

# **The Value Chain Development and Sustainability of Bamboo Housing in Ethiopia**



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**INTERNATIONAL NETWORK FOR BAMBOO AND RATTAN**

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## ABBREVIATIONS

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|                 |  |
|-----------------|--|
| <b>BoARD:</b>   | Bureau of Agriculture and Rural Development            |
| <b>CFC:</b>     | Common Fund for Commodities                            |
| <b>EC:</b>      | Ethiopian Calendar                                     |
| <b>EFAP:</b>    | Ethiopian Forestry Action Program                      |
| <b>EMA:</b>     | Ethiopian Map Authority                                |
| <b>FeMSEDA:</b> | Federal Micro and Small Enterprises Development Agency |
| <b>INBAR:</b>   | International Network for Bamboo and Rattan            |
| <b>MoARD:</b>   | Ministry of Agriculture and Rural Development          |
| <b>NTFP:</b>    | Non Timber Forest Product                              |
| <b>ODI:</b>     | Overseas Development Institute                         |
| <b>SNNPR:</b>   | Southern Nations, Nationalities and People's Region    |
| <b>UNIDO:</b>   | United Nations Industrial Development Organization     |

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## EXECUTIVE SUMMARY

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Ethiopia is the second largest country in Africa in terms of population size and total area with diversified culture, linguistic composition and large ethnic compositions. About 45% of the country is highlands and 55 % is lowlands. It has 9 Federal Regions governed under a Federal System of Government. The current total population of the country 74 million with Addis Ababa (Capital City) with a population size of 2.7 million and its growth rate is 2.1 %.

Bamboo is a native forest resource in the country. It has over 650,000 hectares of native lowland bamboo (*Oxytenanthera abyssinica*) and over 350, 000 hectares of highland bamboo (*Arundinaria alpina* K. Schumach), the latter representing 86% of Africa's highland bamboo resources. Because of the shortage of proper woody plants for construction in the lowlands, the lowland bamboo is commonly used as an alternative for timber in house construction, for fences and also as fodder for cattle, as food for people, and as a source of biomass energy.

The Forest Development, Conservation and Utilization Proclamation No. 542/2007 of Ethiopia, does not have explicit statements on bamboo. However, among other species, bamboo is listed as species considered as tree in the proclamation. The major causes that have led to the neglect, under-utilisation and destruction of the Ethiopian bamboo forests are: insecurity of land tenure right and lack of economic incentive to value them as useful commodities. All natural forests in Ethiopia belong to the state and the government lacks economic incentive and financial capacity to protect and manage them properly. The limited government attention is focused on natural forests from where timber could be profitably harvested for industrial use. Further, the document states that Bamboo forests are not even in the priority list of natural forests selected by the government for management and development. The lethargy of rural people towards bamboo forest development and management is again related to lack of incentive to obtain financial benefits from their sale. Legal situation concerning bamboo use by the local population is somehow confused and suitable to some arbitrary interpretation. In addition to this, bamboo is not considered as an important resource by the local foresters and commercial bamboo extraction and marketing is not regulated clearly, with the exception of the more or less arbitrary fixing of royalty rates.

The Ethiopian regional governments have recognized the deteriorating situation and devised policies to encourage sustainable management of bamboo as a renewable resource. One of the options of increasing bamboo resource is through its domestication on farms. Farmers however need more information to assist them to grow and manage lowland bamboo in particular because it is not a traditional agricultural crop in as the case for highland bamboo.

Various initiatives by non-governmental organisations in Ethiopia are showing the potentials of bamboo. The government has also recently started to support bamboo conservation initiatives. However, a thorough and thought-out strategy that provides incentives to protect and use the remaining natural bamboo forests on a sustainable basis, and to establish bamboo plantations wherever they could have a protection and production function, is urgently required in order to achieve the high market bamboo material demand.

Realizing the potential of bamboo to solve the building material shortage in the country, INBAR is leading activities to develop a bamboo housing industry in Ethiopia and adjacent East African countries. However, questions remain whether bamboo is a sustainable solution in terms of economic, environmental and technical aspects. This report is based on a value chain study carried out to address the question of how a sustainable supply of bamboo raw materials for processing and an economically viable larger scale bamboo housing industry can be established.

Information was collected and verified from primary and secondary sources, interactions with stakeholders/informants from private sector, government and non government agencies, bamboo producers and existing projects/programs. The study took into account the existing studies carried out by INBAR and its partners in the country. The consultant carried out a detailed study on the bamboo value chain in Ethiopia's main Lowland and Highland bamboo producing areas with detailed case studies from Assosa area in the West near the Republic of Sudan and Sidama area (in the Southern Nations Nationalities and Peoples Region (SNNPR) of Ethiopia whose capital city is Hawassa in the Hulla-Agresalem location) in the South, respectively.

It was evident from the study that, besides the vast area of natural highland bamboo stands in the country, there are many places where highland bamboos are found in small plots on farmland next to natural stands. Most of these plots are located in the south-western part of the Ethiopian highlands. However, despite the availability of bamboo, the use of bamboo resources in the country is sub-optimal. Two aspects that have resulted in this are: (a). The supply of raw bamboo is rapidly diminishing both in terms of quality and quantity, and (b). Bamboo-based operations are confined to primary processing often using simple tools such as sickles and axes for own domestic consumption and at best, to rudimentary manufacturing of products for the limited local market. Despite these shortcomings, bamboo processing into furniture and handcrafts and marketing in Addis is proliferating in recent years. Due to such rudimentary working methods, lifetime of the products is short – not more than a couple of months. The major constraints for the traditional bamboo craftsmen are the high transport costs of raw material, low quality of their furniture and lack of storage space. However, the main problem mentioned is the lack of working capital.

Based on the 2007 Population and Housing Census Statistics, it was evident that bamboo is a popular housing material among rural communities near the resource where they extensively use it for construction of walls, roofs, ceilings, structural work, scaffolding and as a source of fuel. Based on detailed case studies from rural and urban areas, it was evident that Ethiopia is rich in traditional bamboo housing designs, practices and skill. However, the sustainability of the traditional and modern architecture used by the poor communities in Ethiopia is under threat from the decreasing resource availability, increased rural populations and lack of processing and bamboo housing sustainable technologies. Most rural communities are shifting from traditional bamboo houses to modern types as their incomes improve and bamboo becomes scarce. The newly established Rural Clustered Village Settlements program, is a major opportunity for the entry and intervention of INBAR and other international development partners to improve rural poor housing in Ethiopia using bamboo materials on humanitarian grounds.

The supply of houses in urban areas has not kept up with the growing demand for housing. To fix the demand, the Ethiopian government housing policy direction is mainly focussed on the implementation of Integrated Housing Development Program that is facilitated by the Federal Government and implemented by regional states and city administrations. The policy is vigorously focusing on development of Condominium houses to meet the needs of the low and medium income earners in the economy.

Financial and economic analysis of four different types of houses preferred by Ethiopians and tourists, indicated that any interested housing investor who wants to make quick money in 2-4 years after investment should target in using bamboo for tourist lodges or for “low income” (but not very low income populations) earners in urban areas.

The government is willing to develop bamboo as an alternative construction material because it plans to start a bamboo mat board manufacturing industry in future within Addis Ababa City. This will be possible avenue through which bamboo can be incorporated in the formal housing industry. The fact that the government is focusing on alternative technologies, means that low-cost bamboo construction materials can carve a niche for themselves if available within the market at an affordable rate to compete with their counterparts. Lack of a formal bamboo housing policy is the most limiting factor for the growth of the sector.

Bamboo in the building and construction sector is extensively and traditionally used for general house construction (walls, structural work, ceiling, partitioning, floor, scaffolding, formwork, etc), fencing, pit latrines, simple bridges, ladders, animal houses and the construction of grain storage structures. There is only one factory in Ethiopia that is producing bamboo floor tiles which also produces bamboo curtains, table mats, toothpicks and incense sticks. Bamboo is a major source of rural energy in form of firewood. The bamboo furniture making is a booming business in Addis

Ababa. Some of the products made include: chairs, tables, beds and storage cabinets. The major challenge has been availability of the materials in the City and low durability of the products which are made from untreated bamboo. Highland bamboo is the most useful in Mat Weaving and basketry in rural areas.

The field survey case study revealed that the key actors in Bamboo market value chains include the following:-

- Bamboo Farmers/ Local community members
- Bamboo Artisans Cooperatives
- Urban housing developers
- Transporters
- Bamboo Traders/brokers
- Industrial processors
- Handicraft makers
- Furniture makers
- Agents/ distributors
- Trans-boundary harvesters from Ethiopia to Sudan
- Trans-boundary illegal harvesters from Sudan
- The Regional Governments
- Bamboo Research Organizations
- Professional Associations
- NGOs in Rural Housing
- Consumers

However, the actors are not well networked due to low processing skills and lack of a clear bamboo conservation and utilization policy. The Forest Development, Conservation and Utilization Proclamation No. 542/2007 of Ethiopia, does not have explicit statements on bamboo. The major causes that have led to the neglect, under-utilisation and destruction of the Ethiopian bamboo forests are: insecurity of land tenure right and lack of economic incentive to value them as useful commodities. All natural forests in Ethiopia belong to the state and the government lacks economic incentive and financial capacity to protect and manage them properly. Legal situation concerning bamboo use by the local population is somehow confused and suitable to some arbitrary interpretation. The lack of forest demarcation and management plans as well as the limited control possibilities by the local forest administrations convert bamboo in most cases to a no man's resource. The Ethiopian regional governments have recognised the deteriorating situation and devised policies to encourage sustainable management of bamboo as a renewable resource. Various initiatives by non-governmental organisations in Ethiopia are showing the potentials of bamboo. The government has also recently started to support bamboo conservation initiatives. However, a thorough and thought-out strategy that provide incentives to protect and use the remaining natural bamboo forests on a sustainable basis, and to establish bamboo plantations wherever they could have a protection and production function, is urgently required.

There is no existing written policy on application of bamboo in the housing sector. Hence, bamboo has been ignored completely by policy makers as a possible alternative and affordable housing material. Bamboo has not been utilized in the upcoming condominium blocks throughout the country. Most regional states with bamboo resources are at transitional stages of developing policies on bamboo conservation and its utilization in the construction sector.

INBAR should work with the local builders; not to change their Architecture but to help in its improvement, especially the *Sidama* house for bamboo tourist lodges. INBAR should endeavour to replicate such technologies to major cities because bamboo lodges are in high demand in Ethiopia and internationally. They also proved to be the most viable economically followed by investments targeting “low income” population. Investments targeting “very low income” populations will not pay back even after 40 years.

It is recommended that the Federal Government should introduce bamboo into the Ethiopian housing market so as to compete with conventional building materials. Without this competition, then bamboo will always be seen as a traditional and inferior material. It can be promoted for flooring, ceiling, walling and partitioning in low-cost housing schemes. INBAR should assist in building capacity by developing a local bamboo building code as its entry point and then create sustainable partnerships with key actors to ensure smooth flow of materials within the various product chains.

## CHAPTER ONE: BACKGROUND TO THE STUDY

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### 1.1 Introduction

The need for sustainable building material is high in Ethiopia. Timber is scarce and the other building materials such as concrete are relatively expensive and may not be environmental friendly enough. Available literature reveals that 85% of the urban population in the Country lives in inhuman, unhygienic and confined housing conditions. The population growth of 2.8% per year and accelerated migration to urban centers (6% per year) has increased the demand for affordable and decent housing. This indicates a greater potential of alternative building materials like bamboo. Ethiopia has a great amount of bamboo covering about 1 million-hectares throughout the country. This shows its great potential for housing and the construction sector in general. If such a rich resource could be harnessed as an alternative building material, it would greatly alleviate the building material scarcity problem in the country. Therefore, knowledge and experiences with bamboo building technology from other countries like China and Asian countries will be highly useful and relevant in Ethiopia in the present context.

Bamboo is a native forest resource of the country. It has over 650,000 hectares of native lowland bamboo (*Oxytenanthera abyssinica*) and over 350, 000 hectares of highland bamboo (*Arundinaria alpina* K. Schumach), the latter representing 86% of Africa's highland bamboo resources. Because of the shortage of proper woody plants for construction in the lowlands, the lowland bamboo is commonly used as an alternative for timber in house construction, for fences and also as fodder for cattle, as food for people, and as a source of biomass energy.

Realizing the potential of bamboo to solve the building material shortage in the country, INBAR is leading activities to develop a bamboo housing industry in Ethiopia and adjacent East African countries. However, questions remain whether bamboo is a sustainable solution in terms of economic, environmental and technical aspects. This report is based on a value chain study carried out to address the question of how a sustainable supply of bamboo raw materials for processing and an economically viable larger scale bamboo housing industry can be established.

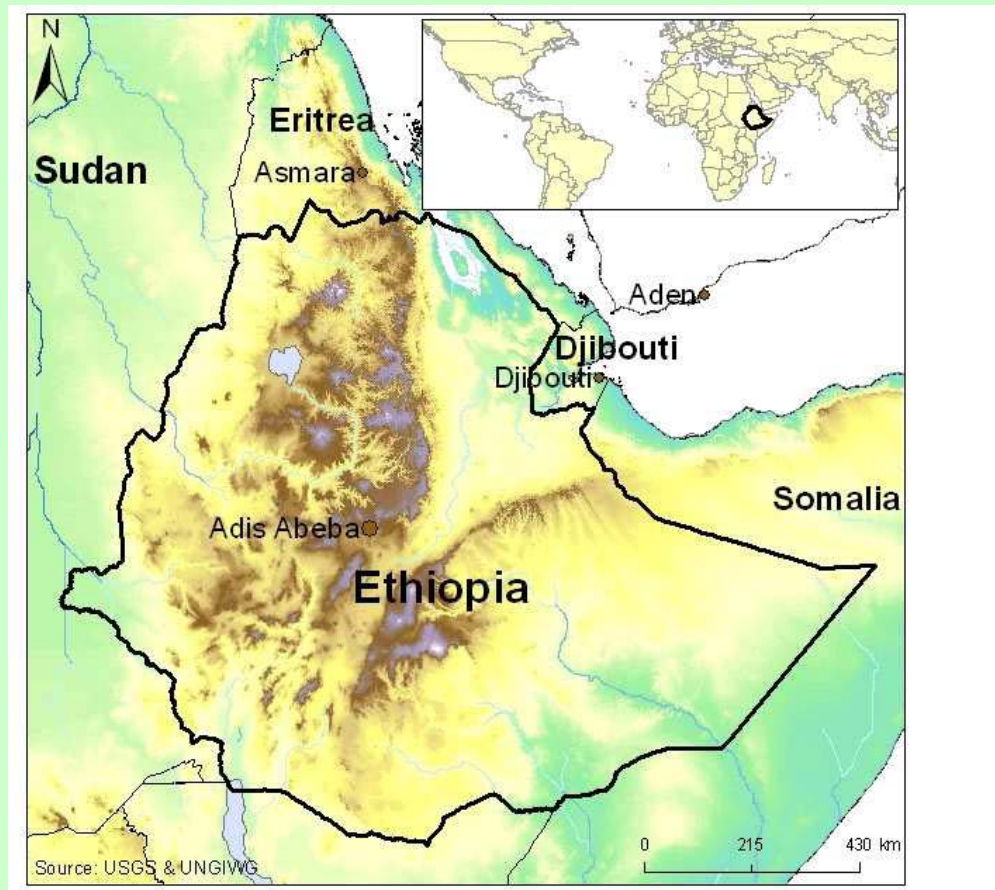
### 1.2 Background Information about Ethiopia

#### 1.2.1 Geography and Administration

Ethiopia is the second largest country in Africa in terms of population size and total area with diversified culture, linguistic composition and large ethnic compositions. Ethiopia is situated in the horn of Africa between 3 and 5 degrees north latitude and 33 and 48 degrees east longitude. The total area of the land-locked country is about 1.13 million sq. Km and its neighbouring countries are Kenya in the South, Sudan in the East, Eritrea in the North, Djibouti in the North east and Somalia in the East (see



Figure 1 below). About 45% of the country is highlands and 55 % is lowlands. It has 9 Federal Regions governed under a Federal System of Government.



**Figure 1: *Geographical Location of Ethiopia***

Since 1993, the federal states of Ethiopia has been divided into nine regional states and two city administrations. The capital city of the country, Addis Ababa, was established in 1886 with 54,000 ha and a population of 50,000. Ethiopia is a home to about 80 ethnic groups that vary in population size from 1,000 to about 18 million persons.

### **1.2.2 Demography**

Despite the long history as an independent nation, census undertakings that attempted to cover the entire country began only recently. The first ever Population and Housing Census was conducted in 1984 covering about 81 % of the country. The lowland areas which were predominately inhabited by the pastoral population & some of the rural and urban parts of the country were not covered. The 1984 total population of the country was 42.6 million (this figure includes Eritrea which was



part of the country by then). Total population of the country was 53.5 million people in 1994 and 77.1 million in 2007 with an estimated annual growth rate of about 2.6%. The current (2011) total population of the country is estimated to be 74million and the urbanization rate is 1.6%, which is very low compared to other countries. United Nations population projections show this number passing the 100 million mark by 2015 and reaching close to 190 million by 2050. Addis Ababa is the Capital City with a population size of 2.7 million and its growth rate is 2.1 % (Census result, 2007).

### 1.2.3 Climate

Diverse rainfall and temperature patterns are largely the result of Ethiopia's location in Africa's tropical zone and the country's varied topography. Altitude-induced climatic conditions form the basis for three environmental zones-cool, temperate, and hot-which have been known to Ethiopians since antiquity as the *dega*, the *weina dega*, and the *kolla*, respectively.

The cool zone consists of the central parts of the western and eastern sections of the northwestern plateau and a small area around Harer. The terrain in these areas is generally above 2,400 meters in elevation with average daily temperatures ranging from near 0°C to 16°C, with March, April, and May being the warmest months. Throughout the year, the midday warmth diminishes quickly by afternoon, and nights are usually cold. During most months, light frost often forms at night and snow occurs at the highest elevations. Lower areas of the plateau, between 1,500 and 2,400 meters in elevation, constitute the temperate zone and daily temperatures there range from 16°C to 30°C.

The hot zone consists of areas where the elevation is lower than 1,500 meters. This area encompasses the Denakil Depression, the Eritrean lowlands, the eastern Ogaden, the deep tropical valleys of the Blue Nile and Tekezé rivers, and the peripheral areas along the Sudanese and Kenyan borders. Daytime conditions are torrid, and daily temperatures vary more widely here than in the other two regions. Although the hot zone's average annual daytime temperature is about 27°C, midyear readings in the arid and semiarid areas near the Red Sea coast often soar to 50°C and to more than 40°C in the arid Ogaden. Humidity is usually high in the tropical valleys and near the seacoast.

Variations in precipitation throughout the country are the result of differences in elevation and seasonal changes in the atmospheric pressure systems that control the prevailing winds. Because of these factors, several regions receive rainfall throughout most of the year, but in other areas precipitation is seasonal. In the more arid lowlands, rainfall is always meager.

In January, the high pressure system that produces monsoons in Asia crosses the Red Sea. Although these northeast trade winds bring rain to the coastal plains and the eastern escarpment in Eritrea, they are essentially cool and dry and provide

little moisture to the country's interior. Their effect on the coastal region, however, is to create a Mediterranean-like climate. Winds that originate over the Atlantic Ocean and blow across Equatorial Africa have a marked seasonal effect on much of Ethiopia. The resulting weather pattern provides the highlands with most of its rainfall during a period that generally lasts from mid-June to mid-September.

