesmith 2001). This management system does not imply a particular type of tenure; common property resources (CPRs) can occur regardless of what tenure system exists (Ostrom et al. 1999). Common property resources, as defined by Ostrom et al. (1999) are subtractable, (i.e. the use of one user reduces the availability for another user), and are difficult to exclude others from using them (e.g. water, air, forests, grazing land). CPRs are particularly important to poor and rural communities because they are naturally occurring, harvestable goods from nature that provide food and income throughout the year (Arnold 1993). Beck and Nesmith (2001) concluded that CPRs in West Africa and India contribute more to poorer households, equalizing rural incomes because poorer households utilize CPRs more than by the better-off. Bamboo is an important rural livelihood activity and is a subsidy from nature, much like the Babassu palm as studied by May et al. (1985).

Common property resources are especially important for communities in countries with nationalized resources or a large population of low income households (Beck and Nesmith 2001). As described by Bruce (1999) common property resources provide communities a sense of assurance and encourage more long term investment; however, these communities often struggle because many lack sufficient organization and legal authority to manage their CPRs. Successful CPR management, as documented by McKean (1992) includes the following attributes: a balanced distribution of resources to community members, use that is self-governed by all community members, rules that enforce sustainable management, and members that are

attentive to the natural environment and evidence of resource degradation or overharvesting. These attributes are rarely achieved in Ethiopia, resulting in unsuccessful CPR management (Mamo et al. 2007, Reynolds et al. 2010).

Households whose needs are sustained largely from NTFPs are especially vulnerable to over-exploitation of CPRs (Bruce 1999). For all CPR users, social regulations that sustain resources are important, but this is especially true for poor households who are more reliant upon the continued availability of CPRs. In Ethiopia, all land and resources are nationalized and cannot be privately owned. Administrative governance exists to regulate resource use but their capacity to enforce and monitor forest activity is low (Crewett and Korf 2008). As a result, resource use resembles more of an open-access regime, rather than a socially regulated CPR management type. The failure of local regulatory or management control has resulted in resource exploitation because individual users have no long-term assurance of resources access; consequently they seek to maximize immediate gains instead.

CPRs management schemes are as varied as the resources they involve, and entail many different management approaches (e.g., seasonal restrictions, controlled harvest volumes, etc.) as desired and upheld by the community of users (Beck and Nesmith 2001). Although a CPR management system gives users equivalent privileges, harvesting opportunities are not the same among all members because of different capacity and interest between harvesters (Beck and Nesmith 2001). Various constraints such as available time and labor differ among households, as 11do household livelihood strategies. This research documents the heterogeneity of households in a community and what influences their capacity to extract native bamboo, an important CPR in Ethiopia.

2.1.4 Bamboo Distribution and Resource Base

Bamboo vegetation covering an estimated area of 36 million ha has is naturally distributed in the tropical and subtropical belt between approximately 46 north and 47 south latitude , and is commonly found in Africa ,Asia and central and south America. Some space also grows successfully in mild temperate zones in Europe and North America. Bamboo is an extremely diverse plant, which easily adapts to different climatic and soil conditions (Rao, 2000; Maxim et al., 2005). Because of its diverse usage and the high ecological and economic values bamboo was planted at large scale and the artificial bamboo forest was developed since the 20th century

worldwide (Zehui, 2007). The total forest area on the land surface decreased from 25% to 17% in recent years and on the contrary the area of bamboo forest increasingly expands, at a steady annual rate 3% ((Fungal et al. 2004 as cited in Zehui, 2007). In terms of bamboo diversity Asia stands first and followed by Latin America and Africa in second and third place respectively. In terms of area coverage about 65% grows in Asia, 28% in America and 7% in Africa (FAO, 2007) During the last 20 years bamboo was introduced to Europe, North America and Australia making the global distribution even (Zehui, 2007).

The major bamboo producing countries in are India (having almost 11.4 million hectares) and China (with over 5.4 million hectares) followed by Indonesia (2 million hectares) and the Lao people's Democratic Republic (With 1.6 million hectares) (FAO,2007), in Latin America , there are at least ten countries have significant bamboo resources of these, Brazil, Chile, Colombia ,Ecuador, Mexico have the richest bamboo recourse (FAO,2007).

Africa has only 45 species and 11 genera occurring on 1.5 million ha. Of these, approximately 40 species are mainly found in Madagascar While the remaining 3 are in mainland Africa (Kigmo, 1988; Ohrnberger; 1999; Tesfaye, 2007). Another report by FAO (2007) shows that six African countries (Ethiopia, Kenya, Nigeria, Uganda, the United Republic of Tanzania and Zimbabwe) have in total over 2.7 million hectares of bamboo and regarding diversity of bamboo in the region a little higher than 13 genera and less than 40 species are reported in the countries.

The highland bamboo can grow at altitudes ranging from 2200 to 3200m. a.s.I. and average annual temperatures of 10 -200 C with annual rain fall of 1700-2200 mm (LUSO, 1997). According to Phillips (1995), the highland bamboo is distributed in Cameroon (Mt. Cameroon), Zaire (Kivu), Rwanda, Burundi , the Sudan and the mountains of Uganda Kenya, Tanzania and Malawi (Nyika plateau). The African alpine bamboo (Arundinariaalpina k. Schumann) and the monotypic genus lowland bamboo Oxytenantheraabyssinica (A. Richard) Munro are the two bamboo species indigenous to Ethiopia and endemic to Africa (Kassahun, 2003; Tesfaye, 2007). The existing information about the distribution and coverage of bamboo in Ethiopia is rather limited and varied .There is a generation that Ethiopia has about 1 million ha of highland and lowland bamboos (LUSO, 1997 and Kassahun, 2003), the latter is estimated to be more than 800,000ha out of which only 480,510 ha was mapped. Regarding the highland bamboo resource base the total mapped naturally grown highland bamboo is 129,626 ha and the area planted by

farmers is estimated to be about 19,00 ha, together, summing up to 148,626 ha (FAO and INBAR, 2005). Thus 67% of African bamboo resources and more than 7% of the world total are found in Ethiopia. However the country has ample resource though it is not scientifically managed and utilized.

In Ethiopia high land bamboo is distributed in Agaro, Bore, Ambo-Shenen, Bale, Gera,Jibat Mountain, Harena Forest, DegagaMunesaShashemene Enterprise in Oromiya National Regional State; Awi Zone in Amhara National Regional State; Awi Zone in Amhara National State ; HagereselamAmeya, Baha-Chapa, Bonga, Chincha, Gecha-Masha, Indibir, Indibir-Jembero and Jembero in SNNPR (Tesfaye, 2007; and EABP, 2009).

In the Amhara National Regional State 27 bamboo growing districts are reported are reported by BoA (2012) and cover about 27,390.59 ha (i.e., highland bamboo 7351.78 ha and lowland bamboo 20,038.81 ha). The high land bamboo is distributed in Guagusa Shikudad, Injibara Town Administration, FagitaLekoma,Ankesha and Banja districts in Awi Zone; Sinan and Bibugni districts in East Gojjam Zone; Farta and Estie districts in south GondorZone;Tarmaber (DebreSina) in North Shoa; Sekela, DegaDamot and Quarit in west GojjamZon (Bereket, 2008; BoA,2012). On the other hand, the lowland bamboo is distributed in Jawi, Guagusa and Ankesha in Awi Zone; quara, Metema, TachArmachiho and Adiarkay in North Gondor Zone (Bereket, 2008).

2.1.5. Ethiopia, Bamboo and Rural Livelihoods

Ethiopia is the second most populous nation in Africa, and one of the world's poorest countries (World Bank 2014). In an attempt to encourage economic development and decentralize authority, Ethiopia has undertaken extensive land reforms in the last 40 years during multiple political transitions (World Bank 2014). During the monarchies, prior to 1975, land ownership was primarily limited to wealthy absentee landlords. The tenure system was highly insecure and most of the population worked as land tenants. After the Marxist *Derg*regime overthrew the Monarchy in 1975, all land was nationalized to better distribute the nation's environmental resources to the majority of the population (Crewett and Korf 2008). Ethnic clans were modernized into management association groups, *kebeles,* to better govern the people and the resources. In 1991, the Ethiopian People's Revolutionary Democratic Front (EPRDF), replaced the *Derg,* but maintained the policy that all land and resources were nationalized. Some

adjustments regarding land leasing and inheritance allowances were made, but individual land ownership is still not possible and leased land could be usurped as the government desires (Deininger and Jin 2006).