The main rainy season is usually preceded in April and May by converging northeast and southeast winds that produce a brief period of light rains, known as *balg*. These rains are followed by a short period of hot dry weather, and toward the middle of June violent thunderstorms occur almost daily. In the southwest, precipitation is more evenly distributed and also more abundant. The relative humidity and rainfall decrease generally from south to north and also in the eastern lowlands. Annual precipitation is heaviest in the southwest, scant in the Great Rift Valley and the Ogaden, and negligible in the Denakil Depression.

#### **1.2.4 Health**

Only 31% of the total population has access to clean water. The coverage in rural areas is 24% while the coverage in urban areas is 72%. The estimation of HIV/AIDS infected people is 2.3%. The most widespread diseases in Ethiopia are related and caused by malnutrition or water borne disease, bacterial and protozoa, hepatitis A & B, typhoid fever, malaria (State of Environment Report for Ethiopia, 2003 and World Fact Book, 2008) and infant mortality rate per 1000 live births is 77.5. The life expectancy at birth for male is 52.92 and for female is 57.97 years (the World Fact Book, 2009).

#### **1.2.5 Economy**

Ethiopia is a country in the process of building the free market economy since 1991. The 2007 World Bank report shows that GDP of the country is US \$ 19.4 billion; GNI per capita is US \$ 220. The strategy of developing the economy is Agriculture Development Lade Industry (ADLI). Agriculture products account for 40-50%. The main agricultural export products are Coffee, oil seeds, hides and skins, flowers, fruits, sugar, etc. Based on estimates of international poverty lines USD 1 per day, 66.3% of the total households are poor (World Bank, 2005). According to the 1994 census result, 79.8% of the labour force was employed in the agriculture sector, 5.9% in commercial activities, 4.4% in other production activities, and 3.5% in hotels and restaurants.

### **1.3 Objectives of the Study**

The main objective of this assignment was to carry out a study on the sustainability of a bamboo housing sector in Ethiopia and the development of an integrated value chain for sustainable production for bamboo housing.

The specific objectives of the assignment were:

- a) To assess the sustainability of a bamboo housing sector in Ethiopia in terms of socio-economic, environmental and technical aspects;
- b) To assess existing the bamboo value chain in the country and to recommend how a sustainable and integrated value chain can be developed to ensure sustainable and economically viable production of bamboo housing

## CHAPTER TWO: METHODOLOGY

### 2.1 Methodological procedures

Information was collected and verified from primary and secondary sources, interactions with stakeholders/informants from private sector, government and non government agencies, bamboo producers and existing projects/programs. The study took into account the existing studies carried out by INBAR and its partners in the country. The analysis and synthesis of the existing information has been done in the next chapter in order to give basic foundation used in carrying out the actual field study.

The assignment started with a briefing by INBAR staff at its regional office in Addis Ababa. Both studies included interviews and consultations at all levels targeting bamboo farmers, buyers, suppliers, producers, processors, traders, architects, civil and structural engineers, building experts, government and non – governmental agencies with bamboo housing / construction related activities in Ethiopia. The consultant visited main Bamboo growing areas in the South and Western parts of the Country where the team met local farmers' bamboo enterprises and bamboo based industries in different locations in Ethiopia's main towns like Addis Ababa, Hawasah, Assosa, etc.

The consultant validated and shared the findings of the study online with key stakeholders and, incorporated feedback before finalizing this report. The consultant incorporated relevant feedback from INBAR and other stakeholders before finalizing the study report. All findings have been supported with sufficient quantitative data.

### 2.2 Timeframe of the Study

The consultancy work started from February 1, 2011 and final report submitted by June 20, 2011. The work schedule used was as follows:-

**Table 1: Timeframe of the Study**

| Activities  | Feb 1- 19 | Feb 20 to March 15 | March 16 to March 30 | April 1-15 | April 16 to June 20 |
|---|-----------|--------------------|----------------------|------------|---------------------|
| Preparations, Literature review and collection of necessary documents and materials |           |                    |                      |            |                     |
| Field Visit in Ethiopia and Consultations   |           |                    |                      |            |                     |
| Preparation of draft report and submission  |           |                    |                      |            |                     |
| Comments from INBAR   |           |                    |                      |            |                     |
| Revision of the Draft report & Preparation of final report and submission           |           |                    |                      |            |                     |

## **2.3 Scope of the Study**

### **2.3.1 Sustainability of Bamboo Housing in Ethiopia**

The scope of the study was to investigate the sustainability based on socio - economic, environmental and technological indicators. The investigation was conducted through field surveys, interviews with villagers and professionals, discussions with local housing companies, manufacturers, government agencies and using available literature like the “Development and Commoditization of the Pre-fabricated Modular Bamboo Housing in Asia and Africa” Project which had already done fieldwork and produced a housing feasibility study which contained some information on the production and cost structures. This report was made available to the consultant for review. Our study gave a comprehensive comparative overview of traditional versus alternative bamboo housing schemes. By investigating the strengths and weaknesses of the local adaptation of bamboo housing technology, this study suggests means for adapting and improving suitable local technology to make it ecologically friendly and economically sustainable. Specifically, the consultant focused on:

- Assessment of the existing housing sector characteristics for the low income groups in Ethiopia;
- Assessment of the feasibility of bamboo housing in Ethiopia for low income groups in terms of resources availability, technical requirements, social adaptability, health and sanitation, durability, economic factors, market demand and environmental sustainability;
- Assessment and evaluation of existing housing policy and its applicability for the long term housing solutions in the country as well as its implications for the development of the bamboo housing sector;
- Preparation of a SWOT analysis (Strengths, Weaknesses, Opportunities and Threats) of bamboo and conventional housing systems in Ethiopia for low income groups;
- Provide recommendations on how to develop the bamboo housing sector so as to be economically viable and how to establish bamboo as a sustainable building material in Ethiopia and possibly for the region.

### **2.3.2 Study on Bamboo Housing Value Chain in Ethiopia**

The consultant carried out a detailed study on the bamboo value chain in Ethiopia’s main Lowland and Highland bamboo producing areas with detailed case studies from Assosa area in the West near the Republic of Sudan and Sidama area (in the Southern Nations Nationalities and Peoples Region (SNNPR) of Ethiopia whose capital city is Hawassa in the Hulla-Agresalem location) in the South, respectively. The main objective of the study was to analyse the current status of the bamboo value chain and to provide sufficient insight into the activities of the chain actors, service providers and supporting institutions. This was aimed in providing

information for interested stakeholders who can provide support to upgrade the sub-sector to a more productive and effective sector with an active role by the private sector, in particular for the production of housing and construction elements. This study specifically investigated the local uses of bamboo, value addition at different levels of the market chain, value differences in each step of market, final products and their diversity. We also looked at how value addition would be different if bamboo is used for housing and how local communities would benefit. The specific factors and questions considered were:-

**Value Chain Overview:** Actors, Service providers and Facilitating organizations: An indication of the low – cost housing sector value chain, and if available specifically for the bamboo – housing value chain: what was the actual value chain (for example: suppliers, producers, processors and manufacturers, transport, wholesalers / retailers, consumers – taking into account also the role of women and men in the value chain if any), what was the size in each step: in terms of numbers of people / households involved, production volume and value, income and profit for each step; added value in each step. Who were the major service providers and supporting/ facilitating organizations, what were their main activities and what was the extent of their influence in the chain? Was there a private sector developing and promoting a bamboo value chain?

**Value Chain Linkages:** Was the housing sector value chain interlinked or were there gaps in the value chain or were the links disconnected? If there were constraints, what were these constraints (linked to the value chain: input / resource related, output related, technology related, investment related? etc.) and how could the constraints be addressed in order to develop a sustainable (bamboo) housing sector for low income groups.

**Markets:** Assessment of where the main market and what its size was for low cost bamboo housing: in Ethiopia and possibly internationally. What were the major market dynamics (including cross boarder flows), trends and growth potential in the sector? What were the comparative and competitive strengths of Ethiopian bamboo sub-sector?

**Policy Environment:** What policies and regulations govern trade in bamboo? What are the opportunities and constraints of existing policy arrangements to enable a bamboo housing sector? What are key areas of improvement and how they benefit the chain?

## **CHAPTER THREE: LITERATURE REVIEW**

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### **3.1 Introduction**

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 WoldeMichael 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 research on bamboo management and method for introduction of new species are being carried out at the Ethiopian Forestry Research Center. However, even though studies and recommendations on bamboo conservation and utilization have been around for quite a while, changes in management and utilization techniques are not visible on the ground. This section will give a review of the documents that were available to the consultant.

### **3.2 Characteristics of bamboo**

There are more than 1500 known species of bamboo in the world (Ohrnberger, 1999), of these, Africa has 43 species covering about 1.5 million ha (Kigomo, 1998). Forty of these species are distributed in Madagascar while the remaining 3 are found in mainland Africa (Ensermu et al, 2000).

Bamboo species grow naturally on the mountains and highlands of Eastern African Countries and in the medium lowlands of other African countries (KEFRI, 2007). Bamboo is one of the important Non-Timber Forest Products (NTFPs) sharing a number of characteristics with other NTFPs in terms of its renewability and accessibility to rural poor people (Ensermu et al, 2000). The uses of bamboo makes significant contribution to rural livelihood and employment, although the rapidly diminishing supplies of forest bamboo through indiscriminate clearing of natural forests and the lack of government priority in its development erode its status in East Africa (KEFRI, 2007).

Bamboos are tall perennial grasses with tree stature that grow up to about 30 m height and 35 cm in diameter (Kassahun, 2003). According to Kassahun (2003) and Luso Consult (1997), the average length measured in the indigenous bamboo forests of Ethiopia is 16.9 m with the maximum size being 23m in height and 20 cm in diameter and the minimum height being 11.1 m.



In a fully developed bamboo root system, which occurs within 3-7 years after seeding, new bamboo shoots are produced every rainy season and attain full height and diameter in about 3 months (Kassahun, 2003; KEFRI, 2007). Bamboos get mature, strong and ready for utilisation after 3-4 years (Kassahun, 2003; Wimbush, 1945; KEFRI, 2007). As mature culms grow older, they deteriorate and eventually die and rot. The life of a bamboo plant is however sustained by the new shoots and culms (Ensermu et al, 2000).

One hectare of the highland bamboo forest is estimated to carry an average of 6000 culms (Kassahun, 2003); whereas that of a lowland bamboo carries an average of 8124 living culms and 4185 dead culms (Ensermu, et al 2000).

It is generally recommended to harvest only the mature bamboo culms (3 -4 years and up) and up to 70% of the culms on a given surface. Effective bamboo management involves systematic but selective cutting of mature culms, thereby harvesting a crop that is valuable. The removal of mature culms also ensures the vigor of the plant and allows for generation of new shoots (KEFRI, 2007). On the other hand, clear cutting depresses the rate of recovery of bamboo after cutting (Wimbush, 1945 cited in Kigomo, 1998).

Most bamboo plants flower only once in their lifetime (14-50 years in most species) and then die soon after (Luso consult, 1997; Kassahun, 2003). They emerge again from germinating seeds if the site is not severely disturbed by detrimental factors such as rodents, fire etc. These phenomena were observed in the lowland bamboo forest of Pawe, South Western Ethiopia where the whole forest flowered and died in 1998 (Kassahun, 2003). But this is not always the same for all bamboo species (Luso consult, 1997).

Bamboo forests are characterised by a complex network of root system making them more efficient than other forest species in holding soil particles together (Kassahun, 2003). Therefore, bamboos are excellent in preventing soil erosion, promoting water percolation, and in sheltering the soil from wind erosion and sun drying (Kassahun, 2003; KEFRI, 2007). Further Bamboo litter fall improves soil structure and fertility (Fanshawe, 1972) and is a material source for furniture, building, pulp, bio-energy, food, forage and medicine (Liese, 1985). It is a preferred material for various applications owing to its straightness, high strength, light weight, easiness of working with it, suitable fibre for pulp production and absence of bark (Suzuki and Jacalne, 1986). Bamboo shoot is of high nutritional value that can be used as source of food and feed (Ayre-Smith, 1963, Chaozong, 1995).

According to Kassahun (2003) Bamboos have the following limitations:

1. The gregarious flowering and eventual death of all bamboo trees in a forest is a characteristic that may seriously affect the sustainable supply of raw materials for bamboo-based industries;



2. Bamboo culm in storage and use is more susceptible to termites, insect borers and fungal attack than hard and soft woods, as it does not contain toxic substances unlike the latter species;
3. Bamboo culm preservation is less effective than most hard and softwoods because bamboo culm does not possess anatomical pathways which facilitate radial distribution of preservatives unlike in hard and soft wood stems. Moreover, culm skin are impervious and thus preservative penetration through them is limited;
4. A preservative method that is equally effective, cheap and safe as for hard and soft wood has yet to be developed;
5. The maximum attainable diameter is limited by their primary growth as they do not increase their diameter through secondary growth unlike hard and soft wood species.

### 3.3 Bamboo species in Ethiopia

The existing information about the distribution and coverage of bamboo in Ethiopia is rather limited. The study by Luso consult (1997) found that topographic maps of the Ethiopian Map Authority (EMA) miss some of the existing highland bamboo areas in Ethiopia; whereas highland bamboo areas shown on the maps prepared by Chaffey (1979) are far more complete but a bit more generalized than indicated in the EMA maps. Therefore, on a new general bamboo map produced by Luso consult, the highland bamboo areas from both Chaffey and the EMA maps were combined. In this regard, the total area of mapped highland bamboo (*Yushania alpina*) in Ethiopia is 129,000 ha. The highland bamboo area gives a good indication since these areas have been mapped quite accurately from aerial photographs. Since most highland bamboo areas are located in remote and inaccessible areas with a relatively low population pressure, it is assumed that the total highland bamboo area has not decreased significantly (Luso consult, 1997). In brief, most literature surveyed, agree that bamboo is a native forest resource in Ethiopia and it has over 650,000 hectares of native lowland bamboo (*Oxytenanthera abyssinica*) and over 350, 000 hectares of highland bamboo (*Arundinaria alpina* K. Schumach), the latter representing 86% of Africa's highland bamboo resources..

The total area of mapped lowland bamboo (*Oxytenanthera abyssinica*) on the other hand, amounts to 480,510 ha (Luso consult, 1997, Kassahun; 2003; Ensermu et al, 2000). However, this figure of lowland bamboo area is heavily underestimated and does not represent the real area, since a lot of spatial data are missing for this land cover type (Luso consult, 1997). WoldeMichael Kelecha (1980) estimated the lowland bamboo to be about 1,000,000 ha but according to Luso consult (1997), this figure is based on unverified assumption. Luso consult (1997) estimates area of lowland bamboo in north western part of Ethiopia between 200,000 and 350,000 ha

which makes the estimation of lowland bamboo between 700,000 and 850,000 ha; though settlements may have reduced some of the bamboo areas.

Two important factors influencing the occurrence of bamboo in Ethiopia are rainfall and altitude (Luso consult, 1997). The highland bamboo grows in the central, southern, south-western and north-western parts of the country in an altitude ranging from 2200 – 4000 m asl. (Ensermu et al, 2000; Luso consult, 1997). The highland bamboo covers areas between the Bale Mountains, Bonga and Metu in the south and south-western part of the country and all the way to Dangla in the north (Ensermu et al, 2000). This species grows in montane forest, often on fertile, volcanic soils and forms extensive pure stands (Luso consult, 1997). The range of temperature where *Y. alpina* grows well is 10 – 20°C. Rainfall also influences the occurrence and growth potential of the species. In Ethiopia its rainfall range falls in general between 1500 and 2000 mm and it is found as far north as 11°N and as far east as 40°E (Luso consult, 1997). The species is therefore a highland, low temperature demanding species, and requires high rainfall. Culms of the highland bamboo reach a height of 10 -18 m and a diameter of 10 -16 cm. Mean culm size in the low and highland bamboo forest is 5 cm and 7 m and 8 cm and 17 m of diameter and height, respectively (anonymous, 1997, cited in Kassahun, 2003).

Lowland bamboo on the other hand grows only in the western part of the Ethiopian lowlands along major river valleys and in areas bordering the Sudan (Ensermu et al, 2000). This species occurs between 700 – 1700 m asl with an average annual rainfall above 700 mm (Ensermu et al, 2000).

The flowering, seeding and dying of *Y. alpina* has been reported by Wimbush (1947) to occur in patches, not normally large. Sometimes this may extend to several hectares but no record of extensive flowering has been recorded. Observations in the field by Luso consult (1997) have confirmed this observation along with confirmation from local people around Masha area. Studies by Wimbush (1947) in Kenya on *Y. alpina* estimated that the life cycle of the species is more than 40 years. It is not however clear whether it is much longer or shorter in other places like Ethiopia where the species also grows (Luso consult, 1997). Both the highland and lowland species are endemic to Africa, confined to the sub-Saharan region (Ensermu et al, 2000). These forests were until recently protected by their remote and inaccessible locations, however, they are now fast disappearing due to improvements in road networks and establishment of villages within and around the bamboo forests (Kassahun, 2003).

Bamboos are multipurpose plants of high economic and environmental value that convert solar radiation into useful goods and services better than most tree species. Developing countries like Ethiopia that are aspiring for better welfare and faster rate of development, therefore, need to preserve their remnant bamboo forests and expand their resource base. They must also ensure the steady increase, stability and sustainability of bamboo forest production and utilization activities (Kassahun, 2003).

### 3.4 Status of highland bamboo forests in Ethiopia

In Ethiopia, high proportion of dead biomass characterises the highland bamboo stands. According to Ensermu et al (1997), this may be attributed to a prolonged cutting cycle and low cutting intensity. According to Kassahun (2003), the remnant natural bamboo forests of Ethiopia are in a neglected state through lack of management. The condition of the Masha bamboo forest in Southwest Ethiopia was found to be a typical example by this study. The age structure of Masha bamboo forest was heavily skewed towards old trees and the annual litter fall (11t / ha) was larger than the current above shoot <1 year biomass (8t / ha). This natural forest was characterised by high percentage of mortality, 20% in the study done by Kassahun (2003) and 27 % in the study carried out by Luso consult (1997).

Kassahun (2003) further showed that about 73% of the 110t / ha total above ground biomass were from bamboo trees older than 3 years, which are mature for harvest. On the other hand, the share of new shoots (<1 year) was very small (7% of the total aboveground biomass). The Masha bamboo forest had a high percentage of dead trees, high stand density, high litter fall mass higher than above ground shoot production which are all indicators of a forest in the process of degradation for lack of management and timely harvest (Kassahun, 2003;Luso consult, 1997). Hence nearly all the culms are able to reach their full age, which lies between 10 – 15 years, after which they reach the end of their life cycle and the dead culms remain in bamboo stands, start to rot and finally collapse (Luso consult, 1997). Thus, the studies recommended the need to harvest / utilise some of the trees to reduce the stand density, improve the age structure and boost the productivity of the forest.

On the other hand, Injibara-kosober has a long tradition of managing bamboo and intensive use of *Y. alpina* (Luso consult, 1997). The predominant ethnic group is the Agaw people. Bamboo planting occurs in the area since about one hundred years ago. The reason for it is unknown but it was mentioned that the people started bamboo planting when the formerly existing natural stands were cleared for cropping (Luso consult, 1997).