Since 1975 with the fall of the Monarchy until present, much of Ethiopia's land is managed under usufruct tenure, with common property resources available to the surrounding community (Crewett and Korf 2008). The local Peasants' Associations (PAs) regulate the land leases in their village. Leases can be granted to farmers who apply with proof of permanent physical residence, and are not charged for a plot of cultivatable land (Deininger and Jin 2006). Harvesting CPRs in nearby forests is possible for local residents who pay a one-time fee of 120 ETB to the Peasants' Association (YosanAbdulkadir 2013). Forest and grazing areas are utilized openly by the local community, and minimal regulation or use restrictions are in place (Deininger and Jin 2006).

A landlocked nation in the Horn of Africa; Ethiopia is bordered by Eritrea to the North, Djibouti and Somalia to the East, Kenya to South and Sudan and South Sudan on the western border (Figure 1). The total area of Ethiopia is 1,104,300 km² making it the ninth largest nation in continental Africa. Inhabiting this spacious area is a rapidly growing population, currently estimated to be 96 million (CIA 2014). The US Central Intelligence Agency (2014) reported that 73% of Ethiopia's inhabitants live in rural areas, and 80-85% of the rural population classify themselves as agriculturalists (Bigsten et al. 2003). Cash crop farms often grow wheat, barley, corn, teff, cotton and chat (Mamo et al. 2007). Many households grow small plots of subsistence crops including potatoes, sorghum, ensete, onion, beans. Almost all Ethiopian agriculture is rain-fed (Chernet 2009).

Ethiopia's economy has been unstable in previous decades and is currently booming; all the while it remains dependent on agriculture which comprises over 47% of the country's GDP (CIA 2014, Koehn and Cohen 1978). Inflated agricultural prices and variable market demands make income security a challenge for the nation's rural population (Yemiru et al. 2010, Zewde and Pausewang 2002). Average national per capital income is $470, or $1.29 per day (World Bank 2014). As Ethiopia strives to boost its economy and reduce poverty, the government has development plans to diversify and increase production from agriculture and industrial sectors (World Bank 2014). Formal manufacturing of bamboo products is a recent development in Ethiopia's economy (Kelbessa et al. 2000), but the small-scale bamboo trade in rural areas has a

long history (Tadesse 2006). The International Network of Bamboo and Rattan (INBAR) works with various Ethiopian government bureaus to promote bamboo enterprises for economic, social and ecological benefit (Chernet 2009, Tadesse 2006).

2.1.6. The Bamboo Kingdom of Africa

It is believed that Ethiopia, which has about 67 percent of bamboo cultivation potential in Africa, could have been generating hundreds of millions of dollars per annum from its bamboo forests. Bamboo is a significant income source for rural Ethiopian households, and also reduces harvesting demands on other more limited forest products such as timber (INBAR 2008). Where it is locally available, bamboo is an important NTFP that provides more regular income to harvesters than most agricultural crops which give only seasonal or annual income (Andargatchew 2008, Kelbessa et al. 2000, Sertse et al. 2011). In addition, plays an important ecological role in Ethiopian forests and reduces deforestation pressures (Mekonnen et al. 2010, Sertse et al. 2011). The Ethiopian government has implemented regulations to reduce access and reliance on timber products due to widespread deforestation; however these regulations are rarely enforced due to lack of resources and curroption (Amede et al. 2001, Yemiru et al. 20010). Bamboo has been advocated as a means to supplement timber production and can be used for charcoal (Chernet 2009, Embaye et al. 2005). Additionally, it can help control soil erosion, declining soil fertility, reduced water availability and the loss of endemic wildlife habitat (Kigomo 1988, Sertse et al. 2011). Bamboo also helps restore forests and provide an important carbon sink (Assaye et al. 2014).

Traditionally bamboo is used for fencing, flooring, water pipes, furniture, beehives, construction and handicrafts in Ethiopia (Embaye 2000, Sertse et al. 2011). Most of the bamboo used for these products is extracted from natural stands and sold at local markets. Market prices are typically low because the quality is poor and it is not high in demand when compared to timber products. Nevertheless, bamboo provides year round income for harvesters that live in bamboo growing areas (Andargatchew 2008, Brias and Hunde 2009). Bamboo is an important, highly renewable resource, but its growth rate and quality are influenced by biophysical conditions and harvesting techniques. Among other factors that threaten Ethiopia's bamboo resources; deforestation caused by agriculture and livestock expansion is the major one (Brias and Hunde 2009, Embaye et al. 2005). Ethiopia's bamboo is considered by the government to be a minor

forest product and management techniques are not widely understood or practiced (Brias and Hunde 2009). Many Ethiopians consider bamboo to be inferior to wood, even though studies have shown that treated bamboo is comparable in strength, and sometimes more durable than some timber products (Brias and Hunde 2009, Kassa 2009). Low quality bamboo products often result not from the original raw material, but from poor harvesting techniques, inadequate storage and failure to protect culms against biological and physical deterioration (Desalegn and Tadesse 2014). With proper management techniques bamboo value and the prospects for sustainable harvesting can be enhanced, which will improve both forest conditions and household incomes (Brias and Hunde 2009, Endalamaw et al. 2013). At present, bamboo and individuals who rely on it are threatened by unpredictable economic conditions and environmental degradation (Embaye 2000, Kelbessa et al. 2000). While Ethiopia is one of the world's poorest nations, it has recently had one of the fastest growing economies in Africa (CIA 2014, Reynolds et al. 2010).

2.1.7. Economic, Social and Environmental impact of Bamboo production

The livelihoods comprise of resources or assets that enable strategies to be employed in order to survive and attain desirable livelihood outcomes such as income, food security, wellbeing and sustainable use of natural resources (Carswell, 1997; Carney, 1998). Bamboo has numerous benefits in day to day uses for the rural livelihoods where the species is growing (Tesfaye, 1998); it also plays important roles in the daily life and wellbeing of both rural and urban communities in Ethiopia (Melaku, 2006). Due to their easy workability, strength, straightness, lightness, combined with extra-ordinary hardness, range of size, abundance, short period in which they attain maturity, they are suitable for several purposes and uses. As a result, there are more than 1,500 uses, ranging from medicine to nutrition and from toys to aircraft (Sharma *et al*., 1998). Worldwide, over 2.5 billion people livelihood depends on bamboo (Cherla, 2008); thus playing important role which is socially acceptable, economically viable and ecologically friendly (Kassahun, 2003). Some socio-economic contributions of bamboo for rural livelihoods are: For construction material and household furniture, Health and nutritional value, as Renewable energy sources & as a source of income and livelihood. In Ethiopia, highland bamboo is used for fences, constructing of propels, vessels for carrying and storing water, water pipes, splits for baskets, beehives, hats, mats, furniture, walking-sticks, flutes, household utensils, animal fodder and agricultural tools. Split bamboos, with edges trimmed sharp are used as raw meat cutters in areas

where there are no knives available (Ensermu et al., 2000). The silica stored in the stem is used as a medicine for many diseases (INBAR, 2011). More importantly, market for bamboo culms and bamboo products has developed for long years in Awie zone of Amhara Region. Many landless individuals buy bamboo from farmers and get engaged in producing mats, fence and furniture and they sell the products along the roadsides. For these households, highland bamboo is the major source of income.

2.1.8.1The economic effects of bamboo production

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. 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 cause 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 labour has increased in the bamboo enterprises.

2.1.8.2 Social benefits of bamboo

The social assessment of bamboo has revealed that bamboo plantation, harvesting and processing has brought much social benefits to rural dwellers, communities and nations which commercialized its plantation. 'Bamboo' mostly considered as "poor man's timber" because it is readily available for poor classes at often very low costs in some years past, mostly in many developing countries where it is available. Social development, investment management system and agriculture production were assessed. ,the social conditions of the people in the areas where bamboos are grown commercially has transform positively, because they have made huge amount of returns from their proceeds. They get foreign exchanges in the form of capitals, machinery and other facilities to boost their socio-economic lives as they engage in its trade. This has brought a new development to the wood processing industries as bamboo's investment has come to stay.

2.1.8.3 Environmental role of bamboo

The current environmental problems being experienced globally in recent years indicated that the current patterns of development are not sustainable. These indications highlight the need for injection of environment friendly developmental patterns and process through industrial development needs to be sustained. In recent times, our environment has suffered many disasters resulting from climate changes causing floods in many countries leading to loss in human lives and properties Soyinka (2012) and Folaranmi (2012). In view of the above, the effect of climate change is fast becoming global reality. As climate change is fast becoming a global phenomenon, it is already influencing patterns of production and consumption activities, including international trade. As a result of this, development initiatives globally tends to support activities that downplays the role of forest resources as industrial inputs, most especially, the utilization of slow growing soft and hard wood plant species, as efforts are been directed towards production and utilization of fast growing high yielding alternatives such as bamboo in industrial production processes.Globally, deforestation has led to significant reduction in the forest cover as a result of high dependence on wood species for domestic processing and exportation. Though, bamboo has contributed immensely to the social needs of its growers and traders, as it enhances the development of their communities' amenities, there are some negative effects on the environment as natural forests are being destroyed to pave way for the cultivation of bamboos. Most chemicals such as pesticides used in the plantations drains into the soil and water bodies

causing the death of livestock and other aquatic species in the area of its cultivation as well as the human beings living in the communities of growing.

It used as Soil and water conservation. Bamboo forests have an extensive rhizome system, a thick litter layer, highly elastic culms and a dense canopy. These characteristics give bamboo forests a high capacity for erosion control, soil and water conservation, landslide prevention and protection of riverbanks (Song *et al*., 2011). According to Kassahun (2003) report, the extensive rhizome system of bamboos lies primarily in the top layers of soil, thus it often play a major role in stabilizing soils on steep slopes and river banks. Most of the time bamboo is characterized by a complex network of rhizome root system which makes them excel other forest types to effectively holding soil particles together, thereby preventing soil erosion and promoting water percolation (INBAR, 2004). As a result of the widespread root system, uniquely shaped leaves and dense litter floor, the sum of stem flow rate and canopy intercept of bamboo is 25%, which is greatly reduces run off, preventing massive erosion and keeping up twice as much water in the watershed (Pandey and Shyamasundar, 2008), particularly in the areas of prone to high amounts of runoff and degraded lands.

On one hand, this species are evergreen plants, thick canopy and soil cover provided by dead leaves reduces splash erosion and enhances infiltration capacity (INBAR, 2009). So, it makes important in securing the hydrological function of the catchments and rivers. Majority of bamboo species are characteristic in high altitude ecosystems on steep slopes in zones of high seismic activity, hence their role in soil stabilization may be critical. The aboveground part of a bamboo forest helps reduce erosion by rainfall interception and by sheltering the soil from wind erosion and sun drying (Kassahun, 2003; Yenesew*et al*., 2013b).Above all bamboo used as Biodiversity functioning. The stand of the species is essentially monocultures and important for biodiversity conservation. In different partof the country, the species provide habitat, food, shelter, and sites for reproduction to a variety of endangered

Species (Bystriakova*et al*., 2004).

2.2 Empirical literature

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 (Kassahun, 2003).

The importance of bamboo as an NTFP with important economic and development potentials is globally accepted. It plays a major role in the development of many countries in the world. Particularly people in developing countries like Ethiopia depend on it for survival and livelihood. Bamboo is linked with Ethiopian rural people's life for centuries. It plays important roles in improving the livelihood of both rural and urban population. Particularly, rural and poor people depend on bamboo as major sources for food, medicine, fodder, fiber, household utensils, furniture, and fencing and construction materials. Bamboo provides off-farm income to a large part of the rural population in Ethiopia and accounts for a large share of household income.

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). National and local trade is likely a few times higher. There are other numerous examples of the importance of bamboo for national economies and international trade. However, reliable statistics are still lacking. Most of the economic activities related to bamboo are not recorded officially. They are site-specific, highly diverse and present challenges for official data collection (FAO, 2001a).

Bamboo ticks many of the 'green development' boxes, offering a renewable resource that can help to restore degraded landscapes, provide sustainable bio-fuel, combat climate change, or provide new income streams for rural and peri-urban economies. Despite these benefits, which have been tried and tested in many Asian countries, bamboo is massively under-used in Africa, though the continent has plentiful indigenous supplies and excellent conditions for planting cultivated species. Some eight percent of the world's bamboo resources are found in Africa.

It is found naturally distributed in large areas of Africa with over 40 species covering more than 3 million hectares. Most of the African bamboo resource is found in natural forest forms. It has been largely used for small crafts, house construction and other utilities. While there is no comprehensive empirical study on how bamboo is valued across Africa, several case studies in the continent have shown that it is less valued than wood products (Obiri and Oteng-Amoako 2007; Endalamaw et al. 2013; Ingram and Tieguhong 2013b). Moreover, the level of technology for bamboo utilization in all African countries remains largely traditional and only a few

manufacturing firms are reported (Athanasiades et al. 2009; Ebanyenle et al; Ingram and Tieguhong 2013b). Recently, increased attention is given to the sector especially within INBAR member countries.

In Ethiopia Bamboo forest is decreasing due to population growth, demand for land, migration and forest fires. Access to bamboo is becoming more difficult as authorities and users recognize the need to protect it from further decline. Management concepts and experience are lacking. In the 1960s, the total area of bamboo was estimated at 1.5 million hectares, including 1 million hectares of lowland bamboo. However, a study by private consultants in 1997 significantly reduced this estimate. The currently estimated total area of bamboo is 849 000 ha. The area of sympodial bamboo is 700 000 ha. About 481 000 ha were mapped and partly surveyed for the 1997 study. The total area of mapped monopodial bamboo is 148 626 ha, including 129 626 ha of naturally regenerated and 19 000 ha of planted bamboo. It is likely that the Ethiopian bamboo area has been shrinking since 1997(FAO,2007).Though bamboo decrease by area coverage by natural as well as human made factors, its livelihood impact to households increase from time to time because of its fast growing nature(poor man's timber). As result, bamboo recently used as new income streams to rural communities, combats climate change & restores degraded landscapes.Documents suggesting the high potentials of bamboo in Ethiopia have been produced since 1959 (Mooney) which suggested the use of lowland bamboo in Ethiopia as a raw material for paper pulp production in the Wellega region (now Benishangul – Gumuz). Similar suggestions were made by Wolde Michael Kalecha (1980) while the Ethiopian Forestry Action Program (EFAP) in 1994 proposed a "bamboo and reed research and development project". Further, in 1997 LUSO consult was commissioned by the German Technical Cooperation (GTZ) to carry out a study on sustainable management of bamboo followed by a production – to – consumption study by Ensermu et al (2000). The Kenya Forest Research Institute (KEFRI) has also produced a guideline for sustainable bamboo use in 2007. In addition, a number of researches on bamboo management and method for introduction of new species are being carried out at the Ethiopian Forestry Research Center.

Recently, Kelbessaetal.found that bamboo is an important commodity, both environmentally and ecologically, for producing regions. At the same time, it is seen as a "poor man's wood". 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. Many households only engage in bamboo production for additional household revenues. The participation of actors in the bamboo value chain remains at a low level of knowledge, skills, and value-addition. 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.

The country is starting to use bamboo for environmental conservation, to protect watersheds and prevent soil erosion. Some farmers are using it for intercropping, planting it as shade for other crops, protection against sun and wind and as a natural 'mulcher' providing drought protection and a steady income stream due to its rapid growth.

According to Hunde, of INBAR's East Africa Regional Office the use of bamboo is dramatically increasing. People in the cities love bamboo and there is a growing demand for furniture, so prices are increasing." But even so, it is used far below its potential. People living in bamboo growing areas use it for fuel wood, fencing agricultural tools and, to some extent, furniture and home decoration. They also collect bamboo shoots for food and animal fodder. But higher levels of value addition are small, limiting growth and export earnings.