Systematic and organised harvesting based on a management plan could improve dramatically the growing stock and bolster perpetual yield increment by reducing mortality and creating space for new recruits to emerge and grow. It is likely that bamboo forests of Ethiopia could only be conserved and developed if valued as useful crops. Thus, integrated management of their production and utilisation systems is recommended for their suitable conservation and development, as part of a strategy to remedy the deforestation-related problems of Ethiopia (Kassahun, 2003).

### 3.5 Value chain of Ethiopian bamboo

A value chain describes a range of activities required to bring a product from the producer to the consumer, emphasizing the value that is realized and how it is communicated (ODI, 2006). The terms 'supply' or 'marketing chain' and production-to-consumption system' are also used interchangeably (ODI, 2006).

NTFP value chains may include a number of different activities from harvesting to cultivation of the resource, various degrees of processing, storage and accumulation at different points in the chain, transport, marketing and sale (ODI, 2006). In addition, there are more tangential but less critical activities such as information gathering and provision, and capacity building that are part of the value chain (ODI, 2006).

In the 1900s, when vast areas of tropical forests were cleared of timber for local use and exportation, bamboos and other NTFPs were usually discarded or destroyed during logging operations (KEFRI, 2007). In the 21st century, however, there is a growing consensus that NTFPs are not only essential components of ecosystems but also invaluable to the livelihood of communities; NTFPs are known to generate substantial foreign exchange and are increasingly being regarded as valuable commodities around the world (KEFRI, 2007).

In Ethiopia, besides the vast area of natural highland bamboo stands, there are many places where highland bamboos are found in small plots on farmland next to natural stands. According to Luso consult (1997), most of these plots are located in the south-western part of the Ethiopian highlands. However, despite the availability of bamboo, according to the research done on the production – to – consumption system of bamboo in Ethiopia, the use of bamboo resources in the country is sub-optimal (Ensermu et al, 2000). The authors identified two aspects that have resulted in this: (a). The supply of raw bamboo is rapidly diminishing both in terms of quality and quantity, and (b). Bamboo-based operations are confined to primary processing often using simple tools such as sickles and axes for own domestic consumption and at best, to rudimentary manufacturing of products for the limited local market.

According to Ensermu et al (2000) and Luso consult (1997), Bamboo processing and marketing in Addis is proliferating in recent years. Mainly two groups conduct the processing. The first group is traditional processors who came from Injibara or Kosober and settled in Addis Ababa that produce low quality products aiming at low-income customers; whereas the other group is modern workshops in Addis Ababa that are producing high quality products. The fact that people from Kosober migrated to Addis and other towns in order to start local production is pointing out that there must be an advantage to produce in the consumption centers instead of the raw material areas (Luso consult, 1997).

Forty-two private owned semi-modern and 16 traditional bamboo entrepreneurs' workshops are found in Addis Ababa. All workshops are scattered and found in 8 different places in the city. None of bamboo the entrepreneurs are registered in

the trade and industry bureau of the city council (Eastern Africa Bamboo Project, 2007).

In the traditional bamboo processors from Kosoher, the raw material is purchased from middle-men who buy the bamboo poles from the farmers. Craftsmen in Addis Ababa order truck loads of bamboo in Kosoher and store them sometimes for several months in a rented place in Addis Ababa without shelter against rain and sun. Stools, sofa chairs, shelves etc are made exclusively out of bamboo with no use of other inputs like varnish or fixing material. Thus the only three cost items are the bamboo poles, the rent for the hired land and labour (Luso consult, 1997). The later one is a non cash expense because the members of the working groups are paid with the profit made by product sales.

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According to Luso consult (1997), due to rudimentary working methods, lifetime of the products is short – not more than a couple of months. The major constraints for the traditional bamboo craftsmen are the high transport costs of raw material in the harvesting season when trucks are occupied with agricultural products, low quality of their furniture and lack of storage space. However, the main problem mentioned is the lack of working capital (Luso consult, 1997).

Regarding the modern shops, most shop owners get their raw material from Agereselam in Southern Nations, Nationalities and people's Region and prefer it to other raw material which comes from areas such as Hosaina, Shenan (160 km from A.A.) and Kosoher because of its durability. The one from Kosoher is said to be of low quality – cracks easily, not durable, output of culm low and color changes. All workshop owners previously were trained by those trained people by Chinese or Japanese or at the Federal Micro and Small Enterprises Development Agency (FeMSEDA) training centre (Luso consult, 1997).

A research done in Injebara and Addis Ababa by Enserum et al (2000) showed that bamboo manufacturing units in both towns were generally micro-enterprises providing self-employment for owner operators and their family members. The result also showed that the majority of bamboo craftsmen work based on experience rather than proper training.

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In some cases, management capacities of the owners are very poor. They live on a day-to-day business with chronic shortage of working capital and lack of any type of bookkeeping (Luso consult, 1997). The very often stated working capital problems are based on a lack of management skills but also on their family situation.

All existing modern bamboo processing workshops are of recent creation opening starting 1994 whereas immigrants from Kosoher started traditional bamboo processing in order to produce low cost chairs, shelves baskets etc in 1992 (Luso consult, 1997). Most of the craftsmen do not have enough working capital (3,000 – 5,000 birr) in order to buy a whole truck load in cash. Therefore, they have to get bamboo culms from *Mercato* (retailers) to a considerably higher price.



Trade in bamboo raw materials and products in East African countries are extremely limited and fluctuate greatly from year to year. UN COMTRADE statistics (that lump bamboo and rattan together) indicate that Kenya imports the greatest value of bamboo and rattan products in East Africa, averaging US - \$1,463,000 for the period 1989 to 2000 inclusive, but that after a peak of over 3 million dollars worth exports in 1994 the figure has remained relatively steady at about US - \$800,000 per annum (Eastern Africa Bamboo Project, 2007). Of this approximately US 100,000 is imported from other East African nations. Ethiopia did not export bamboo or rattan products between 1989 – 2000. The exception was a surprisingly large US 1.5 million dollars in 1998 all of which went to other East African nations (Eastern Africa Bamboo Project, 2007).

There is no large demand for bamboo culms in rural markets, and transporting them to nearby urban areas is not financially viable. Hundreds of hectares of natural bamboo forests in Metekel, Southwest Ethiopia, were left to decay on the site after flowering in 1997/98 for lack of adequate market for sale even at the cost of harvesting. Moreover, bamboo is considered as a perishable material susceptible to biological and physical deterioration. This perception has led to its neglect by the rural people as a useful renewable resource. The various technologies available to increase its service life are not practiced in the country and are not at all known by the rural communities. Knowledge limitations on its propagation, growth and utilisation have also contributed to the lethargy regarding its cultivation (Kassahun, 2003).

The research by Enserum et al (2000) concluded that the bamboo production- to - consumption system in Ethiopia is at its infant stage of development which is evident almost at every stage of the production and consumption process. Annual average profit margin of the vast majority of bamboo manufacturers in the survey areas was found to be less than the minimum government wage rate indicating the need for action in support of improved income from bamboo manufacturing.

In recent years however, there is an increase in bamboo business investment in Ethiopia. Two such initiatives are those of the Land and Sea Development – Ethiopia PLC (LSDE) and Adal Industrial PLC. In May 2006, LSDE obtained a five year, 136 million dollars contract agreement with a 99-year concession providing for the sale and delivery of dry raw bamboo from the Benishangul Gumuz State to pulp and paper mills in India (Statz et al, 2007). However, personal interview revealed that this company has changed its business direction to building a paper factory in Ethiopia due to the high export expenses faced. On the other hand, Adal Industrial PLC started operation of a bamboo factory in Dukum in March 2007. Being the first of its kind in Africa, this factory has marked a new era for bamboo products in Ethiopia (Eastern Africa Bamboo Project, 2007).

### **3.6 Shelter Situation Analysis in Ethiopia**

### **3.6.1 Housing stock**

The 1994 census result shows that the total housing units of Ethiopia is 1,482,589 and 374,742 that had been estimated to rise up to 650,000 by the year 2010 for Addis Ababa.

### **3.6.2 Housing deficit**

The study of Integrated Housing Development Program (IHDP) undertaken in 2006 indicated that the housing deficit in the urban area of the country is 900,000 out of which 450,000 is the share of (Addis Ababa AACAA, 2006). Similarly ORAAMP estimated the housing units to be built up to 2006 are 314,422. 50% of the urban housing stock was in poor or irreparable condition by 1997(PADCO,1997).

### **3.6.3 Occupancy**

The number of households of urban area at national level is 3,009,285 and house holds in Addis Ababa are 651,970. (Census result 2007). The average national house hold size in the urban area is 3.9 while the Addis Ababa house hold size is 4.1. (Census report, 2007). Persons per housing unit are 5.5 and the number of house hold per housing unit is 1.1(CSA, 1999). An average floor area per person is about 12m<sup>2</sup>.

### **3.6.4 Housing standard**

97.4% housing stock in the country is built with permanent structure of which 82.3% are made of mud and wood. 80% of the citizens are living in the substandard houses (Housing survey, 2007).

### **3.6.5 Tenure of households**

In Ethiopia, land is a common property of nations, nationalities and peoples of Ethiopia and shall not be subject to sale. Land is only leased for commerce or made available for voluntary settlements. Freehold lands occupied by private owners are expected to pay land rent.

### **3.6.6 Ownership (formal and informal)**

In Addis Ababa, 37.92% of housing units are rental houses owned and administered under the government (federal government and local administrations). 25% of the housing stock is informal settlement. The non slum households of the city are estimated only between 0.9%-15.8percent (UN- Habitat, 2004). 35% and 42% of housing stocks are privately owned in urban centres of the country and Addis Ababa, respectively.

### **3.6.7 Housing affordability ratio**

The market rent price is high (3-6 USD) per m<sup>2</sup> for residential houses. But the rent of some local government houses (kebele houses) rent is even lower than 1USD per month. This is because the proclamation 47/1975, which nationalized the urban land and extra houses declared the rent cost to reduce by half. Therefore, rent of the majority of 37.92% governmental houses are extremely very low. In the case of Condominium houses, studio type or small size housing units cost USD 6,000 each. The low income earners (of about USD 30 per month) are required to pay USD20 per month, which is 66% of the salary making it unaffordable.

### **3.6.8 Housing construction and formal land distribution**

200,000 housing units have been built in 54 towns under the IHDP (January 2010 Annual Report of Ministry Of Works and Urban Development) of which 60,000 housing units were built in Addis Ababa. The construction of condominium houses under IHDP are highly subsidized in terms of the following interventions:-

1. The project is designed to create jobs for low income people and save money to possibly pay at least the 20% down payment of the total cost of the condominium house. These groups are mainly organized in the form of micro and small scale enterprises (MSSE) to produce construction materials for IHDP. The enterprises assisted by facilitating land, production machineries, loan, raw materials, etc.
2. The constructors, consultants and all professionals involved in the project are capacitated through loan facility to buy machineries and tools to run the projects and then they are engaged in the project with fixed prices.
3. The construction site is selected on the bases of criteria stated to minimize the cost of the construction. These are mainly: infrastructure to the area, minimum slope, good quality of soil characteristics, etc.
4. The construction technology of IHDP is different from the conventional one. The slab is constructed with prefabricated beam, slab block and reinforcement bar which minimizes the carpenter work concrete. Low cost walling material like Agrostone<sup>1</sup> is applied.
5. The allocation of land for particular projects is facilitated by the government with infrastructure development.
6. Foreign masons, carpenters etc. are involved in order to transfer their knowledge and skill to local builders. This is also one aspect of capacity building.



7. The supply of main materials like cement, reinforcement bar, etc. are purchased in bulk and supplied directly to project offices.
8. Transporters are also capacitated through loan facilitation to buy heavy duty trucks and then engaged in the transportation of materials for various multiple projects with minimal time wastage.
9. Establishment of program offices at regional and local levels. The Central Housing Bureau only coordinates, facilitates, evaluates and provides feedback to program offices. The facilitation is mainly in terms of loan, machineries, capacity building, standard designs, research and development on alternative building technologies, etc.
10. Finally, the completed condominium houses are distributed to the beneficiaries through lottery. The first 20% initial payment is paid with a given agreed period by the beneficiaries, and the rest is facilitated by through bank loans of up to 20 years.

Apart from the above mentioned program activities, more land is distributed to individuals, cooperatives and real estate companies through public auction, lottery and negotiation systems(CSA, 2007).

### **3.6.9 Building materials**

Conventionally, the reinforced concrete for structural element, hollow block and fired brick for wall, corrugated iron sheet for roof, and masonry for trench foundation are the most commonly used materials in the on-going projects. But, recently other materials like compressed stabilized earth block and/or Hydraform, Agrostone etc for wall and corrugated mica, clay, metal sheet for roofing have been introduced(CSA, 2007).

### **3.7 Housing Policy**

The national urban development policy was issued in 2005. The housing development policy direction is focused on enhancing the saving culture, overcoming the problems of decayed urban areas through urban renewal and upgrading, increasing the density of developed area, developing the construction industry, through the implementation of IHDP. The government intervention is through facilitating housing finance, land, capacity building, bulk purchase of industrial product of construction materials, organizing medium and small scale enterprises, introducing new construction technology that minimize cost and time and standardizing the housing designs and technology. The policy also encourages real estate developers through the facilitation of developed land, strengthening the system for ensuring property rights, supporting the developers to utilize local materials, marketing and creating forums for discussion for solving emerging problems and encouraging investors interested in the housing sector. Similarly,

cooperatives have been supported through the facilitation of developed land, standard typologies, etc. Construction of illegal houses or those that do not confirm to the standards and plans are seriously prohibited by the policy.

### **3.8 Policies and Actions taken by the Ethiopian Government**

According to a research done by the International Network for Bamboo and Rattan (INBAR) cross national problems identified in Ethiopia and Kenya included policy restrictions on harvesting and /or transport, and a lack of a viable support such as centres of excellence where interested people could go for information, or training programmes (Eastern Africa Bamboo Project, 2007). The Forest Development, Conservation and Utilization Proclamation No. 542/2007 of Ethiopia, does not have explicit statements on bamboo. However, among other species, bamboo is listed as species considered as tree in the proclamation.

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According to EFAP (1994) the government of Ethiopia has given a priority for bamboo and reed research and development. There was a plan by the government to strengthen the management and use of the native bamboo and reed species. The programme was to focus mainly on assessing the market for bamboo and reeds as raw material for export, manufacturing and marketing of artifacts, and the use in the paper and pulp industry. In the programme, an extension service to the local communities would be piloted to promote improved bamboo and reed resource management and a sustainable supply of raw material. However, on ground implementations since this proposal was put forward have not been visible.

According to Kassahun (2003), the major causes that has led to the neglect, under-utilisation and destruction of the Ethiopian bamboo forests are: insecurity of land tenure right and lack of economic incentive to value them as useful commodities. All natural forests in Ethiopia belong to the state and the government lacks economic incentive and financial capacity to protect and manage them properly. The limited government attention is focused on natural forests from where timber could be profitably harvested for industrial use. Further, the document states that Bamboo forests are not even in the priority list of natural forests selected by the government for management and development. The lethargy of rural people towards bamboo forest development and management is again related to lack of incentive to obtain financial benefits from their sale.

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Legal situation concerning bamboo use by the local population is somehow confused and suitable to some arbitrary interpretation (Luso consult, 1997). The lack of forest demarcation and management plans as well as the limited control possibilities by the local forest administrations convert bamboo in most cases to a no man's resource. In addition to this, bamboo is not considered as an important resource by the local foresters (Luso consult, 1997); and commercial bamboo extraction and marketing is not regulated clearly, with the exception of the more or less arbitrary fixing of royalty rates (Luso consult, 1997).

In Ethiopia, FeMSEDA is the one with the broadest experiences in bamboo. Experts from China started a handicraft training programme in 1975 (Luso consult, 1997). The training of trainers by the Chinese is until now the knowledge basis for nearly all Ethiopian bamboo handicrafts (Luso consult, 1997).

The governments in the Eastern Africa region have recognised the deteriorating situation and devised policies to encourage sustainable management of bamboo as a renewable resource. One of the options of increasing bamboo resource is through its domestication on farms. Farmers however need information to assist them to grow and manage bamboo because it is not a traditional agricultural crop in most of the African countries (KEFRI, 2007).

Various initiatives by non-governmental organisations in Ethiopia are showing the potentials of NTFPs. The government has also recently started to support such initiatives by taking part in the Eastern Africa Bamboo Project. The project had the objective to promote the development of the sustainable production and use of bamboo products in East African countries with a focus on markets as the driving force behind such sectoral development. The project that closed in 2009 was funded by International Commodity Body of the Common Fund for Commodities (CFC), executed by the United Nations Industrial Development Organization (UNIDO) and supervised by the International Network for Bamboo and Rattan (INBAR). The major line ministries involved in the project execution were: Ministry of Trade and Industry (Ethiopia and Kenya), Ministry of Agriculture and Rural Development (Ethiopia) and Ministry of Environment and Natural Resources (Kenya).

According to Kassahun (2003), a thorough and thought-out strategy that provide incentives to protect and use the remaining natural bamboo forests on a sustainable basis, and to establish bamboo plantations wherever they could have a protection and production function, is urgently required. The Ethiopian government needs to establish an effective institution to oversee these developments. It is crucial that the remaining natural bamboo forests have a rightful owner who could properly protect, manage and use them in perpetuity and enhance their value. Further, part of the remnant bamboo forests should be preserved for future generation without interference; this will enable future studies on the natural course of development in the absence of human-induced disturbances (Kassahun, 2003).