2.3 Conceptual framework

The term 'livelihoods' has become increasingly important in development theory and practice, as it is seen to encompass a wide range of concerns, and to allow inclusion of the broad range of people's activities and assets in considering how they support themselves, rather than focusing more narrowly on economic, income-generating or formal activities. One way in which this concept has been developed has been through the formulation of sustainable livelihood frameworks. The livelihood strategies and activities of poor people are often complex and diverse. For rural people, agriculture and other natural resource-based activities may play an important role, but rural households also diversify into other activities, some of which are linked to agriculture and the natural resources sector, others which are not. They engage in part-time farming activities with a mode of agricultural production distinct from that of other farms (such as commercial, smallholder family or co-operative farms) with multiple economic activities which are predominantly in small scale (often household) activities and enterprises in the informal economy. These activities also tend to have a heavy dependence on family labor and

little use of capital.Poor rural people's livelihoods are significant in national economies and the world economy because of (1), the potential market for increased demand for consumer goods and services if rural people become more wealthy (2), their potential contribution to, or drain on, resources either as a dynamic and growing part of national economies generating employment, tax revenues, and so on, or as a stagnant sector demanding welfare support for a poor and large part of the population .the factors that affect the producers age,sex, distance to market,education,access to market, etc depend their livelihood directly or indirectly .so the researcher try to link the two that is bamboo production and household income in this thesis .