## **CHAPTER FOUR: ANALYSIS OF EXISTING BAMBOO HOUSING CHARACTERISTICS AND CONDITIONS FOR THE LOW INCOME GROUPS**

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### **4.1 Introduction**

Based on the 2007 Population and Housing Census Statistics, we selected the following factors for detailed analysis to meet the objectives of the study:-

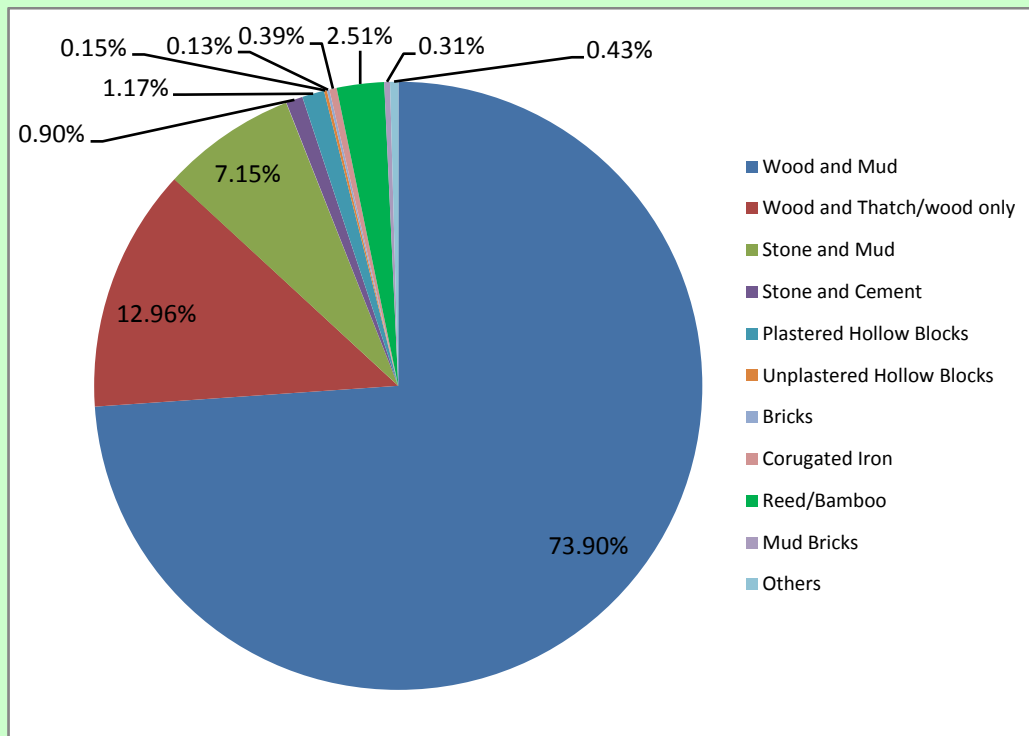
- Construction Material of Wall
- Construction Material of Roof
- Construction Material of Ceiling
- Construction Material of Floor
- Average Number of Rooms Per Housing Unit
- Source of Drinking Water
- Type of Tenure
- Type of Fuel for Cooking
- Whether Livestock Spend the Night in the Same Room as Persons

### **4.2 Housing Units by construction Material of Wall**

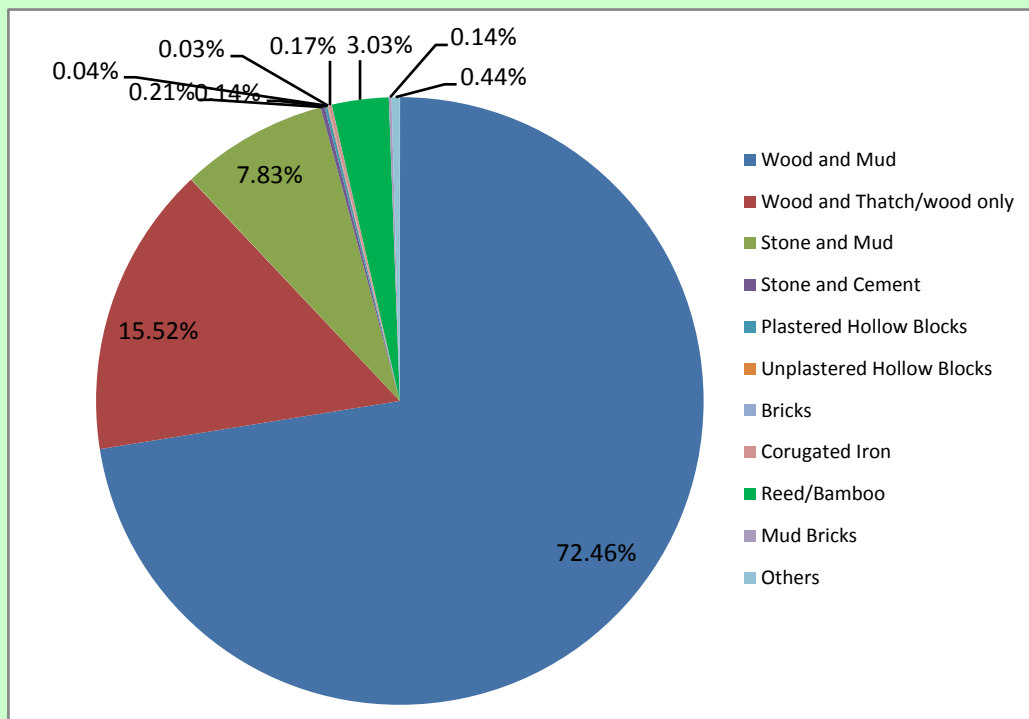
The distribution of the housing units by the type of material used for the construction of the wall is shown in the Figure 1 below. It can be observed that housing units in the county (urban + rural) that 73.90 percent of the walls had wood and mud, 12.96 percent wood and thatch, 7.15 percent stone and mud walls, 0.9 percent stone and cement, 1.17 percent plastered hollow blocks, 0.15 percent unplastered hollow blocks, 0.13 percent bricks, 0.39 percent corrugated irons, 2.51 percent Reed/Bamboo and 0.31 percent had mud bricks. "Other" type of construction materials used for walls constituted 0.43 percent.

In rural areas of the country (Figure 2 and Figure 3) housing units made of wood and mud walls constituted 72.46 percent, wood and thatch 15.52 percent, stone and mud walls 7.83 percent, stone and cement 0.21 percent, plastered hollow blocks 0.14 percent, unplastered hollow blocks 0.04 percent, bricks 0.03 percent, corrugated irons 0.17 percent, Reed/Bamboo 3.03 percent and 0.14 percent had mud bricks, while "Other" type of construction materials used for walls constituted 0.44 percent.

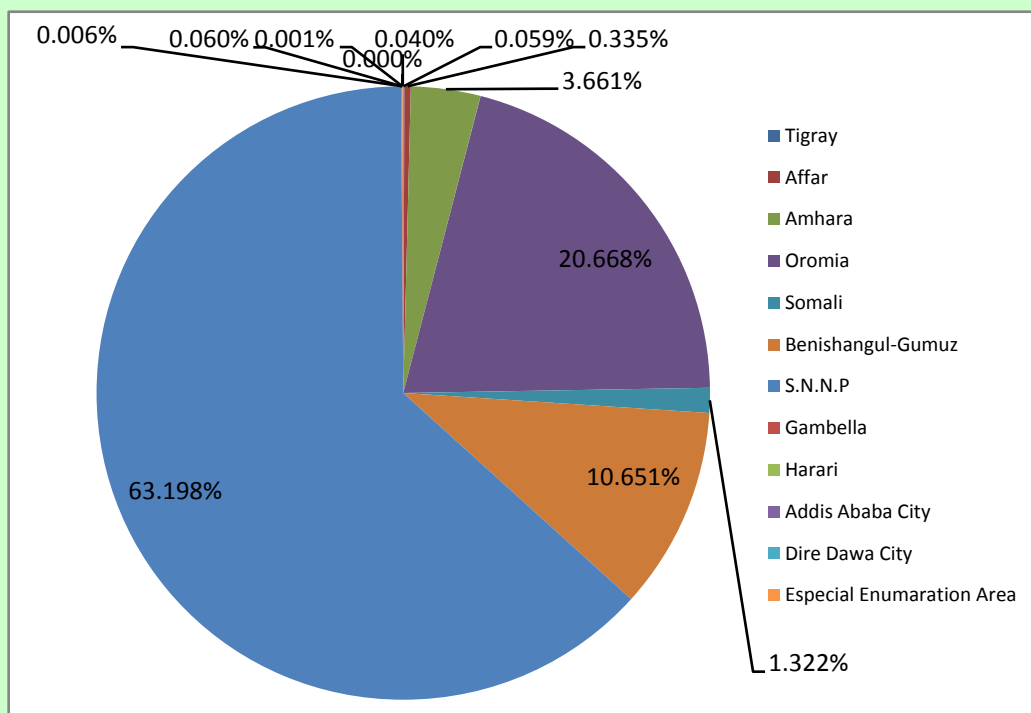
Figure 4 presents utilization of Reed/Bamboo materials for construction of walls (see also Plates 1 and 2 below) by rural regions where S.N.N.P has the highest percentage of 63.198, Oromia had 20.667 percent and Benishangul-Gumuz had 10.651 percent whereas the remaining regions had less than 5.0 percent. Utilization of Reed/Bamboo as a material for wall construction was significant in all regions except in Addis Ababa city.



**Figure 2: Housing Units by construction Material of Wall at the country level**



**Figure 3: Housing Units by construction Material of Wall in the Rural Areas**



**Figure 4: Utilization of Reed/Bamboo materials for construction of walls by rural regions**



**Plate 1: Utilization of Bamboo materials for construction of walls**





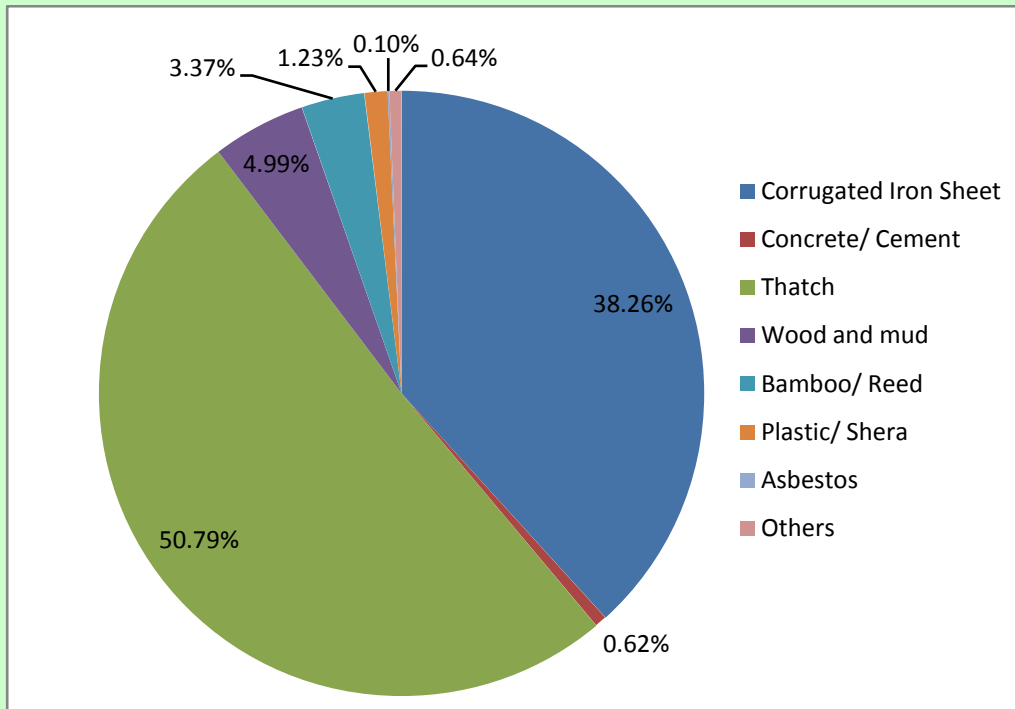
**Plate 2: Utilization of Bamboo materials for construction of walls (Tea Kiosk)**

#### **4.3 Housing Units by Construction material of roof**

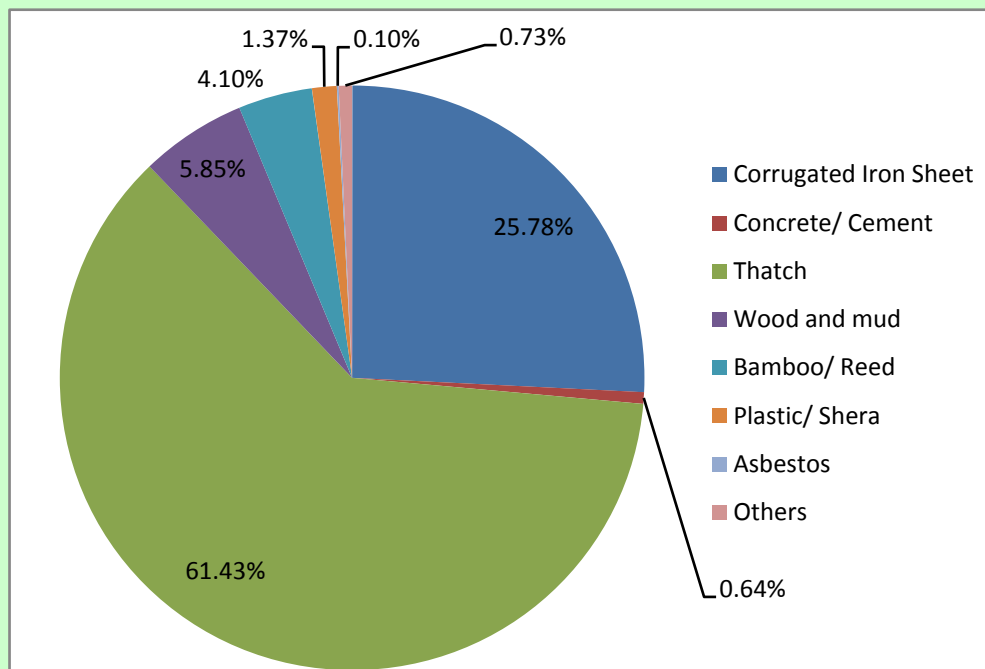
The majority (50.79 percent) of the roofs of the housing units in the country are made of thatch. Corrugated iron sheets had 38.26 percent. Wood and mud with 4.9 percent while Bamboo/ Reed had 3.37 percent. The rest of roofs of housing units in the country had less than 2.0 percent (Figure 5).

In the rural areas, the majority of the roofs of housing units are made of thatch and this accounted for 61.43 percent. Housing units made of corrugated iron sheets accounted 25.78 percent, wood and mud had 5.85 percent while Bamboo/ Reeds accounted for 4.10 percent. Other types of construction materials used for roofs consisted about 3.0 percent.

Using different designs, utilization of Bamboo/ Reed as a roofing material (see Plates 3 and 4 below) for the housing units varied in different regions with S.N.N.P region recording the highest (63.56 percent), Oromia had 25.42 percent, Amhara recorded 7.05 percent whereas Gambella had the lowest (0.01 percent). Harari and Addis Ababa regions had no roofs made of Bamboo/ Reeds (Figure 6).

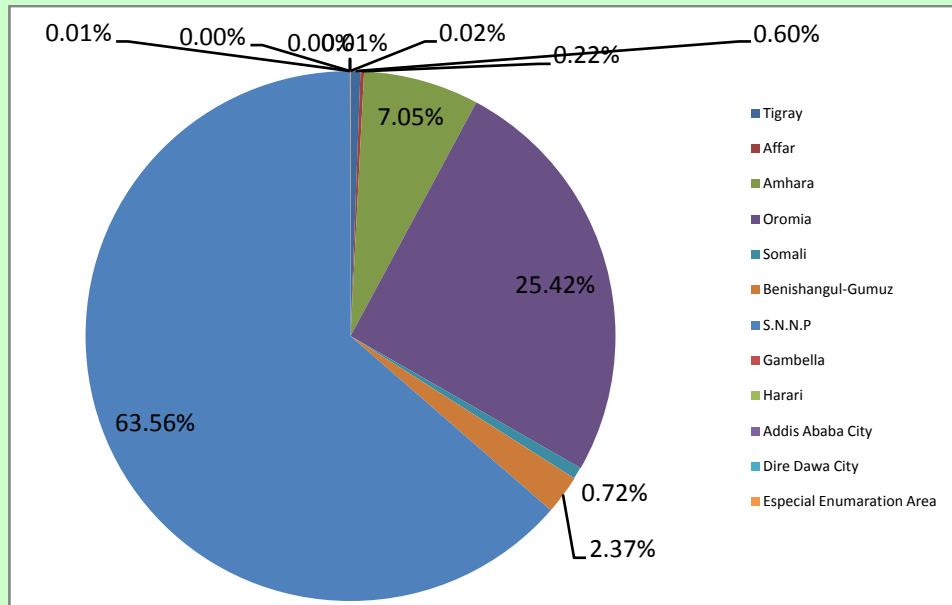


**Figure 5:** *Housing units by construction material of roof at the country level*



**Figure 6:** *Housing units by construction material of roof in the Rural Areas*





**Figure 7:** Housing units utilizing Reed/Bamboo for Roof construction in rural regions



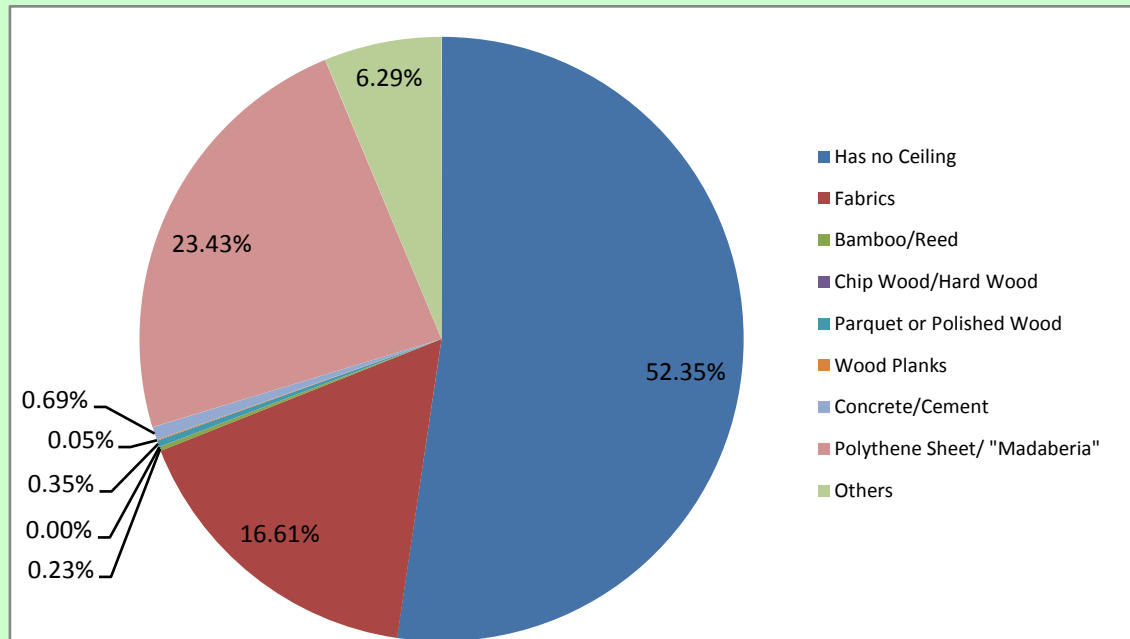
**Plate 3:** Utilization of Bamboo/ Reed as a roofing material-design one



**Plate 4: *Utilization of Bamboo as a roofing material-design two***

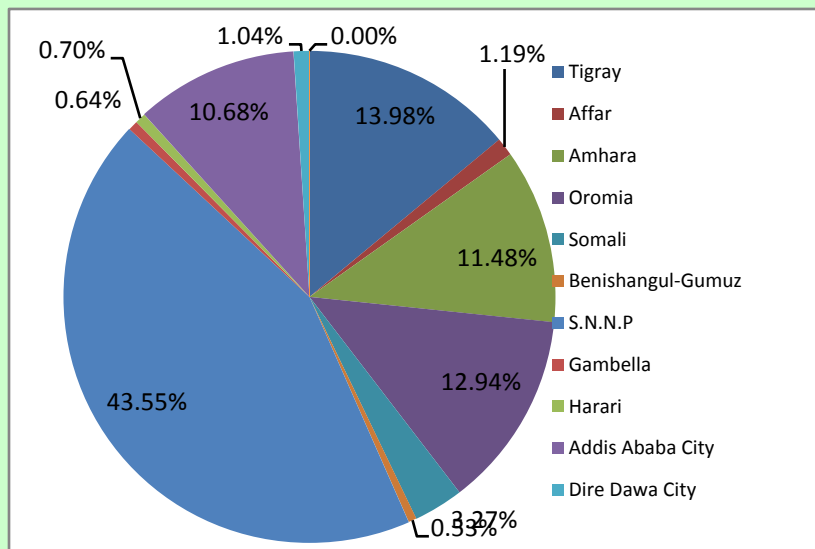
#### **4.4 Housing Units by Construction material of Ceiling**

As observed from Figure 7 below, majority of the housing units in the country had no ceiling recording the highest percentage of 52.35. Housing units with ceiling material made of Polythene Sheet/ 'Madaberia' had 23.43 percent, fabrics had 16.61 percent whereas Bamboo/ Reed recorded the lowest percentage of 0.05. No housing unit had ceiling made of Chip wood/ Hard Wood construction material.

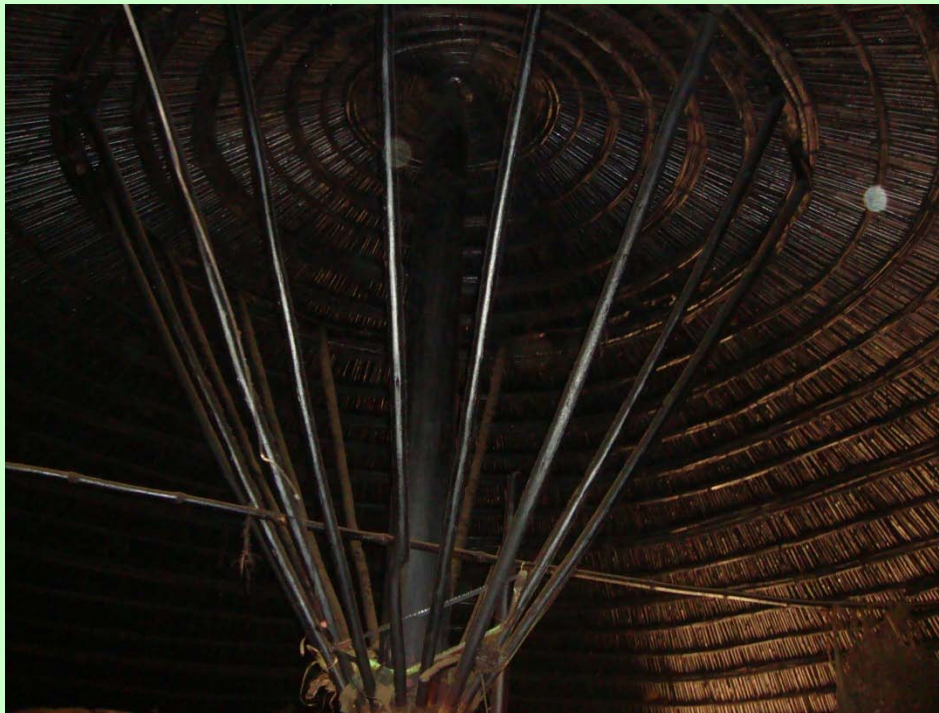


**Figure 8: Housing Units by Construction material of Ceiling at the country level**

At the regional level, most of the regions have utilized Bamboo as a construction material for ceiling (see Plates 5 and 6 below) with S.N.N.P recording the highest percentage of 43.55, Tigray region had 13.98 percent, Oromia had 12.94 percent, Amhara had 11.48 percent, Addis had 10.68 percent while Benishangul-Gumuz recorded the lowest percentage of 0.53. No single housing in Especial Enumeration region utilized Bamboo/ Reed as construction materila for ceiling due to its local unavailability.



**Figure 9: Use of Bamboo/ Reed in Housing Units of Regions for Construction material of Ceiling**



**Plate 5: *Utilization of Bamboo as a construction material for ceiling in rural areas***

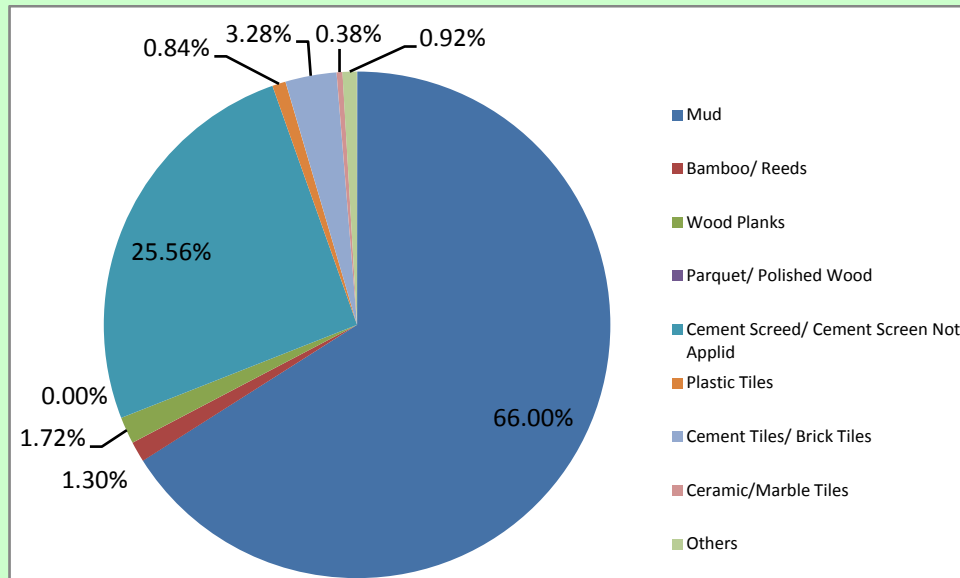


**Plate 6: *Utilization of Bamboo as a construction material for ceiling in urban areas***

#### **4.5 Housing Units by Construction material of Floor**

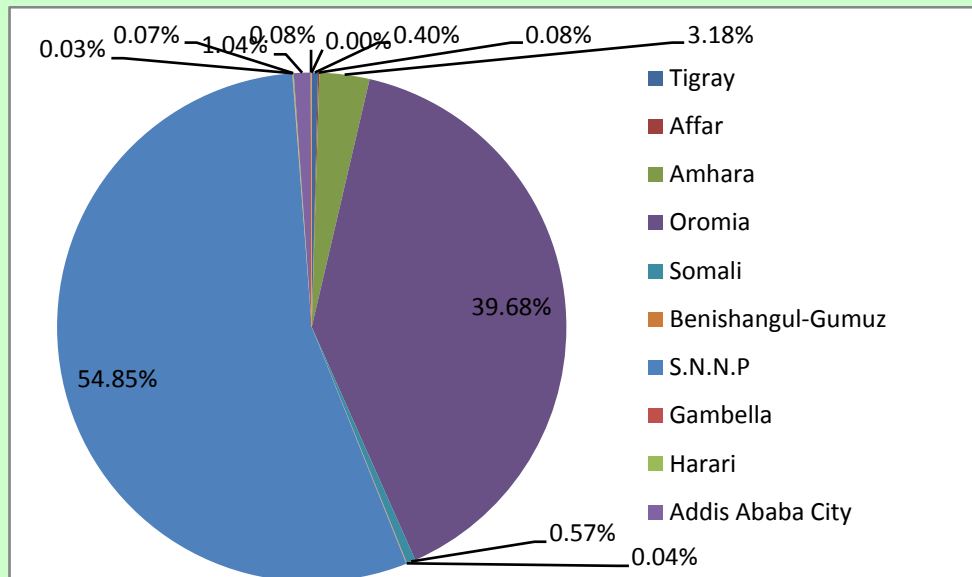
The majority of the regions utilized mud for construction of floor. This accounted for 66.0 percent followed by Cement Screed which accounted for 25.56 percent. Bamboo/ reeds was utilization constituted 1.30 percent. Parquet/ Polished Wood was never utilized for construction of floor in the regions.





**Figure 10: Housing Units of Regions by Construction material of Floor**

At the regional level, bamboo/Reed was utilized highly in S.N.N.P region (54.85 percent) (see Plate 7 below) and lowest in Gambella with a percentage of 0.03. None of the housing units in Especial Enumeration Area utilized Bamboo/ Reed as construction material of floor.



**Figure 11: Housing Units of Regions utilizing Reed/Bamboo for Construction material of Floor**



**Plate 7: Utilization of Bamboo for Construction material of Floor**

#### **4.6 Average Number of rooms per Housing Unit in Rural residence**

As indicated below, the number of rooms averagely range between 1-2 in all regions. However, space provision varies from family to family or tribe to tribe. Three spatial divisions have been identified as:-

- Partitioned houses
- Dwarf partitioned houses/ semi- partitioned
- Non-partitioned houses

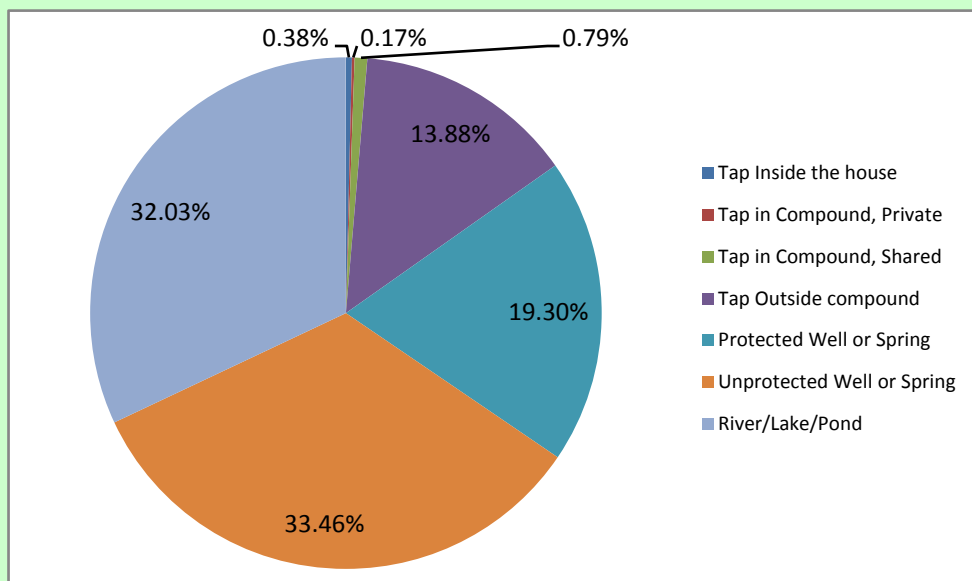
**Table 2: Average Number of rooms per Housing Unit in Rural residence**

| Region   | Tigray | Affar | Amhara | Oromia | Somali | Benishangul<br>-Gumuz | S.N.N.P | Gambella | Harari | Especial<br>Enumeration<br>Area |
|--|--------|-------|--------|--------|--------|-----------------------|---------|----------|--------|---------------------------------|
| Average<br>Number of<br>rooms per<br>Housing<br>Unit | 1.9    | 1.2   | 1.7    | 1.8    | 1.2    | 1.5                   | 1.7     | 1.7      | 1.7    | 1.2                             |



#### 4.7 Housing units by Source of Drinking Water in Rural Residence

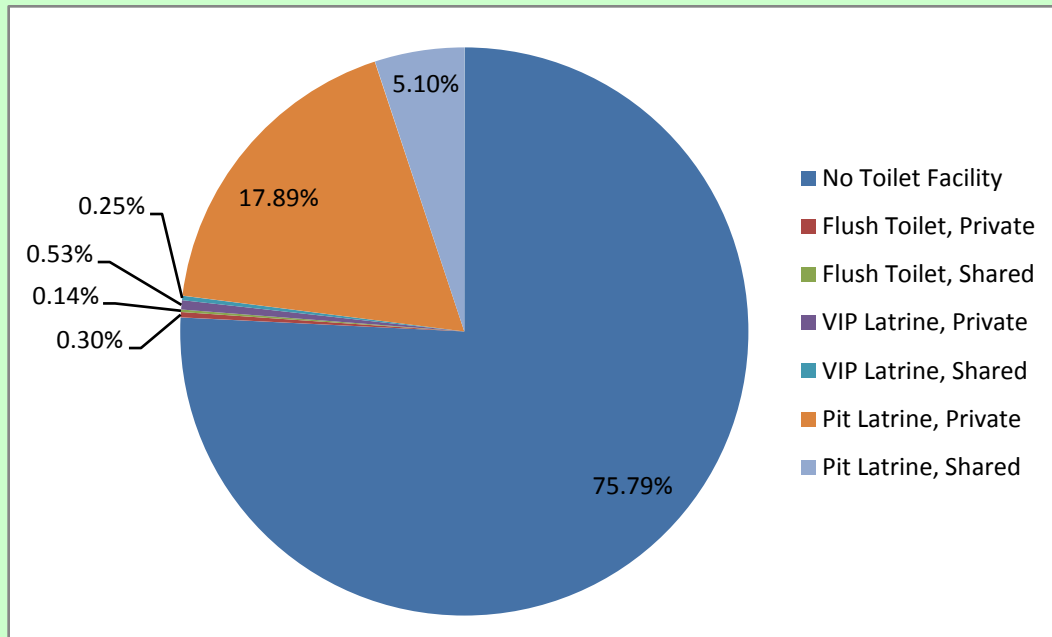
As shown in Figure 12 below, majority of housing units utilize tap water as source of drinking water. 33.46 percent of the source of drinking water is from unprotected water or spring, 32.03 percent from River/ Lake/ Pond, 19.30 percent from Protected Well or Spring and 13.88 percent from Tap outside compound. The rest of the sources of drinking water amounted to less than 2.0 percent.



**Figure 12: Housing units By Source of Drinking Water in Rural Residence**

#### 4.8 Housing units by Type of Toilet Facility in Rural Residence

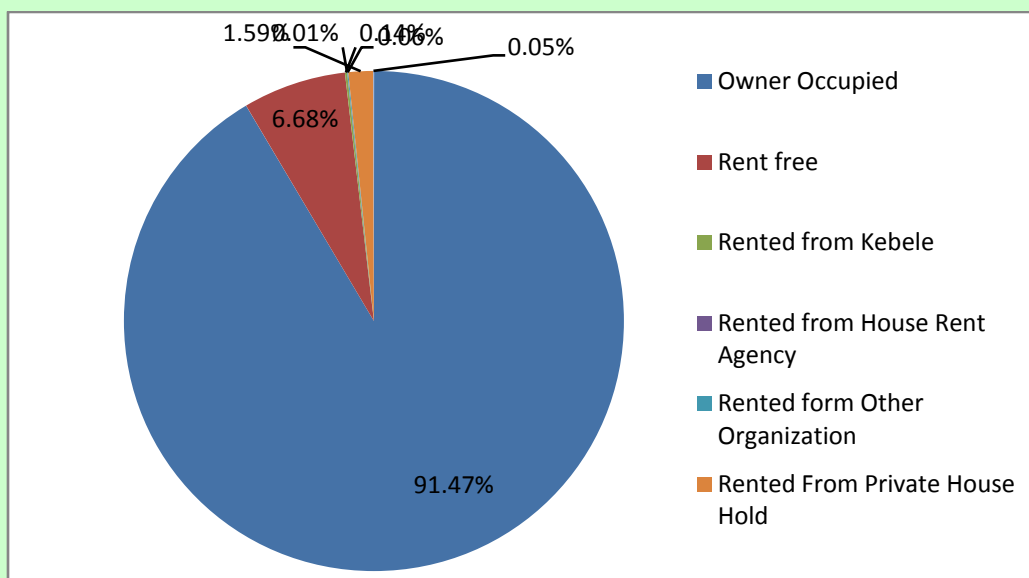
As shown in the Figure 13 below, majority of Housing Units in the Rural residence have no toilet facilities and these households constitute 75.79 percent. 17.89 percent of the housing units have Pit Latrine, private whereas 5.10 percent of the housing units have Pit Latrine, shared. The rest of the Toilet facilities in the Rural residence amount to less than 2.0 percent in the housing units.



**Figure 13: Housing units By Type of Toilet Facility in Rural Residence**

#### 4.9 Housing units by Type of Tenure in Rural Residence

A majority of housing units (91.47 percent) in the rural residence are owner occupied as shown in the Figure 13 below. This is followed by Rent free housing units which constitute 6.68 percent. The remaining systems of tenure in the rural residence are less than 2.0 percent.



**Figure 14: Housing units by Type of Tenure in Rural Residence**

#### 4.10 Housing units by Type of Kitchen for Rural Areas

As depicted from Figure 15 below, most of the housing units in the rural areas do not have kitchen area (53.77 percent). However, 22.39 percent of the housing units have traditional kitchen inside, private while 19.18 percent housing units have traditional private kitchen outside. Housing units with a modern kitchen inside, had the least percentage of 0.05.

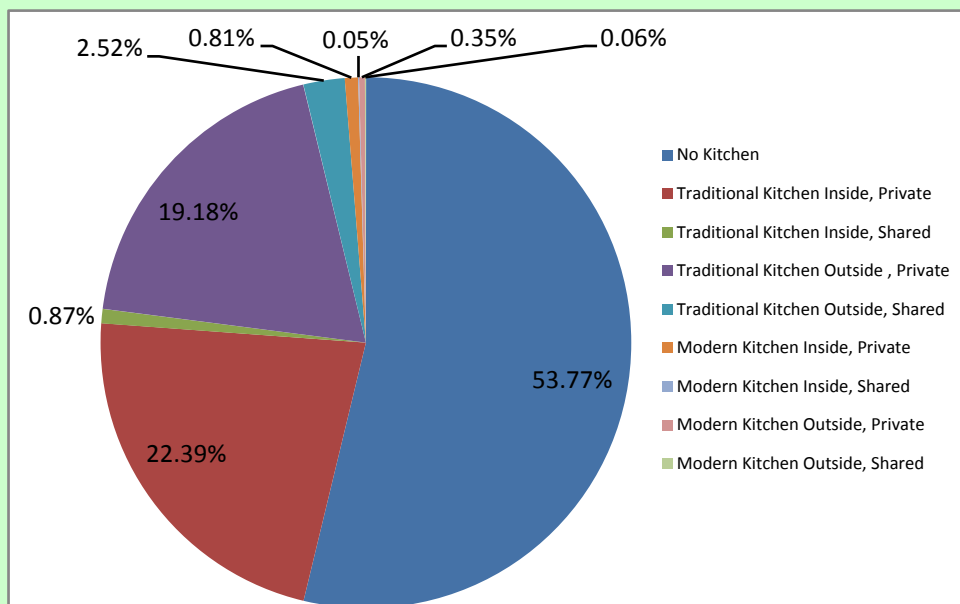
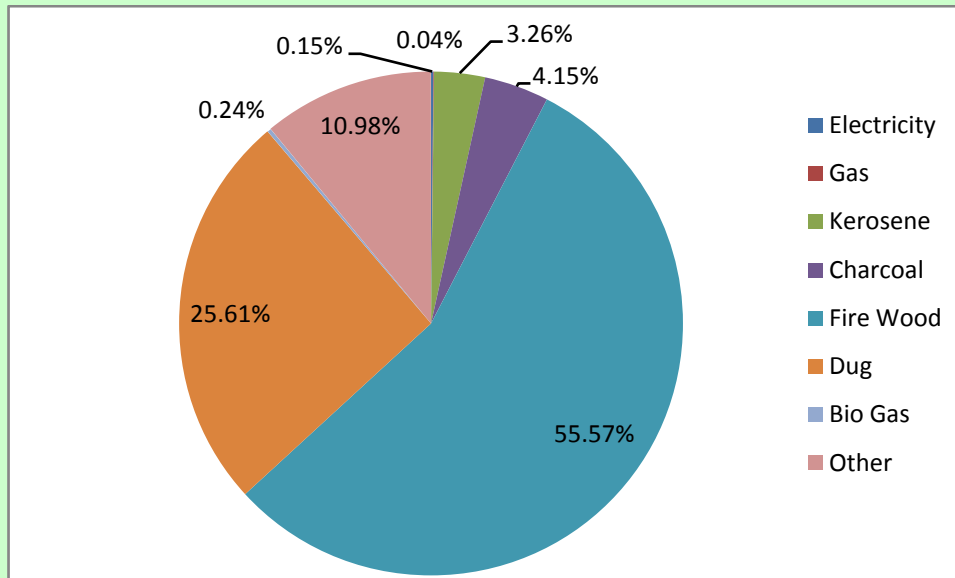


Figure 15: *Housing units By Type of Kitchen for Rural Areas*

#### 4.11 Housing units by Type of Fuel for Cooking in Rural Areas

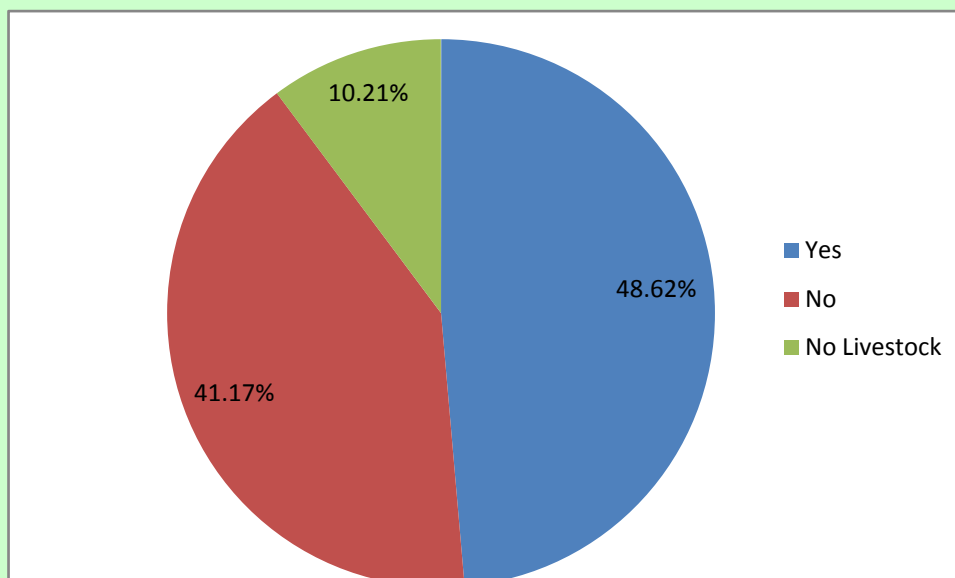
The distribution of housing units in rural areas by type of fuel used for cooking is given in Figure 16 below. A large portion (55.57 percent) of the housing units used fire wood with bamboo common in regions with the resource. Housing units which used Dug/ Manure constituted 25.61 percent and 0.04 percent used gas which was the lowest utilized type of fuel in the rural areas. 10.98 percent of the housing units use other types of fuel not defined in the data.