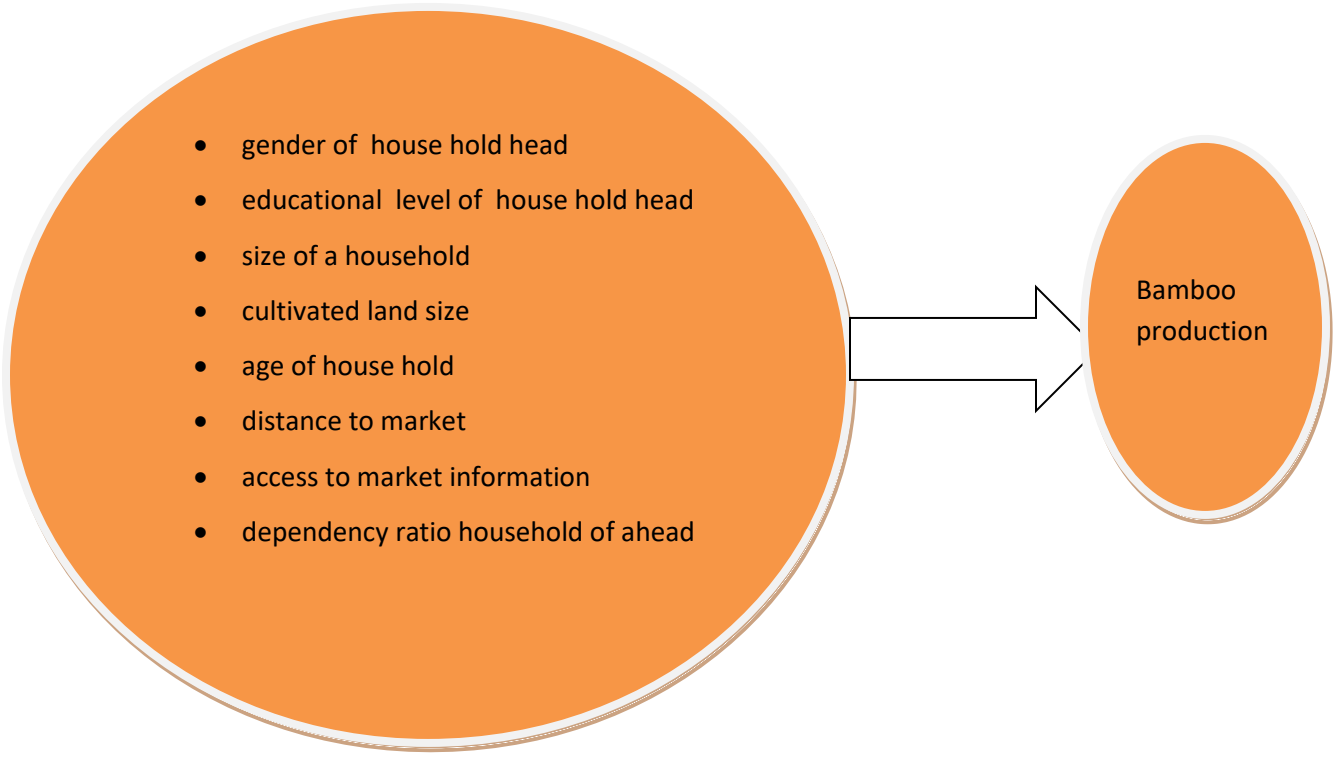


Fig. 1 conceptual framework on bamboo production and its determinants

CHAPTER THREE

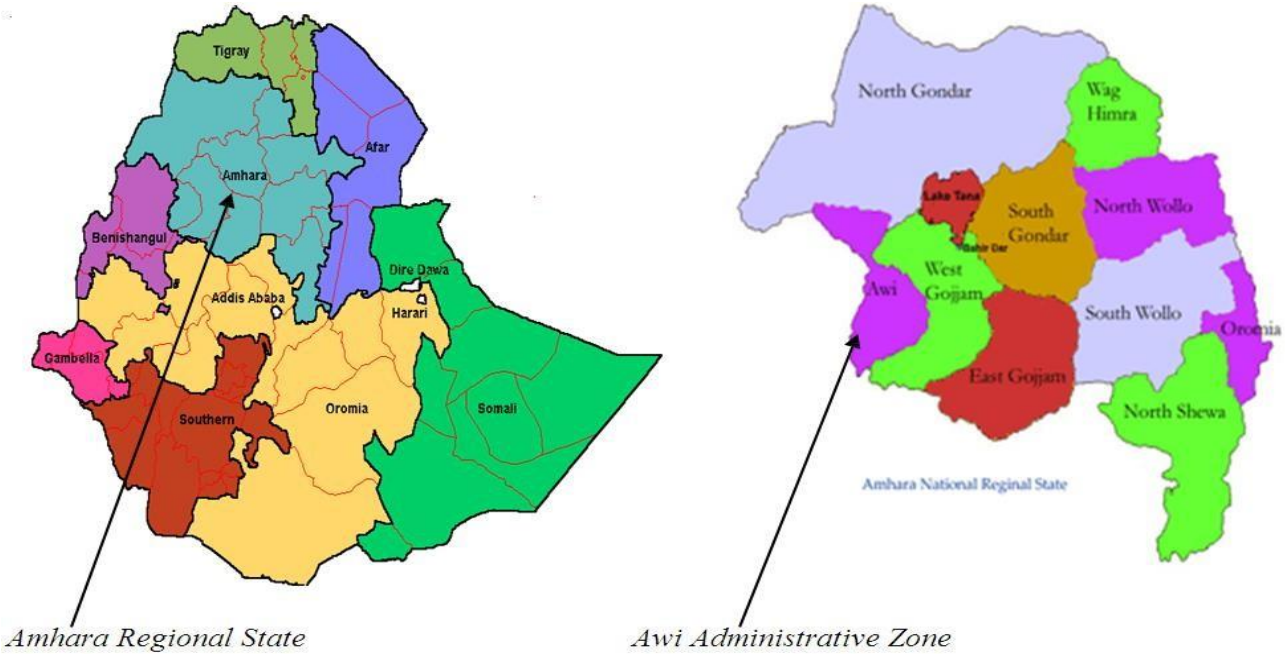
RESEARCH METHODOLOGY

3.1. TARGAT POPULATION

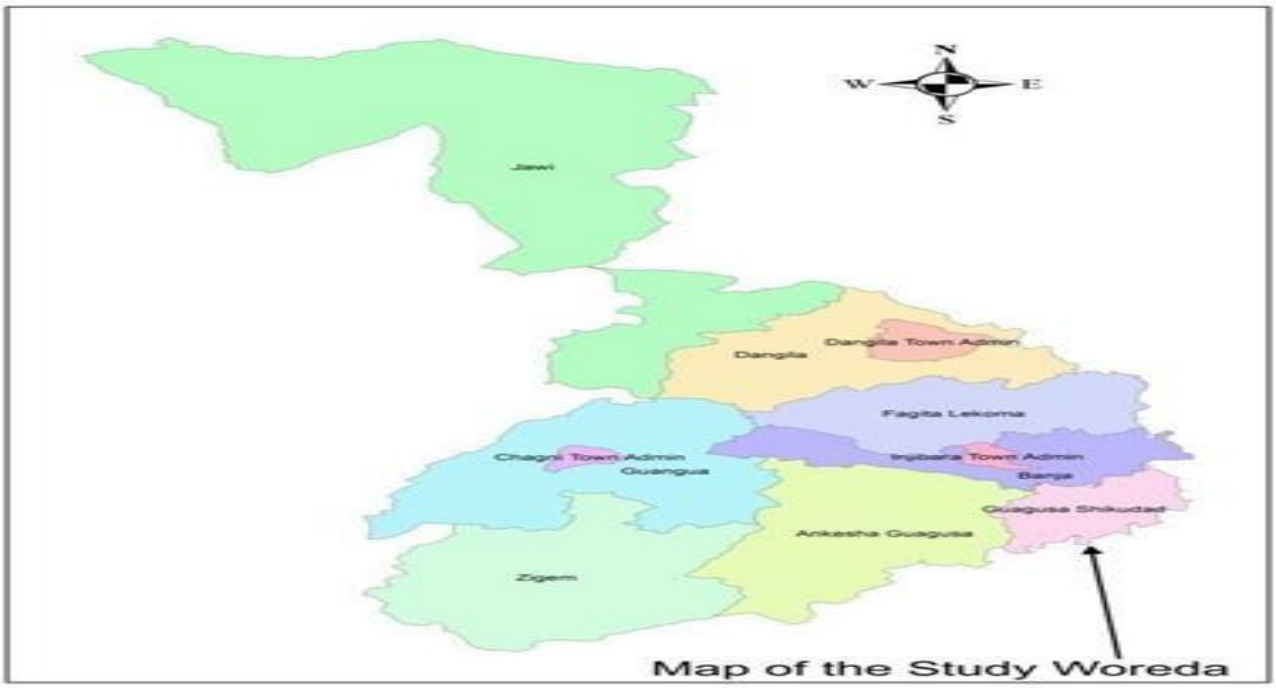
The study area is shikudadworeda in awi zone. The target population for this research will be all bamboo producers at that selected area; which will be selected by simple random sampling technique.

3.2. Description of the Study Area

This survey was conducted in the northwestern Ethiopia, Awi zone of the Amhara Regional State, particularly in Guagusa shikudad wereda. Awi zone is a high rainfall area that range between 1200-2000 mm annually with a bimodal distribution. The short and long rainy season falls in February to March and June to September, respectively, followed by an extended dry season from October to February.The average annual rainfall is 1750 mm while the average monthly temperature ranges from 17°C to 27°C. Awi zone is located within a longitude and latitude of / 10.95°N and 36.5°E and lies at an altitude range of 1800 - 3100 meters above sea level with an average altitude of 2300 m.a.s.l (Awi Zone Agricultural and Rural Development Office /AZARDO, 2008). Guagusa Shekudad is one of the woredain the Amhara Region of Ethiopia. Part of the AgewAwi Zone, Guagusa Shekudad is bordered on the west by Ankasha Guagusa, on the north by BanjaShekudad, and on the east and south by the MirabGojjam Zone. Towns in Guagusa Shekudad include Tilili. Guagusa Shekudad was part of former Banjaworedas.It covers 296.04 km^2 (114.30 sq mi). Based on the 2007 national census conducted by the Central Statistical Agency of Ethiopia (CSA), this woreda has a total population of 83,930, of whom 41,427 are men and 42,503 women; 9,043 or 10.78% are urban inhabitants. This number is estimated to 91752 in 2012. The majority of the inhabitants practiced Ethiopian Orthodox Christianity, with 99.91% reporting that as their religion.



The distribution of bamboo product in awi zone map



Source: Amhara National Regional State Bureau of Finance and Economic Development

3.3. Type and Source of Data

This study was conducted to assess the economic contribution of bamboo production on households existed in Guagusa Shikudad wereda. Primary data was mainly used to conduct the study using a survey method involving a structured questionnaire on multitude of socio-economic variables. The socio-economic data was include sex of the household, age, family size, early occupation, experience, farmer's education levels, availability and amount of credit, other livelihood source , etc.

Secondary data was collected from different sources including books, journal articles, previous studies of researchers and/or scholars in the sector and other internet sources as well as they provide detailed and latest findings on the field of the study.

3.4. Sampling Design

A two–stage sampling technique would be used in this study. In the first stage, Jibayta and wuhassakebele was selected purposively since there is large amount of bamboo existed in this two kebele. In the second stage, sample households were categorized into Bamboo producers and non-producers. Therefore, in order to select the sample household the study used the formula recommended by Yamane (1973).

There is a total of 405 households in two kebelei.e. 206 Housholds in Wuhasa and 199 in Jibaytakebele

$n = \frac{N}{1+Ne^2} = \frac{405}{1+405\text{x } 0.05^2}$=201

Where, n is sample size,

N= total population,

e^2= probability of error

To determine sample size in each kebele, the researcher employed proportional samplingtechnique, the total samples (201) to the selected kebeles proportionally. Each kebele sample

Size was computed as follows, to calculate sample size in each kebelefirist multiply number of households existed in that kebele by the sample total size and divide by the total population.

Table 3.1

KEBELIE	NUMBER OF HOUSHOLDS	WAYS OF COMPUTATION	SAMPLE SIZE
JIBAYTA	199	199x201/405=99	99
WUHASA	206	206x 201/405=102	102

The study was used Kothari (2004) proportional sample size allocation formula which is [n$i = n\frac{\mathrm{Ni}}{\mathrm{N}}$] to calculate the size of the sample from producers and non-producers; where n_i is the sample size of producers and non-producers, n is the total sample size which is determine by Yemane formula, N_i is the households size of each producer and non-producer and N is the total household in the Kebele.

3.5. Method of Analysis

The study would employ both descriptive and econometric. Double stage econometrics models were employed in this thesis. The first model would investigate the factors that affect bamboo production. This would be analyzed by using logit model, because due to the complexity of estimation procedure of Tobit model than the logit model, logit is widely used (Caliendo and Kopeinig, 2005). To capture this advantage, the logit model would be used. In the second model the researcher will analyze effects of bamboo production on household income be using Tobit model.

3.6 Econometric Model Specification

According to Gujarati (1995), three types of models have been proposed in the econometric literature for estimating binary choice models: the linear probability, logit and Tobit models represented by linear probability function, logistic distribution function and normal distribution function, respectively. These functions will be used to approximate the mathematical relationships between explanatory variables and bamboo production that is always assigned qualitative response variables.

According to Hosmer and Lemeshow (1989) the major point that distinguishes these functions from the linear regression model is that the outcome variable in these functions is dichotomous.

Besides, the difference between logistic and linear regression is reflected both in the choice of a parametric model and in the assumptions. Once this difference is accounted for, the methods employed in analysis using logistic regression follow the same general principles used in linear regression.

According to Hosmer and Lemeshow (1989), there are two primary reasons for choosing the logistic distributions: from mathematical point of view; it is an extremely flexible and easily used function; and it lends itself to a meaningful interpretation. The interest of the study with regard to this objective is to analyze the determinant of bamboo production. For this study, analytical model selected is binary logit model which significantly identifies bamboo production producer.

Binary choice models are appropriate when the decision making choice between two alternatives (bamboo production producer and none producer). Bamboo production is a dependent variable, which takes a value of zero or one depending on whether or not a producers is participating in bamboo or not (i.e. bamboo producer =1 and none producer=0).