**Figure 16: Housing units By Type of Fuel for Cooking in Rural Areas**

#### **4.12 Housing units by Whether Livestock Spend the Night in the Room Where Persons also Spend the Night in Rural Areas**

According to the data collected, majority of the housing units in the rural areas consist of persons sharing the same room with livestock during the night (48.62 percent), 41.17 percent of the housing units do not share the same room whereas 10.21 percent housing units had no livestock.



**Figure 17: Whether Livestock Spend the Night in the Same Room as Persons in the rural areas**

#### **4.13 Division of labour in housing construction**

It differs from tribe to tribe, the existing forms of labour are:

- Women builders in Afar region
- Men builders, this is the most common type of labour in Ethiopian tribes
- Children (mainly make mats for roofs, walls and floor)
- Hired labour
- Communal labour among men/women

### 5.1 Introduction

Based on detailed case studies from rural and urban areas, this chapter is focusing on the designs, practices, skills and sustainability of the traditional and modern architecture used by the poor communities in Ethiopia. The chapter is divided into the following key sections:-

- *Rural Bamboo Housing*
- *Low-Income Urban Housing/ Slum Houses*
- *Integrated Housing Development Program*
- *Transformation in Housing Types*
- *Housing Demand and Supply in Addis Ababa City*
- *Building Technology and opportunities for bamboo in the IHDP*
- *Financial and Economic Returns of bamboo housing investments*
- *SWOT Analysis of Bamboo Applications in the Low Income Housing Sector*

### 5.2 Rural –urban Bamboo Housing

Analysis of the existing rural-urban bamboo housing structures was done in two key sampled areas and in Addis Ababa city as outlined in the methodology chapter. This served as case studies for the bamboo housing technical studies. Three bamboo house models emerged and they are discussed under:-

- ***Amhara house Traditional house: Case Study for Lowland Bamboo Housing***
- ***Sidame house Traditional house: Case Study for Highland Bamboo Housing***
- ***Modern-Traditional Bamboo House: Case Studies***

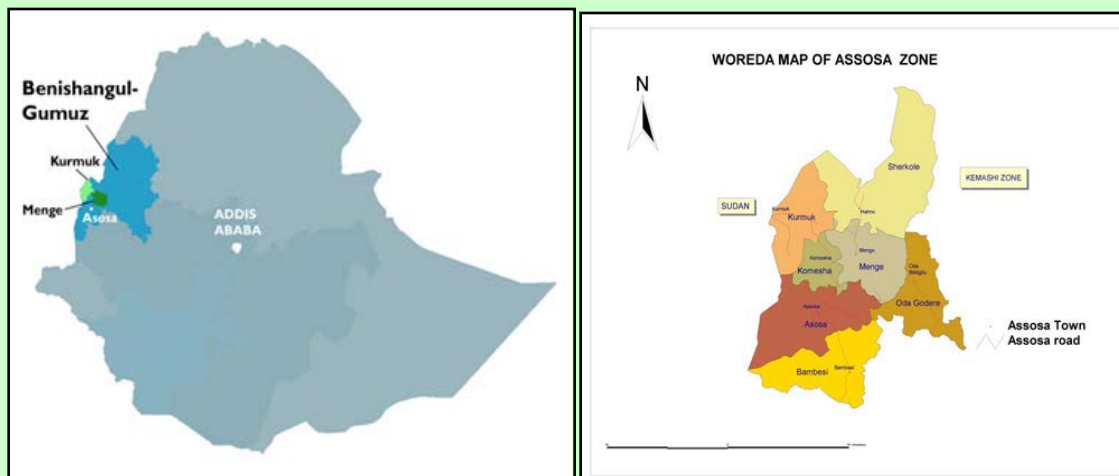
#### 5.2.1 Amhara House Traditional House: Case Study for Lowland Bamboo Housing

This type of house is common in the Benishangul/Gumuz regional state (see Maps below) which is predominantly covered by lowland bamboo that covers about 450,000 hectares. The bamboo in this region is majorly used as: firewood, house construction material and furniture making. All rural housing is predominantly made of bamboo and thatch. Currently, *eucalyptus* and *acacias* are used in scaffolding, while bamboo is mainly used for formwork.



The Regional government owns the forest bamboo stands but allows people to access and utilize it with limited restriction. Locals can only use the bamboo in the forests around their zone of habitation and not in a different zone. Incase bamboo is to be harvested from a different zone; then a permit is required. The Federal Government's policy for the region requires that a permit must be obtained for accessing the resource from the forest. This permit costs between 100-150 birr for a truck load of 1,000 bamboo culms, which is too low to allow control over-exploitation and sustainability and regeneration of the resource. Generally, the area under bamboo has been decreasing due to the following key reasons namely:-

- i. Land under bamboo is being reclaimed into Agricultural land
- ii. Bamboo is being overexploited due to rapid increase in rural populations that require shelter
- iii. Poor and indiscriminate harvesting methods used by the local communities
- iv. Low pricing of bamboo poles by the regional government



**Figure 18: Benishangul/Gumuz regional Map**

Bamboo is becoming scarce and expensive as the resource recedes further from human settlements, thus people are turning to other materials. Currently, 1 bamboo culm costs 3birr compared to 2-3 years back when the cost of one culm was 0.5 to 1birr. The local people are being encouraged to establish their own bamboo farms. Currently, there are 38 government nurseries and 65 small bamboo private farms in the region. As a regional government policy, private Bamboo products processing companies may be granted an operational permit if they establish their own bamboo stands.

### 5.2.1.1 Rural Clustered Village Settlements Program

Assosa zone has four towns that are extensively using bamboo namely: Bambazi, Assosa, Mengel and Mao Komo. The government has recently been encouraging development of clustered village (*kebele*) settlements to ease service delivery to the people. Services like electricity, animal yards, security services, schools, churches/mosques, water, access roads and health are now closer to the people who were otherwise marginalized by the government for a very long time. Each settler is allocated a 30x30m plot on which to build family domestic houses. Farming land is allocated away from the homes; usually about 3 acres per family. The study revealed that the Regional Government puts aside an annual estimated budget of 16,000,000Birr for developing the above listed basic infrastructure. There was no budget for improving rural housing. The newly established Rural Clustered Village Settlements program, is a major opportunity for the intervention of INBAR and other international development partners to improve rural housing in Ethiopia using bamboo materials.



**Plate 8: *Intensive Bamboo use for housing in rural clustered rural villages in Assosa***

### 5.2.1.2 The House Architecture and Construction Process

Each house consumes averagely 300culms of bamboo, although this was dependent on the size of the house under construction. Bamboo is used both for structure and as a filling material, usually woven around the structure. Grass thatch is used for roofing. The construction is carried out by local people. Some of the houses have

open plan whilst others have been partitioned. The walls are smeared with mud plaster and construction labour costs about 25 to 30birr per day.

The wall structure consumes about 30-50 bamboos, 120-150 bamboos for the other parts that include weaving between the wall structures/ the upright standing bamboos and about 100 bamboos for the roof. In total, a house consumes about 250-300 bamboo culms depending on its size. The construction period is about 12 days; where 5 days are used to collect and prepare the construction materials and the remaining 7 days are used in building one house with an average of 6 adult men. The house lasts about 20 to 30 years depending on the quality/ age of bamboo used. Mature bamboo of 6-7 years lasts longer than immature one.

Bamboo for rural housing construction is available for free to community members upon request from the *Kebele* Chairman. However, some substantial cost (depending on the distance) is incurred in transporting the poles from the bamboo forests to the construction sites.

### 5.2.1.3 Amhara Bamboo House Layout Plan

There is clear separation/differentiation of spaces, which could be inspired by the Islam religion which is predominant in these Kebeles i.e. the family house is occupied by the man and wife and small children. There are separate houses for the older girls, the older boys and also for cooking. Men have dominion over women and a man can marry many wives; each wife gets her own house but their children stay together in one house. Men carry out all the construction of houses. Women carry out simple repair works in addition to the other tasks like farming, mining and cooking.

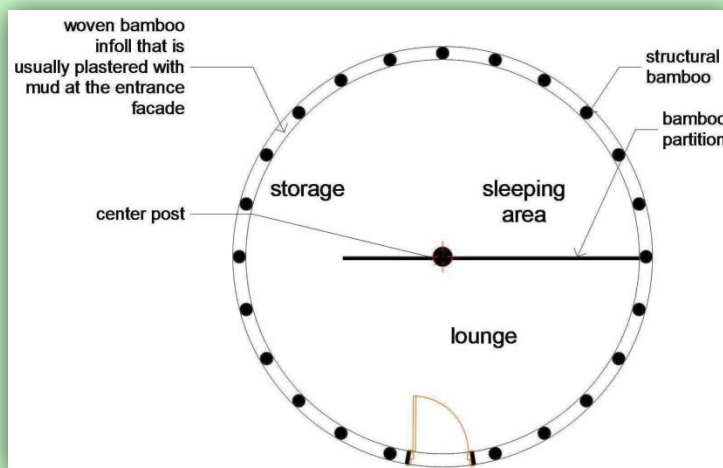


Figure 19: Typical Amhara Bamboo House Layout plan



**Plate 9: *Roof of the Amhara house before and after the thatch***

#### **5.2.1.4 Structural Integrity and Design**

The house is supported by a center post that carries the weight of the roof; the roof is further reinforced by four bamboo members that are tucked into the woven wall at the ring beam level and also jut out of the thatched roof. The walls comprise of structural bamboo poles that end up in the ground and bamboo infill that is woven around these members. The front is sometimes plastered with mud for purposes of beautification. Joinery is done using ropes made from one year old bamboos because they are flexible and soft. The roof eve is made very low as a means of protection of the house against strong winds. It also protects the bamboo walls from rain, therefore, it's a means of bamboo preservation. The eve is also used as a resting shade during the day and as a firewood store (see Plate 10 below).



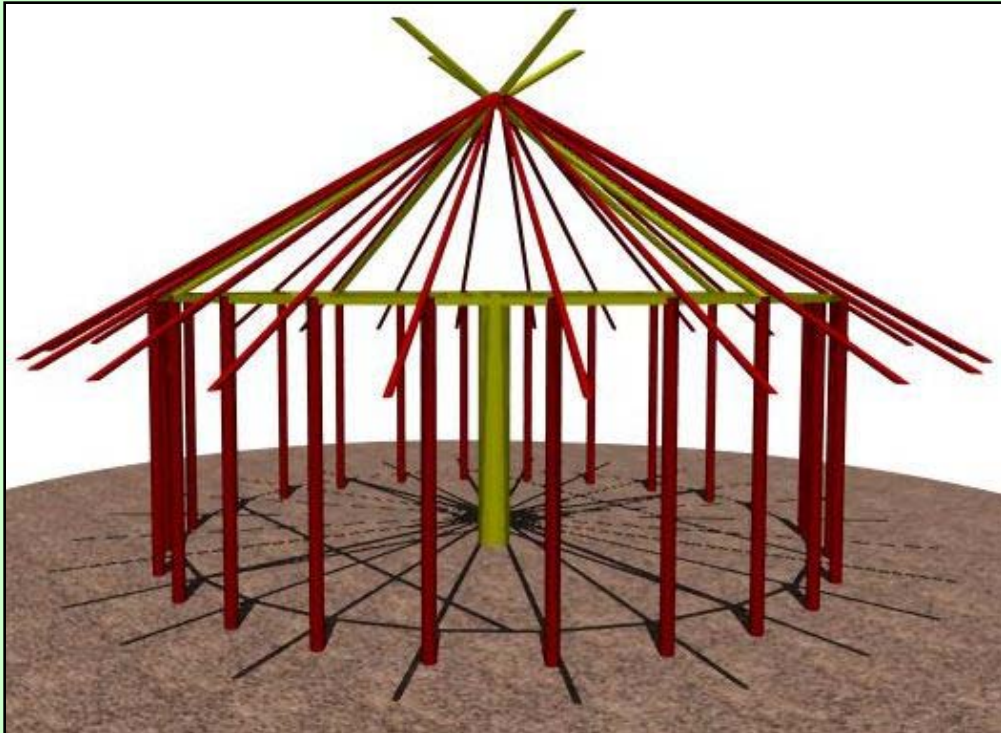


Figure 20: *Amhara bamboo house Structural Plan*

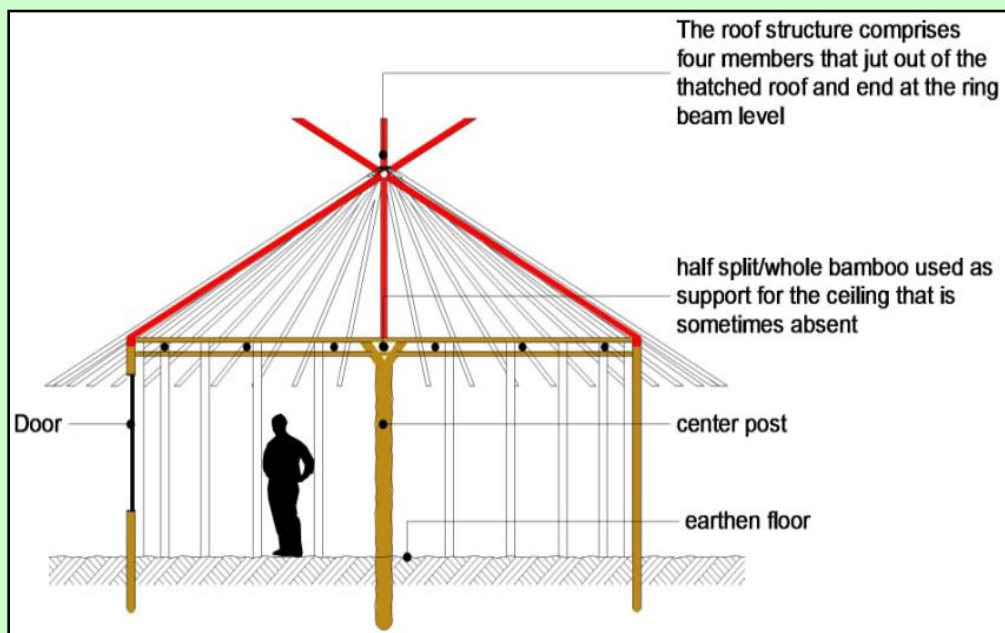


Figure 21: *Amhara bamboo house Structural Design Details*



**Plate 10: Use of the Amhara bamboo house eve as a firewood store**

#### **5.2.1.5 Health and Sanitation**

Each *kebele* settlement has several pit latrines. The walls as well as the floor are mainly made of bamboo. In some cases however, concrete or natural stone floor slabs have been provided for the toilet floor by NGOs like World Vision-Ethiopia (see Plates below). A jug with water for hand-washing was placed at the entry/exit point especially among the Muslim communities. Each family had its own pit latrine facility.







**Plate 11: Common bamboo pit latrine structures and other materials used in Assosa rural settlements**

#### **5.2.1.6 Traditional Bamboo Quality Control Measures and Challenges for Amhara house**

Termites and weevils were reported to be the major challenge at certain spots where they occasionally attacked bamboo used in buildings. Boring beetles were also a menace by attacking immature bamboo poles which have a lot of starch which attracts them. To ensure durability, the local housing artisans take precaution by preparing a good or very strong base that termites are unable to penetrate through. Salt solution is also sprayed around the house during construction in order to deter beetle attacks on the bamboo. Selection of mature bamboo may solve the current existing problem in the region. The use of bamboo in construction is also reducing due to limited research to improve local/ traditional bamboo building technology.

Bamboo is fast disappearing due to high demand for housing and firewood. Currently, the local community members take an average of 2 hours drive by car, 4 hours when transported by donkey carts and 6 hours when carried especially by women. The road leading to the forest had no tarmac and was very dusty.

#### **5.2.2 Sidama House: Case Study for Highland Bamboo Housing**

This study area is found in the Southern Nations Nationalities and Peoples Region (SNNPR) of Ethiopia whose capital city is Hawassa in the Hulla-Agresalem location. The people in this region have access to natural forest highland bamboo, but majority of them traditionally practice private bamboo farming. The architecture of this people is a unique beehive shaped structure that is finished by fixing a layer of undifferentiated woven bamboo onto the structure. Partitions are also made of woven bamboo. Most of the houses have two entrances, a back and front entrance.

The back entrance is meant for use by the cattle and sheep while the front entrance by the people.