Following (Gujarati, 1995) the logistic distribution for the bamboo production can be specified

$$\text{Ni} = \frac{e^{ni}}{1+e^{ni}} \quad \ldots\ldots (1)$$

Where Ni =was the probability that an household is being participating production for the i^{th} bamboo and ranges from 0 to 1.e = Represents the base of natural logarithms and

ni= is the function of a vector of n- explanatory variables(x) and expressed as

$$ni = \beta 0 + \sum \beta i Xi + ui \quad \ldots\ldots (2)$$

Where β0= is the intercept

Bi = is regression coefficients to be estimated,

Xi= is explanatory Variables and µi is a disturbance term

1-Ni was represent the probability of do not participating in labor force and can be written as:

$$1 - \text{Ni} = \frac{1}{1+e^{ni}} \quad \ldots\ldots (3)$$

Then odds ratio can be written as

$$\frac{\text{Ni}}{1-Ni} = \frac{1+e^{ni}}{1+e^{-ni}} = e^{ni} \quad \ldots\ldots 4$$

Equation (4) was indicates simply the odds ratio. It was the ratio of the probability that the producers participating in bamboo production (Ni) to the probability that producers that are not participating in bamboo production(1-Ni)

Finally, by taking the natural logarism of equation (4) the log of odds ratio could be written as:

$$Li=Ln(\frac{Ni}{1-Ni})=Ln(e^{\beta 0}+\sum j^{n}=1\beta jxij) =ni=\beta o+\sum j^{n}\beta jxij =1 +ui \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 5$$

Where Li was log of the odds ratio, which was not only linear in X ji but also linear in the parameters. Where Li was log of the odds ratio, which was not only linear in X ji but also linear in the parameters. The first analysis of this study is to investigate the factors that affect bamboo

production. Regression analysis is one of the standard methods used to assess the effect of different factors. The following explanatory variables would determine bamboo production

Decision: $Z_{cal}>Z_{tab}$, Reject Ho, other wise $Z_{cal}<Z_{tab}$, Accept Ho

Test of hypothesis:

H_o: There is not factors' affecting bamboo production. $H_{1:}$ Not H_o

3.7. Diagnostic Tests and description of variables

Before the start of complete analysis, various diagnostic tests were conducted to make the data ready for regression. Model-Fit test is one of the most useful tests for truly assessing model fit for binary various regression models (Gujarati, 2004). To assess the usefulness of the model in indicating the amount of variation in the dependent variable, R Square, described as pseudo R2-statistics (from a minimum value of 0 to a maximum of approximately 1) were tested. In a rule of thumb p-value of 0.05 is taken as a reference in assessing the goodness-of-fit test. In this study the prob> chi2 was found to be 0.0015 which is less than (0.05). Thus, the model was good. As general rule, multi-colinearity is a problem when the correlation result is above 0.80and below -0.80 (Stock & Watson, 2007).It can be tested by Variance Inflation Factor (VIF).

3.8. Determinants of Bamboo Production

The first analysis of this study is to investigate the factors that affect income from bamboo production. Regression analysis is one of the standard methods used to assess the effect of different factors. The following explanatory variables would determine bamboo production

Cultivated land size (LANDSZ): total cultivated land size is the total sum of the households' own and/or rented in/out from/to other households and measured in hectares. This land does not include the grazing and uncultivated land but it includes irrigated and rain fed land. Farmland is the major input for agricultural production in rural households. Total cultivated land should have a positive relationship with the amount of bamboo produced by a household (Kamara et al. 2001).

Family size of a household in adult equivalent (FAMSZADUL): family size in adult equivalent of a household was calculated by using a conversion factor. A household family size in adult equivalent is calculated by multiplying each household member with respective conversion factor and then summing. Its size depends on the age of each family members of a household. In rural households, family labor is the major input used in agricultural production. Households with large family size in adult equivalent will have more labor for agricultural production. Family size in adult equivalent was expected to positively affect total production of bamboo.

Education (literacy) level of a household head (EDUHHL): Education has paramount impact on production improvement and poverty alleviation. It is likely that educated farmers would more readily adopt modern technologies and may be easier to train through extension support. The variable was entered in the model as dummy variable by giving 1 for households that take primary education and 0 otherwise.

.Gender of the household head (GENDEHH): This is a dummy variable with 1 for male and 0 otherwise. Male household heads are expected to have higher productivity compared to female household heads because of better labor inputs used in male-headed households. Women farmers may need long adjustment period to diversify their potential source fully and become productive.

Age of a household head (AGEHH): Age is a continuous variable and measured in years. In Ethiopia, household head is the decision maker for farm activities. Age is one of the factors that determine decision making of a person. Advanced aged household heads are more reluctant to accept new technology and agricultural production styles than younger household heads. Thus, age of household head was hypothesized to have positive contribution to household productivity.

Dependency ratio of the household (DEPRATIO): The dependency ratio is equal to the number of individuals aged below 15 and/or above 64 divided by the number of individuals aged 15 to

64, expressed as a percentage (John 2002). Dependency ratio is important because it shows the ratio of economically inactive compared to economically active. The dependency ratio of agricultural households provides planners and policy makers with an indication of agricultural labor availability in male and female managed holdings and their abilities to actively participate in agricultural programs and projects. Members of holdings with high dependency ratios might not be able to participate in programs and projects due to time, labor and/or financial constraints (FAO 2010), that is dependency ratio is thought to be negatively related to productivity of households.

Access to market information (ACMIF): the probability of participation in bamboo production for a household was expected high in access to market information than households who do not have access to market information. It is dummy variable take the value one if information access zero otherwise.

Distance to market (DISM): it measured in kilometers required to reach to the nearest market place. The study was expected the probability of participation in bamboo production decreases with farness of the nearest market.

Table 3.2: Variable used in the model to explain factors affecting bamboo production

Variable name	Type and description	Value
Family size	Family size	Adult Equivalent (AE)
Age	Age of the household head	Years
Education	Education level of the head	Years of education
Gender	Gender of the head	1 if the head is male 0 for female
Market information	Access of Market information	1 access to market information ,and 0 other wise
Farm size	Total farm size	Hectare
Market	Distance to market	Kilometer

CHAPTER FOUR

RESULT AND DISCUSION

4.1 Descriptive Statistics and Discussion

4.1.1. Ownership of Bamboo Plantation

In the highland districts, bamboo is owned privately as backyard and riverbank plantation or around farm area as live fences . The species of bamboo cultivated in these districts is highland bamboo (*Yushania alpina*), which is locally named *kerkeha* (INBAR 2005; Berhanu and Statz 2007). Highland bamboo species plantation in Awi zone is known to be a long tradition (LUSO Consult, 1997).

4.1.2 Opportunities and Challenges of Highland Bamboo Production

Among the major opportunities which could help to develop bamboo production of the study area, include the presence of bamboo resource and traditional wisdom of bamboo processing in the study area, the existence of promising policy environment, the possibility to learn from best practices of bamboo handicraft processing at global level and the presence of educational institutions in the study area. On the other hand, this sector underdeveloped because of the existence of various challenges, such as lack of product quality, trained manpower, training and technology, capital, work and selling place, marketing and market linkage, support service, organizational, bamboo resource and attitude related challenges.

4.1.3 .Current Uses of the Highland Bamboo

Table 4.1: Bamboo is utilized to serve a range of functions such as a raw material for construction, furniture making, and others.

Uses of bamboo production	Rank	%
House construction	2nd	21
Cash income	1st	35
Furniture making	3rd	19
Others	4th	25
Total		100

The primary use of bamboo is as a source of income followed by house construction in the study area (Table 4.1). Highland bamboos are preferred as a raw material for furniture making, because of the hollow nature of the culm than lowland bamboo, which has solid culm (Kassahun 2000). Low value of lowland bamboo as a raw material for furniture making was also reported by Arsema (2008), who noted that the lowland bamboo is mainly used for income generation, construction and fences rather than furniture. The result of the present study revealed the economic importance of bamboo, which is capable of generating employment as off-farm activities for rural poor, skilled and semi-skilled farmers, particularly in the highland area where the bamboo species is suitable for making different handicrafts.

Bamboo is used for a variety of local or traditional applications in the study area. The applications include construction, fencing. According to most respondents its benefit is relatively low importance of construction among the rich, compared to the other category, is due to the fact that the rich can afford to construct better houses, covered by corrugated iron, and utilized more of eucalyptus than bamboo. Instead, the rich households utilized bamboo mainly for fencing, fodder and as a source of income. In fact, the rich households also owned relatively large bamboo resources compared to the other categories.

Figure various household instruments made from bamboo.