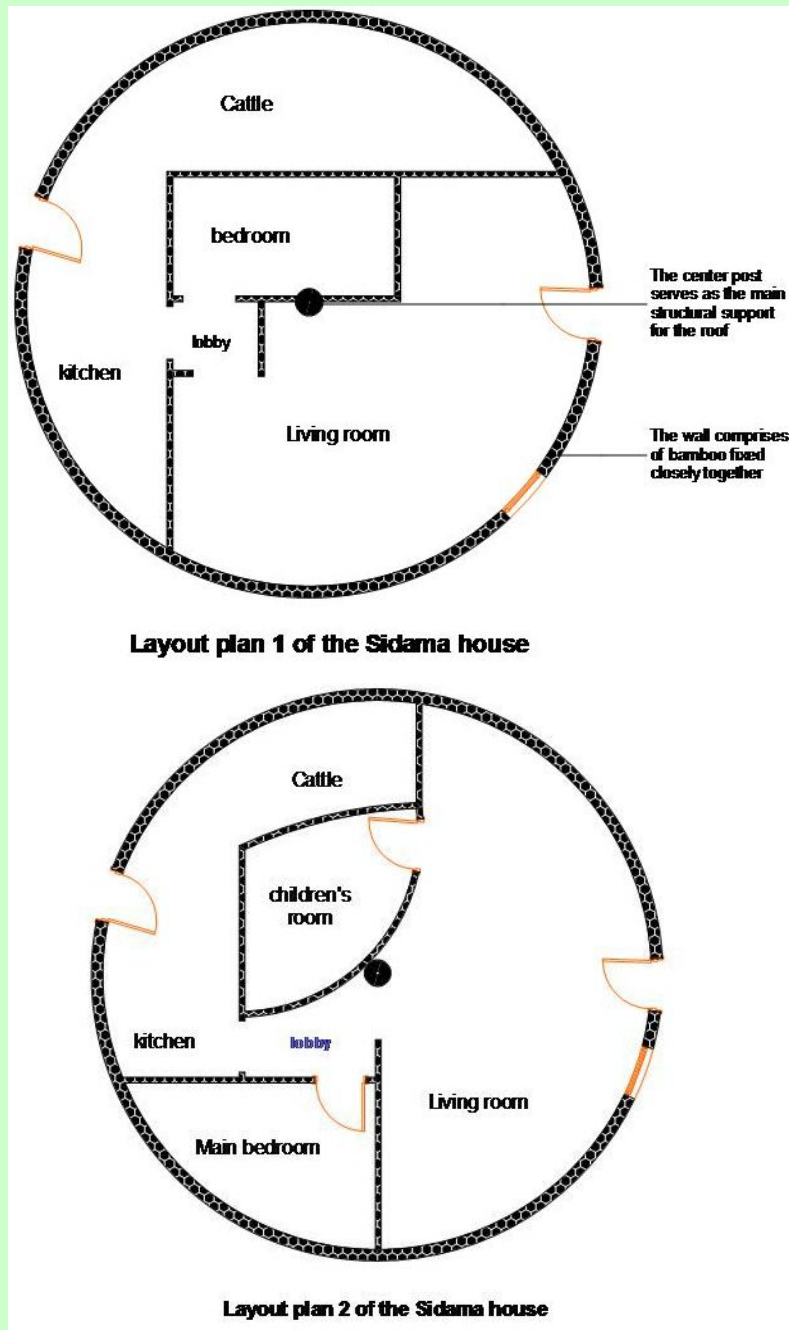


Figure 22: *Sidama House Layout Plans*

### 5.2.2.1 Construction Skill, Materials and Technology

The traditional skill of building is inherited and passed down within the family from fathers, sons and grand children. The resulting bamboo house can last up to forty (40) years but the woven outer layer is usually replaced after about 15-20 years.

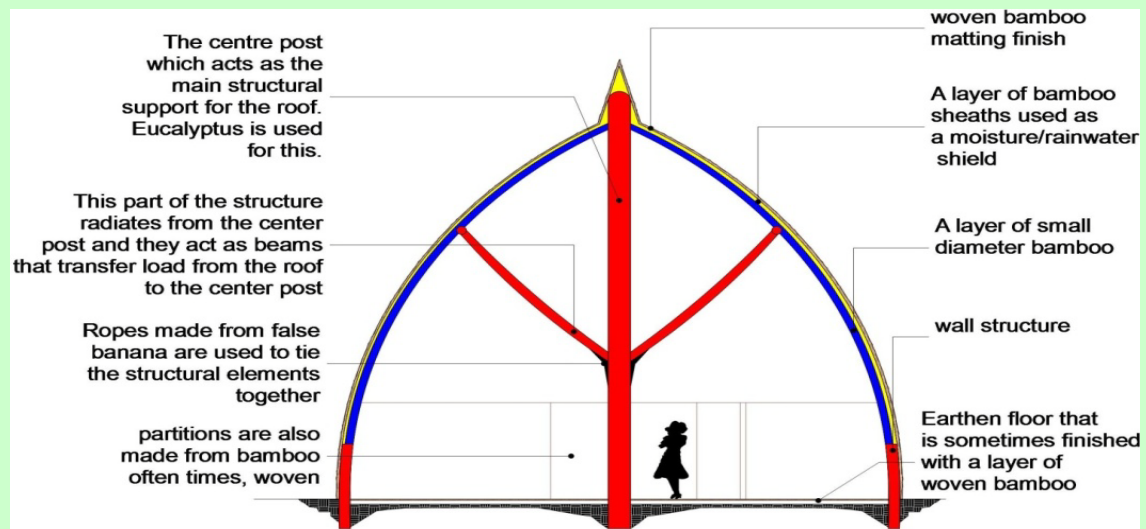
The materials used include:

- Bamboo poles of at least 7 years old
- Ropes for joinery, usually made from the stem of false banana, a staple plant in parts of Ethiopia including *Sidama* area.
- Bamboo sheaths are used to line the inner core of the roof as a means of moisture exclusion
- Center post (usually from *eucalyptus*); it carries the weight of the building i.e. it is the main structural element in the house
- Nylon ropes are used for decorative purposes; this is a recent addition that has happened with modernization. False banana ropes are also used for these decorative purposes in some houses visited.
- Bamboo varnish is applied to enhance shine. This is also a recent addition used in restaurants and guest houses to enhance visual aesthetics.

### 5.2.2.2 Construction Process and Details

First, the suitable site for construction is identified and a circle is drawn on the ground which marks the perimeter of the house. The vertical wall elements and the center post are erected, the roof is then fixed and the finishing done. In the rural setting, an average of 10 men are involved in materials collection, site preparation, construction and finishing. Labour is intensively required for cutting, splitting, erecting and net making. A standard *Sidama* house has a diameter of 10 metres and takes about one month to complete the construction. A total of 800-1000 culms for one main family structure are required for a standard house. In urban areas like Addis Ababa where similar structures are constructed for tourist/ luxury traditional bars/ hotels/ entertainment centres, their sizes and costs vary from place to place depending on availability of bamboo materials and traditional skill. Generally, the cost is higher in towns compared to rural areas because a standard *Sidama* house costs almost nil (all materials are free from the private bamboo farms and free communal labour) in rural areas while in urban areas it cost upto 75,000 Birr. Labour constituted about 35% of construction costs in urban areas.





**Figure 23: A section showing the construction elements of the Sidama house**



**Plate 12: Different stages in the construction of the Sidama house**



**Plate 13: Sidama house at different stages of age**





Plate 14: *The inside view of the Traditional Sidama House Ceiling*

### 5.2.2.3 The Modified Sidama House

Due to modernization, there are modifications and special improvements to the *Sidama* house as observed in the field. These include the introduction of a concrete plinth and woden doors as is the case with *Aregash* lodge shown in the photos below.





**Plate 15: Aregash lodge near Hawassa and a Decent Car park at Debre Zeit (near Addis Ababa) roofed with bamboo matting**

#### **5.2.2.4 Health and Sanitation**

The water at the rural area visited was supplied by the local Catholic Church through communal boreholes. The toilets are either pit latrines that are fenced around with a hedge of live bamboo or a woven mat. The floors of the latrines were made from a mixture of split and whole bamboo.

#### **5.2.2.5 Traditional Quality Control Measures and Challenges for Sidama House**

The following are the major sustainability challenges in this type of bamboo house design:-

- i. Poor ventilation due to inadequate or non-existent window openings. During the day, air circulation is good because the doors are open, the animals are out for pasture and the people are also out attending to various duties. However, at night there is a lot of stuffy air from the animals and the owners of the house. Furthermore, since most cooking is done at night, the houses are also smoky.
- ii. Day lighting: As illustrated in the layout plans above, most of the rooms in this house lack an opening to the outside which makes the house very dark during the day. This is made worse by the blackening of the house from smoke. Lack of windows due to the following reasons:
  - a. Rudimentary building technology and lack of exposure to new modern housing technologies
  - b. As a strategy to cut down the cost
  - c. It is a means of bamboo preservation by retaining the smoke
  - d. It is also a social strategy to enhance security and privacy i.e. Ethiopians like privacy
- iii. Termite attack: this is especially common for immature bamboo poles
- iv. Fire: sometimes, the kitchen is put outside the house to mitigate this
- v. Non-effective water exclusion system



To preserve the bamboo, this community relies on smoke that comes from the cooking area. The community is also very keen in selecting only mature bamboo of over 7 years for long-lasting and durable houses. Most of the traditional houses had no ventilation, but in recent constructions; windows have been added to the elevation of the house.

### **5.2.3 Modern-Traditional Bamboo House: Case Studies**

There are changing trends in housing types due to modernization and influence from the West to meet various present needs. The floor plan is changing from the traditional circular to rectangular. The walls remain predominantly mud mixed with grass and reinforced by *eucalyptus*, bamboo or other cane plants.

#### **5.2.3.1 Case Study I: Regional Government Office Premises**

The Regional Agricultural Bureau's meeting room in Assosa comprises mainly of bamboo as the walling material joined together by nailing. The building has two layers of bamboo on the walls set on a concrete plinth. The plinth serves as a protection to bamboo against direct contact with ground moisture and rain water. This building has been in existence for at least twenty years. Some of the technological interventions observed include:-

- The bamboo walls have been painted as a protective mechanism on bamboo from decay.
- Nailing is used instead of bamboo ropes or false banana materials used in rural areas.
- The building has been elevated on a concrete plinth which protects bamboo from moisture induced decay.



Plate 16: *Regional Government Agricultural Bureau meeting room*

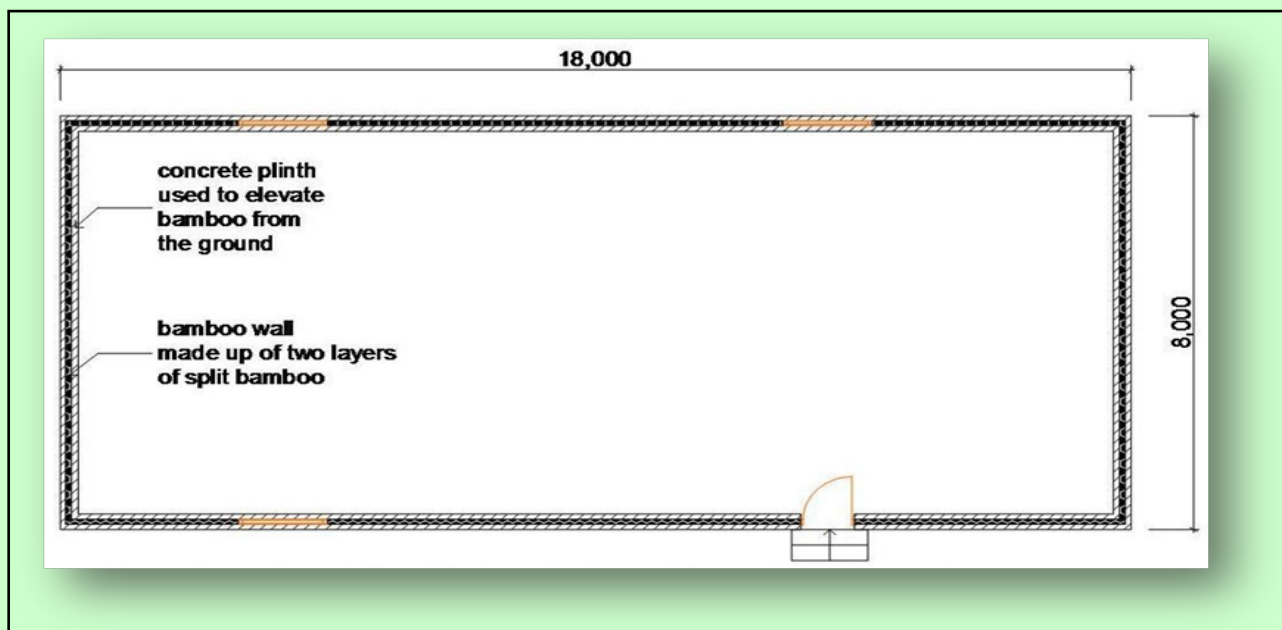
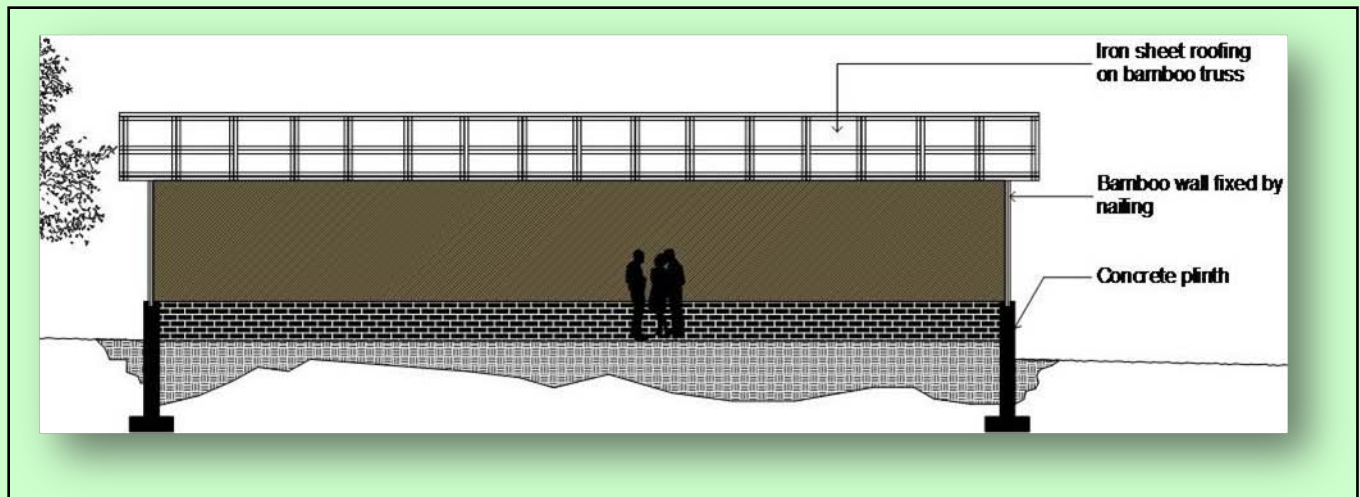


Figure 24: A sketch layout plan of the Regional Agricultural Bureau's meeting room



**Figure 25: A section through the meeting room**

#### **5.2.3.2 Case Study II: Assosa Town Commercial Houses**

This house examined was selected in Assosa town. It has a rectangular layout plan, iron sheet roofing and had electricity connection although the structure remained predominantly bamboo, with a few eucalyptus poles used as reinforcement. Interior partitioning was mainly by bamboo with clay plaster and white wash.



**Plate 17: Front elevation and roof of the traditional-modern house**

#### **5.2.3.3 Case Study III: Bamboo cultural/ tourist restaurants**

These are built by traditional builders using traditional technology skills still available from rural areas. Some of these restaurants are built with conventional building materials like HCB and structural steel, but the finishing and aesthetic improvements are traditionally done using bamboo. The objective behind these structures is tourist attraction. Entertainment and general service illustrates the traditional culture of Ethiopians. Some of these restaurants are depicted in the following photos



Plate 18: *Bamboo cultural/ tourist restaurants (exterior and interior views)*

#### 5.2.3.4 Case Study IV: INBAR office in Addis Ababa

In this office, bamboo has been used structurally as columns and beams, ceiling and walls partly as flattened bamboo and as plastered bamboo using the IPIRTI wall construction technology.



Plate 19: *INBAR bamboo office in Addis Ababa*

#### 5.2.3.5 Transformation in rural Housing Types

Most rural communities are shifting from traditional bamboo houses to modern types shown below due to the following factors:-



1. Better income from salaried citizens leading to improved family income- the trend is to construct a modern house when incomes improve.
2. The cost of maintenance for traditional bamboo houses is higher, thus people are moving away from this type of housing.
3. Better returns from agriculture, hence farmers go for better/ modern housing technologies
4. Exchange between local people and foreigners/ influence from the Diaspora
5. Increasing scarcity and price of bamboo poles
6. Influence of technologies being promoted by international NGOs like GTZ, Habitat for Humanity, World Vision Ethiopia, etc.



**Plate 20: *Some Non-bamboo Traditional rural housing types***



**Plate 21: *Modern rural housing types***

#### **5.2.3.6 Challenges to Modern Bamboo Housing Sector and Technological Interventions**

The use of bamboo as a construction material faces increasing competition from emerging conventional materials. As bamboo recedes further away from human settlements, the cost is also increasing and people are gradually turning to other building materials. Bamboo in Assosa is thought to be less susceptible to termite

attack but since it is used together with eucalyptus which is more prone to attack, treatment has to be carried in two ways:-

- The eucalyptus is treated using oil to avoid spread of termites from wood to bamboo
- They give the houses a clay finish both for beautification and as a means of preservation against termites. The protective clay mixture comprises of: clay, water and diesel (petrol). Once this mixture is smeared on the walls, it serves as a termite deterrent.

The reasons why eucalyptus is preferable as scaffolding/ housing construction material include:-

- It is easier to work with and join together by nailing unlike bamboo which has to be tied, a cumbersome and time consuming process
- It is more acceptable since people have used it for long
- It can be used at least 2 times or more.
- It is readily available from local plantations

### **5.3 Low-Income Urban Housing/ Slum Houses: Case Study of Kirkos Sub City**

Kirkos is one of the sub-cities in Addis-Ababa. It covers an area of 14.72km<sup>2</sup> and has a population of 335,330 people giving an average density of 22,781 people per km<sup>2</sup>. It administers 11 *kebeles*. The building types are typical of any other slum areas in the developing world (see Plates 23 below). By approximation, the average house of the slum house is between 5-10 meters in length and 3-5m width. This is not standard size however because a big number of slum dwellings fall below this sizes. The materials used are:

- Mud or adobe mixed with *tefe* grass used to cover the walls that are usually eucalyptus poles
- Eucalyptus poles are used as the supporting structure
- Iron sheets are in some cases used as walling material, fencing material or as roofing
- In some cases, natural stone is used as the foundation for the houses; most of the street paving is also made of natural stone.
- Polythene bags and nylon sacks have been used as walling and roofing in some cases, or as awnings for business stands.
- Joinery is done with banana fibres and nails. Both the ropes and the grass are supplied by the local farmers within and around the City's outskirts.



**Plate 22:** *Some of the slum shanties within Kirkos sub-city*



**Plate 23:** *Common construction materials used in low-income housing in urban areas*

#### **5.4 Integrated Housing Development Program**

The Ethiopian government housing policy direction is mainly focussed on the implementation of Integrated Housing Development Program that is facilitated by the Federal Government and implemented by regional states and city administrations. The policy is vigorously focusing on development of Condominium houses to meet the needs of the low and medium income earners in the economy. The objectives behind the government condominium houses are:

- Since Addis Ababa serves as Africa's capital (i.e. for the Africa Union), there is need to build vertically thus accommodating more people at less space.