4.1.4 Distribution of Bamboo Production in Ethiopia

Ethiopia has over one million hectares of highland and lowland bamboo resources (Anonymous, 1997). The coverage of lowland bamboo is estimated to be 1,000,000 hectares (WoldemichaelKelecha, 1980), while the highland bamboo is estimated to be 300,000 hectares (LUSO CONSULT, 1997). This means that 86% of the African bamboo resource is found in Ethiopia. The highland bamboo (*Arundinariaalpina*) on the other hand grows naturally in the south, south-west, central and north-west highlands of Ethiopia at altitudes ranging from 2200 to 4000 m.a.s.l. Out of the total area covered by highland bamboo, 130,000 hectares have already been mapped (LUSO CONSULT, 1997). The highland bamboo grows in montane forest, often on volcanic soils and forms extensive pure stands, occurring in *Afrocarpusfalcatus*(= *Podocarpusfalcatus*) rainforest and with *Juniperusprocera*in drier forests (Phillips, 1995).

Table 4.2: Major Highland Bamboo Areas in Ethiopia.

No	Bamboo Area	Region	Natural Stand(Ha)	Plantation (Ha)	Total area (Ha)
1	Awi	Amhara	30	2350	2,380
2	Agaro	Oromiya	-	1500	1,500
3	Bale Mountains	Oromiya	56,851	-	56,851
4	Shenen/Jibat	Oromiya	1,774	2561	4,335
5	Gera	Oromiya	36,000	1250	37,250
6	Bore/Hagereselam	Oromiya	-	2460	2,460
7	Chencha/Arbaminch	South	2,460	3250	5,710
8	Indibir/Jembero	South	-	1850	1,850
9	Jima/Ameya	Oromiya/South	-	900	900
10	MizanTeferi/Kulish	South	-	1850	1850

No	Bamboo Area	Region	Natural Stand(Ha)	Plantation (Ha)	Total area (Ha)
11	Debresina/Wofwasha	Amhara	35	-	35
12	Wushwush/Bonga	South	-	1120	1120
13	Bonga/Ameya	South	7,997	-	7997
14	Masha	South	18,652	-	18652
15	MunesaShashemene	Oromia/South	4,183	-	4,183
	TOTAL	-	127,982	19,091	147,073

Source, (ARARI) report, 2015

The above table shows that major highland areas in the country. Among the total highland bamboo 2380 hectares are existed in Awi zone.

Table 4.3: Distribution of highland bamboo Bamboo production in Awi zone

No	Wereda	Bamboo coverage in hectare
1	BANJA	732
2	ENJIBARA	38.5
3	GUAGUSA	134.85
4	ANKESHA	1112.85
5	FAGITA	118.32
	TOTAL	2136.42

Source, (ARARI) report, 2015

The above table shows that distribution of highland bamboo in awi zone and the research area covers 134.85 hectare or 6.3% of the total. Among the total area covered by highland bamboo in this wereda majority of bamboo found in two keblies (wuhasa and Jibayta).

Table 4.4.of Bamboo producers &non producers by education level

Participation in bamboo production	educational status of households		
	NO	YES	TOTAL
NO	82	35	117
YES	47	36	83
	129	71	200

Source own survey, 2021

The above table shows that 82 or 24% of respondents are uneducated and did not participate in bamboo production while 47 or 23% of respondents participate in bamboo production but they did not take primary education. Among respondents 35or 17% are educated but not participate in bamboo production.71 or 35.5% of respondents are educated bamboo producers. From this most of educated households existed in the research area are more reluctant in participation of bamboo production

Table 4.5: status of bamboo production by Gender

Participation in bamboo production	Gender of households head		
	Female	male	TOTAL
NO	54	63	117
YES	15	68	83
	69	131	200

Source own survey, 2021

The above table shows that 54 respondents or 27% are female in gender and they did not participate in bamboo production. On the other hand 15 or 7.5% of respondents are female that are engaged in bamboo production to get their annual income. Among the total respondents 63 or 31.5% are male in gender but they did not produce bamboo for their survival. But 68 or 34% of respondents are producers of bamboo that are male in gender. From this bamboo producers of male are greater from female producers.

Table 4.6: Bamboo production and by dependency ratio

Participation in bamboo production	Dependency ratio					
	0	1	2	3	4	Total
No	20	23	33	29	9	114
Yes	15	22	21	15	8	81
Total	35	45	54	44	17	195

Source own survey, 2021

The above table shows that the amount of dependency ratio that exist within a family. Households that have high dependency ratio is not reluctant to participate bamboo because there is high number of individuals are unproductive. On the other hand in family within low dependency ratio has large number of active individuals that are productive, so the probability of engaging in bamboo production is high.

4.2 Econometric Analysis and Discussion

As discussed in chapter three, diagnostic tests of multi-co linearity, heteroskedasticity and normality were checked before applying regression estimate the potential effect of each explanatory variable on the dependent variable of both models. The results of these tests shows that no problems of sever multi-co linearity, model specification bias, normality and robust was run to solve the problem of heteroskedasticity and to get better estimations.

4.2.1 Estimation Results of logit Regression

The logit model was estimated using Stata software application version 14. From the logit model some variables are significant at 5 % significance level, which indicates that explanatory variables taken together are significant in explaining the model.

4. 2.2.Multicollinearity test for Logistic Regression Model

The term multi-colinearity refers to the existence of linear relationship among some or all explanatory variables of the regression model. If multi-colinearity is perfect the regression coefficients remain indeterminate and their standard error tends to be large. As a result the

population values of the coefficients cannot be estimated precisely/Gujirati,2009/.The existence of multi-colinearity among independent variables is examined through variance inflation factor/VIF/ having the following decision rule. If VIF>10 or tolerance is close to zero the explanatory variables are correlated accept the alternative hypothesis of there is multi-colinearity. When VIF < 10 or tolerance is greater than zero then accept the null hypothesis of no multi-colinearity.

Table 8: Table of variance inflation factor (VIF) of logit model

Variable |	VIF	1/VIF
famsadul	2.07	0.482666
dism	2.03	0.492360
gender	1.07	0.932959
Acmif	1.05	0.950796
education	1.05	0.954571
depratio	1.04	0.963058
agehh	1.03	0.972628
landsz	1.01	0.993306
Mean VIF	1.29	

Source own survey, 2021

VIF which is less than 10.This implies that there is no problem of multi-colinearity among explanatory variables included in the model.

Table 9. Logistic regression result (Dependent variable bamboo production)

Variable	Coefficient	Std. Err.	z	P>|z|
agehh	.9837437	.0208194	-0.77	0.439
famsadul	1.45397	.3546027	1.53	0.125
dism	1.1442	.2908646	0.53	0.596
depratio	.7799307	.1143369	-1.70	0.090
landsz	1.095098	.3431188	0.29	0.772
gender	3.402534	1.323088	3.15	0.002
education	2.442188	.9273584	2.35	0.019
Acmif	8.77611	3.454259	5.52	0.000
_cons	.0345613	.0403581	-2.88	0.004

Source own survey, 2021

Variables that have significant effect in determining the Bamboo production are interpreted in this section as follows.

Access to market information: As Table shows on the above, Access to market information found to be positive significant determinant of farmers' dependency on bamboo for their livelihood in the study area. The positive coefficient for household size was found to be 8.77 and statistical significant at five percent level of significance. As the Access to market information increases by one percent (%), keeping all other independent variables constant, probability of farmers' dependency on bamboo for their livelihood increases by a marginal factor of 0.467.percent

Dependency ratio of the household (DEPRATIO): dependency ratio has positive significant effect on the growth of bamboo production. As the table above, bamboo production increases by 0.779 percent when households become independent. This means that as households are independent they are reluctant more of producing bamboo.The amount of dependency ratio that exist within a family. Households that have high dependency ratio is not reluctant to participate

bamboo because there is high number of individuals are unproductive. probability of farmers' dependency on bamboo for their livelihood decreased by a marginal factor of -0.058.

Gender of the household head (GENDEHH): This is a dummy variable with 1 for male and 0 otherwise. From the table above, gender has positive significant effect on bamboo production. It indicates that bamboo production increases by3.4 percent when genders of household become male. Probability of farmers' dependency on bamboo for their livelihood increases by a marginal factor of 0.262.

Education (literacy) level of a household head (EDUHHL): education found to be positive significant determinant of farmers' dependency on bamboo for their livelihood in the study area. The positive coefficient for education was found to be 2.4 and statistical significant at five percent level of significance. As education increases by one unit, keeping all other independent variables constant, probability of farmers' dependency on bamboo for their livelihood increases by a marginal factor of 0.212.

Table 10, Marginal effects after logistic regression

variable	dy/dx	Std. Err	. z	P>|z|	X
agehh	-.0038574	.00498	-0.77	0.439	32.7128
famsadul	.088091	.05729	1.54	0.124	2.79487
depratio*	-.0584963	.03454	-1.69	0.090	1.81026
dism	031703	.05989	0.53	0.597	2.92821
landsz	.0213802	.07372	0.29	0.772	1.66538
gender*	.2676654	.0763	3.51	0.000	.651282
educatn*	.2126569	.08942	2.38	0.017	.358974
Acmif*	.4673724	.07038	6.64	0.000	.528205

(*) dy/dx is for discrete change of dummy variable from 0 to 1

4. 3 Test for Tobit Regression Model

4. 3.1 Multi-co linearity test for Tobit Regression Model

The term multi-co linearity refers to the existence of linear relationship among some or all explanatory variables of the regression model. If multi-co linearity is perfect the regression coefficients remain indeterminate and their standard error tends to be large. As a result the population values of the coefficients cannot be estimated precisely/Gujirati,2009/.The existence of multi-co linearity among independent variables is examined through variance inflation factor/VIF/ having the following decision rule.

Table 11. Table of variance inflation factor (VIF) of Tobit model

VARIABLE	VIF	1/VIF
BAMBOO	1.32	0.757397
OTHER	1.32	0.758674
AGRI	1.01	0.993239
LIVESTOCK	1.00	0.995349
Mean VIF	1.16	

If VIF>10 or tolerance is close to zero the explanatory variables are correlated. Accept the alternative hypothesis of there is multi-co linearity. When VIF < 10 or tolerance is greater than zero then accept the null hypothesis of no multi-co linearity.

4.4 Estimation Results of Tobit Regression

Table 12, estimation result of by Tobit model (Dependent variable Household income)

VARIABLE	Coef.	Std. Err	t	t P>|t|
Bamboo	12452.67	1423.415	8.75	0.000
Agri	-1310.748	1147.572	-1.14	0.255
Livest	916.5096	1379.216	0.66	0.507
Other	6283.216	1307.062	4.81	0.000
_cons	13540.5	1113.684	12.16	0.000

The estimation of the regression result depicted that all variables except agriculture and livestock are not significant in determining household's annual income since their value of p > /t / is not less than 0.05. The result shows that the slope of bamboo production is positive in magnitude and significant at 5 percent significant level. It is interpreted as the income of household who participate in bamboo production is higher by 12452.67 from their counter parts.

The second explanatory variable is agriculture in which its slope is negative in magnitude and insignificant .It refers to the income of households that are engaged in agricultural production is lower by 1310.748 from non participants. This indicates that agriculture is unproductive in this area. On the other hand households lose income from other sector by engaging in agriculture/opportunity cost/.

The third explanatory variable is livestock in which its slope is positive in magnitude and insignificant .It refers to the income of households that are engaged in livestock production is higher by 916.509 from non participants. This indicates that livestock production is unproductive and non profitable in this area.

The fourth variable is income from other activities (daily labor wages, small private shops, and government services)and its slope is positive in magnitude and significant. It is interpreted as the annual incomes of those households that are participated in this sector get more income annually by 6283.21from their counterparts.

R^2 shows that the goodness of fit of the model is found to be 41.89 %. This means that 41.89 percent of the variation is explained by the independent variables included in the model, the remaining 57.11% of the variation is explained by the error term U. This value R^2 is high since the data type employed was cross sectional data.

According to Anton Rainer the main reason for higher R^2 for time series analysis is that these are: In general working with high aggregate data and or data for the same statistical unit every period. But this is not found in cross sectional data, so it leads lower R^2.on the other hand, in cross section studies, R^2 always low.

Many reasons contribute that respondent's contribution, lack of training of data collectors, poor wording of survey, ordering of survey questions, among others. So you would be lucky to have R^2 0.40 % (sherinahimed sheriff, Jan, 2018).

In general from the result bamboo production and other economic activity contribute more than other variables to affect household's income.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

Bamboo can be used for construction, pulp, board, food, fuel, medicine, utensils and crafts. The main reason why bamboo was preferred were those: it is the fastest growing tree, it can give high economic returns, it is multi-purpose and gives output to many products, it can stabilized gullies and is good for soil fertility maintenance.

The major driving forces for the disappearances of the bamboo forests are conversion to agricultural land and bamboo forest being common pool for all individuals for last times, increase of population growth, environmental change and unsustainable cutting for sale, house construction, fencing and low replanting habit local bamboo in the study area.

The contribution of bamboo to household's income improvement is crucial in study area though there is very low attention given to its benefits .The study also revealed the existence of opportunities which could help to develop the bamboo production of the study area.

These opportunities include the presence of bamboo resource and traditional wisdom of bamboo processing in the study area, the existence of promising policy environment, the possibility to learn from best practices of bamboo handicraft processing at global level and the presence of educational institutions in the study area. The exploitation of these opportunities can transform the sector to advanced level up to development of private investment.

On the other hand, this sector underdeveloped because of the existence of various challenges, such as lack of product quality, trained manpower, training and technology, capital, work and selling place, marketing and market linkage, support service, organizational, bamboo resource and attitude related challenges. Above all the outputs produced are traditional, so that the income obtained used as subsistence. But as compared to other sectors like agriculture and livestock production this sector contributes more for improvement of annual income of households.

In addition to bamboo production other activities (daily labor wages, small private shops, and government services) contribute more for household's income in the short run and livelihood improvement in the long run.

5.2. Recommendations

- Agricultural development Bureau of Guagusa Shikudad wereda should to solve the bottlenecks (challenges) related to bamboo production and should give awareness the benefit of it to the society.
- Households exist in this area should use various opportunities for improving modern ways of bamboo production and should shift from unproductive sector of agriculture and livestock and focus on productive sector of bamboo to increase their income in particular and improving their livelihood in general.
- Guagusa Shikudad wereda investment Bureau should give emphasis for investors to participate in this sector and create favorable environment for them by giving training of modern bamboo production system, create trade channel, make available credit facility to the concerned body etc.
- Finally I would like recommend potential researchers to do various researches in this title by including other explanatory variables that I did not consider during accomplishing this paper.
- Encourage the participants of bamboo producers to the use of bamboo for , environmental change and sustainable development

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ANNEXES

Dear respondents, I would like to say thank you for your voluntariness. The aim of this thesis is to collect data concerning to bamboo production in Guagusa wereda. So I need, short and precise response from you. Please put (x**)** signin your choices in order to do these thesis properly.

1. Age ……..

2. At what age group does you included? 15-19 [ ] 20-34 [ ] 35-49 [ ]

3. Educational status illiterate [ ] elementary school [ ] high school

4. How much is your monthly household income.....

5. How money children do you have…….……

6. Have you ever produce bamboo? Yes [ ] no [ ]

7. How many Hectares do you plant bamboo? Below 1 [ ], 2-3 [ ], 4-5 [ ], above 6 [ ]

8. Do you have an information to bamboo supply to the market have value? If your answer is yes, how much do you sell a price of bamboo in birr? 30 [ ],40 [ ],50 [ ], above 51 [ ]
9. How many kilo meters dose the market station is found to sell bamboo product?
   Below 1 [ ], 2-3 [ ], 4-5 [ ], above [ ]
10. Is there an age above 64 and below 18 years in your family? Yes [ ] No [ ]
11. If your answer is yes in equation 10 what is that age? ----------
12. How long does bamboo plant to become bamboo tree? In year Below 1 [ ], 2-3 [ ], 4-5 [ ]
13. What is your optional work to gain income? trade [ ], livestock [ ], agriculture [ ], other [ ]
14. From Q 2 Which type of investment is better to increases your income……
15. Who is more productive in bamboo production? male [ ], female [ ]

Thanks for your help!!!