- It is part of city long-term renovation and international image reclamation strategy

A condo/condominium house is one of a group of housing units where each homeowner owns their individual unit space, and all the dwellers share ownership of areas of common use. The individual units normally share walls, but that isn't a requirement. The main difference in condos and regular single homes is that there is no individual ownership of land. All the land in the condominium project is owned in common by all the homeowners. Usually, the exterior maintenance is paid for out of homeowner dues collected and managed under strict rules. The exterior walls and roof are insured by the condominium association, while all interior walls and items are insured by the homeowner.

The current low income housing development is under the Ministry of Works and Urban development and is coordinated by the Land and Housing Coordinating Bureau. The roles of the Bureau are:-

- Regulation and follow up of land and housing development. Provision of home ownership facilities for low and medium income earners in the country.
- Creation of employment opportunities by outsourcing services from Small and Medium Enterprises (SMEs).
- Increasing construction material supply capacity.
- Promotion of technology that is geared towards low-cost housing construction.
- Improving the vocational training system for individuals working within the construction industry.
- Coordination of bulk purchase of construction materials.
- Preparation of the standard housing typologies.
- Capacity building among the actors involved in the housing programme.
- Evaluation of the implementation of the Integrated Housing Development Programme (IHDP).

The target for condominium housing in Ethiopia is mainly the urban poor. The construction takes place in regions that were occupied by shanty/ slum dwellings initially. The IHDP aims at incorporating small and medium scale building contractors as a means of employment creation. Interviews with senior management of the Land and Housing Coordinating Bureau revealed that there are about 40,000 SMEs members working in the housing scheme who provide the following services:-

- Walls construction
- Sanitary facilities installation
- *Agrostone* partitioning installation
- Electrical and plumbing works
- Supply and installation of right angle steel bars trusses and windows
- Supply of precast HCB and beams

The materials used include:

- Hollow concrete blocks (HCB)
- Cement
- Iron bars reinforcement
- Precast beams
- *Agrostone*: used to partition internal space
- Terrazzo tiles on the bathroom floors



**Plate 24: Condominium houses in Addis Ababa**

Cost reduction in materials is achieved by:

- Ensuring minimal wastage of materials
- Purchase of materials in bulk
- Sub-contracting services to various specialized service providers using fixed prices without openings for variations.

Some city residents feel the project may have failed to meet its initial objectives and partly failed due to the following reasons:-

- The workmanship is poor
- Although meant for urban poor people, the current occupancy is from the middle to upper income groups. This has led to springing up of new shanties.
- The rent is very high compared to other building types
- They are located far from the places of work for the poor people, hence those with cars may afford to stay there.

The Bureau is embracing alternative and affordable technology in order to minimize the cost of construction as can be seen in the cost comparisons of different construction materials available in the market projected in the following table.

**Table 3: Different construction materials available in the market**

| Item | Description   | Unit price/m <sup>2</sup> USD | Cost comparison against HCB | % comparison |
|------|---|-------------------------------|-----------------------------|--------------|
| 1    | HCB(hollow concrete block) plastered and painted on both sides  | 14.52                         | +/-0.0                      | 100          |
| 2    | Compressed stabilized earth blocks(CSEB)/ <i>hydraform</i> ; interlocked, pointed and painted with water resistant chemical from exterior and varnish paint from interior | 12.5                          | -2.52                       | -17          |
| 3    | <i>Agrostone</i> , painted on both sides  | 9.1                           | -5.42                       | -38          |
| 4    | Clay brick plastered and painted on one side and pointed on the other side  | 22                            | 7.48                        | +51          |

*Source: Housing Development Department; Ethiopia*

The conclusion from the above table is that *hydraform* and *agrostone* are low-cost materials that are being embraced. The Housing Bureau's studies show that using concrete structurally takes up to 40-50% of the total construction cost, thus they were in the process of building using CSEB/*hydraform* and avoiding concrete in order to reduce the housing cost further.

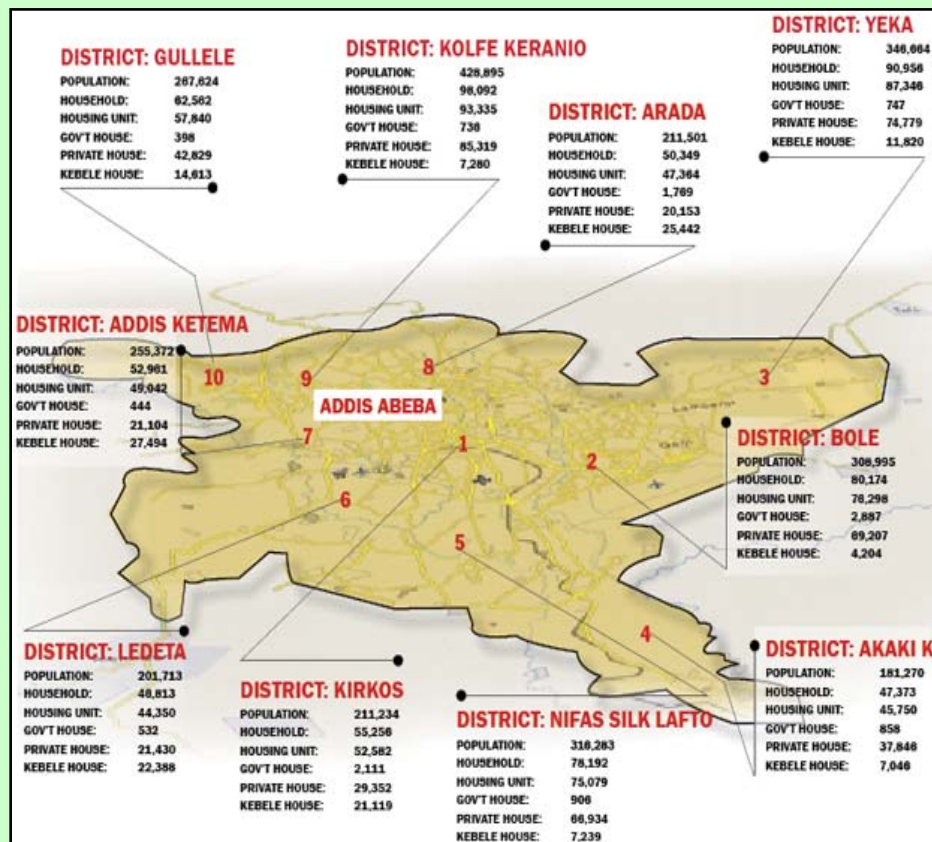


**Plate 25: Some of the materials (hollow concrete blocks) and natural pavement stones used in the condo houses**

### **5.5 Housing Demand and Supply in Addis Ababa City**

Like other markets, the housing market in Ethiopia is subject to demand and supply. However, the supply of houses has not kept up with the growing demand of the expanding capital. This is one of the factors driving prices up as home owners or primary tenants charge large amounts for their units. Ethiopia's population has risen by 23.4 million people over the past 14 years, to 76.9 million in 2007, according to the Population and Housing Census that was conducted for the third time by the Central Statistics Authority (CSA) in 2007. Only 16.1% of the total population were counted as residing in urban areas, out of which Addis Ababa holds 23.1%.

The illustration below depicts the population size and housing statistics in the 10 districts of Addis Ababa City. Based on a projected annual growth rate of 2.6%, the city has a population of 2.7 million. Around 662,728 households were counted as living in 628,984 housing units in the capital. Out of the total housing units, 74.6% are private holdings whereas 23.6% are *kebele* houses. The remaining 11,388 (1.8%) houses are government houses.



**Figure 26: Population size and housing statistics in the 10 districts of Addis Ababa City**

The illustration above shows the projected demand and supply for residential houses, until 2015, taking into account that Addis Ababa's population is projected to



reach 3.1 million by the end of the year 2011. If the trend in the increase of housing units continues gradually at one per cent every five years, the projected supply is estimated to reach 706,441 houses in 2015, up from 629,984 in 2011. Assuming that the average household size of 5.1 people remains the same, the demand for residential housing in the city is estimated to be 670,196 current year (2011).

Over the past decade, the population of the capital has shown significant growth, from 2.5 million inhabitants, in 2001, to close to 3.0 million people, in 2010, according to the Central Statistics Authority (CSA). As a result, the demand for housing has also been increasing. In an effort to meet these demands, particularly for low-income households, the Addis Ababa City Administration is renting out and selling houses at a subsidized price and interest rate payable over longer periods.

As at February 2011, 485,000 people had applied for homes. So far, 80,246 houses have been constructed within the last 6 years but the government's aim is to have an output of 50,000 houses annually in order to meet the high demand for houses and the already existing backlog in the provision of houses. The City government further plans to construct 50,000 housing units per year over the next three years, starting from 2011/12. However, this depends on the availability of construction materials and other inputs, including infrastructural facilities.

The transfer fee is: 2,300 Birr/m<sup>2</sup> for upper level houses and 1,500 Birr/m<sup>2</sup> for ground floor houses which is highly subsidized. The houses are transferred at the cost of construction. Payments are done in two parts, 20% of the cost of the house is paid as deposit and 80% paid over a period of 20 years. No interest is charged. The project is wholly supported by the government; 20% building cost comes from the budget and 80% from local bank loans. GTZ helped by introducing the technology for the project, but it was handed over to the government thereafter.

On the other hand, the private residential real estate sector is one of the fastest growing sectors of the economy, industry experts agreed during interviews. The selling price of modest homes exceeded one million Birr in many of the city's neighbourhoods, while the average sale price for large homes with 1,000sqm and four or more bedrooms cost more than six million Birr. The rent price of these sites can go up as high as 40,000 Birr, according to the study findings. The brokers are also major contributors to houses being more expensive since their income increases when they broker higher priced deals for houses. Another reason is real estate developers, who are attempting to address the housing shortage, but have financial constraints, lack skilled manpower, and face a shortage of construction materials. Despite these constraints, they still make high profits, causing the buyers to sublet the houses at inflated prices in a bid to recover their high costs.



## **5.6 Social, Financial and Economic analysis of investments in bamboo housing**

### **5.6.1 Overview of the Ethiopia Economy**

The economy of Ethiopia is based on agriculture, which accounts for half of gross domestic product (GDP), 43% of exports, and 85% of total employment. Ethiopia is unique in Africa with virtually no private sector business at all. There are no Patent Laws in Ethiopia. Many governments owned properties during the past regimes have now been transferred to pro-government enterprises in the name of privatization. In financial services, no foreign banks are allowed and it remains almost impossible to find start-up loans for small and medium businesses. Youth unemployment is estimated to be as high as 70%.

Furthermore, the Ethiopian constitution defines the right to own land as belonging only to "the state and the people", but citizens may only lease land (up to 99 years), and are unable to mortgage, sell, or own it. Various groups and political parties have sought for full privatization of land, while other opposition parties are against privatization and favour communal ownership.

The current government has embarked on a program of economic reform, including privatization of state enterprises and rationalization of government regulation. While the process is still ongoing, the reforms have begun to attract much-needed foreign investment. Despite recent improvements, with an exploding population, Ethiopia remains one of the poorest nations in the world.

With a GDP per capita of about USD 330 in 2010, Ethiopia is one of the poorest nations on the globe. At the same time, however, the country is one of the fastest growing non-oil economies in Africa, having sustained average annual growth rates of 11 percent for the five years prior to 2010 – driven mainly by the agriculture and services sectors. The country has also enjoyed a 24 percent growth in exports, dominated by coffee, oilseeds and flowers, and a sustained inflow of Official Development Assistance (ODA) and FDI.

Ethiopia's financial sector is relatively small. The government dominates lending, controls interest rates, and owns the largest bank, the Commercial Bank of Ethiopia, which accounts for two-thirds of outstanding credit. The Central Bank, the National Bank of Ethiopia, has a monopoly on all foreign exchange transactions and supervises all foreign exchange payments and remittances.

In recent years, the state has allowed the local private sector to participate in banking, but foreign ownership and branch operations remain strictly barred. As of 2010, there were three government-owned banks, nine private banks (controlling 30 percent of total bank assets in 2009), and nine insurance firms.

The microfinance sector is relatively well developed but not strictly supervised. Currently about 30 MFIs operate in the country and have become a major source of financial

services to many businesses. Some unlicensed NGOs are also active in the delivery of microfinance services through informal channels.

Capital markets are in their infant stages of development. The government issues a limited amount of 28 day, 3-month and 6-month Treasury bills. No stock market is present but, in 2008, the Ethiopia Commodity Exchange (ECX) was opened. The ECX trades coffee, sesame, haricot beans, wheat and maize. The non-banking sector remains largely undeveloped, except for 12 insurance companies with about 190 branches across the country.

### **5.6.2 Financial and Economic analysis**

There are a number of property investment return calculation methodologies that are used to analyze investment return but the real question is which of these methodologies provide the best indication of the investment return that is achieved from a property investment? The various calculation methodologies do not all serve the same purpose and some of the calculations are more useful than others. It is therefore imperative that property investors understand the benefits and shortcomings of each methodology because this knowledge forms an integral part of interpreting the calculation results correctly.

The following calculation methodologies are commonly used in residential property calculation solutions:

- Internal Rate of Return (IRR)
- Net Present Value (NPV)
- Return on Equity
- Rental Yield
- Weighted Average Cost of Capital (WACC)
- Capital Growth
- Interest Rates

An accurate calculation of the Internal Rate of Return (IRR) of a property investment is by far the most useful method of calculating the cumulative property investment return, measuring the investment return on an ongoing basis and comparing different property investment opportunities. The IRR is calculated by first determining the annual cash flow that is generated by a residential property investment and then calculating an annual investment return percentage.

The internal rate of return on an investment or project is the "annualized effective compounded return rate" or discount rate that makes the Net Present Value (NPV) of all cash flows (both positive and negative) from a particular investment equal to zero. In more specific terms, the IRR of an investment is the discount rate at which the Net Present Value of costs (negative cash flows) of the investment equals the Net Present Value of the benefits (positive cash flows) of the investment.

Internal rates of return are commonly used to evaluate the desirability of investments or projects. The higher a project's internal rate of return, the more desirable it is to undertake the project. Assuming all projects require the same amount of up-front investment, the project with the highest IRR would be considered the best and undertaken first.

The calculation of an IRR could be quite tricky and as with many other calculation methodologies, the calculation is only as useful as the data on which it is based. It is therefore imperative that all the property variables that have a significant effect on property investment return are included in the annual cash flow totals that are calculated.

IRR is the rate at which the project NPV equals 0. It also provides the expected return rate of the project, assuming certain conditions are met. In other words, if  $C(n)$  is the cash flow for each period, then

$$NPV = C(0) + C(1)/(1+r) + C(2)/(1+r)^2 + \dots + C(n)/(1+r)^n$$

and IRR is calculated by setting  $NPV = 0$  and solving for “ $r$ ” above. (Excel’s IRR function makes this all a cinch by running iterations.)

The period is usually given in years, but the calculation may be made simpler if  $r$  is calculated using the period in which the majority of the problem is defined (e.g., using months if most of the cash flows occur at monthly intervals) and converted to a yearly period thereafter.

It is also important to note that the IRR indicates what the overall investment return of the property investment is on an annual basis. The percentage that is calculated reflects the annual return on investment that is achieved over the entire investment period. The IRR is therefore the best indicator of overall investment return but is not very useful if you only want to calculate the investment return for a particular annual period.

From the social perspective, Ethiopians in the rural areas are still and would like to preserve their cultural housing designs. Hence, unless one is developing rural housing on humanitarian grounds, it doesn’t make any business sense. However, in urban areas four (4) scenarios based on 4 selected common housing designs preferred by most Ethiopians and tourists were selected for detailed financial and economic viability analysis.

From the overview of the Ethiopia economy, various assumptions have been made while assessing the economic viability of investing in the bamboo houses. A one unit house scenario has been used because with the results one can extend the number of the units to as many units as the capital can allow. We have also assumed a discount rate of 8% which is the average 2011 lending interest rate in Ethiopia and the cash flows have been adjusted with an inflation rate of 7%. These rates have been obtained from the Bank of Ethiopia and even from the background it is clear that the financial sector in Ethiopia is highly controlled by the Government. The operation costs have been assumed to be 4.5% which is a commonly used rate in property investments. This category includes all the operational expenses that are incurred on an ongoing basis. These include rates, property

management fees, levies, repairs & maintenance and insurance premiums. An annual increase percentage of the same has been included in order to adjust the initial operating expense amounts for future periods.

In our analysis, the initial investment is the fixed cost because it includes all the cost for building the one unit until it is ready for occupation while the operational cost gives us the variable costs on annual basis. The life span of each of the different types of houses has been assumed to be 40 years

A financial and economic analysis has been undertaken and cash flows prepared for different periods depending on the scenario. The total estimated costs of each type of house was based on information from the local people and professional judgement by the consultant. The results for the four scenarios is shown below:

***First Scenario: Investment in “low medium income” houses in urban areas:*** In Scenario one, an investment of 75,000 Birr in a one unit house (see Plate below) which attracts a monthly rent of 1000 Birr has been calculated. The life span of the house has been taken to be 40 years. Based on assumptions of a discount rate of 8 percent and additional annual operation cost of 4.5 percent, the project results in an IRR of 18.94% and a payback period of 10 years which confirms its financial viability (See details in Appendix).

***Second Scenario: Investment in “very low income” housing in urban areas:*** In the second scenario, an investment of 75,000 Birr has been assumed for a single unit which attracts a monthly rent of 300 Birr. Using a period of 40 years and applying all the aforementioned assumptions in scenario one, the project has been found to be unviable because it has an IRR of 1.82 percent and the investor will not get back his/her capital (See details in Appendix).

***Third scenario: Investment in a recreational bamboo lodge/ hotel:*** In scenario three an investment in a recreational Bamboo house of 225,000 Birr per unit has been assumed. A single unit attracts 12,750 Birr per month. Using a period of 40 years and similar assumption like in the other scenarios, the investment has an IRR of 70.64 percent and a payback period of 2 years hence the project is viable. (See details in Appendix).

***Fourth Scenario: Investment in “low income” housing in urban areas:*** Finally in Scenario four, financial viability has been undertaken for an investment in a single unit house of 30,000 Birr (see Plate below) which attracts a monthly rent of 1000 Birr. Using a project period of 40 years and having similar assumption like the other three cases, the project yields an IRR of 42.74 percent and a payback period of 4 years which confirms its financial viability (See details in Appendix).

Scenario three and four are proposed for any interested housing investor who wants to make quick money in 2-4 years after investment. Scenario one will only repay after a medium term of 10 years.



*Plate XX : Selected Sample Houses (with complete finishing) for scenarios 1-4(in that order)*

### 5.6.3 Comparison of bamboo houses versus alternatives

As discussed elsewhere in this report, the Ethiopian Government policy and the people's cultural perceptions encourage and only prefer permanent concrete houses for residential purposes. This is mainly due to bamboo construction negative characteristics and weaknesses listed below. Because of this popular housing policy to majority of Ethiopian people, bamboo has no potential in the development of houses for **sale** to the local people. The future housing investments will continue to be influenced by this long term policy of developing apartment and storey buildings in cities and rural towns. However, bamboo has a very high potential in the two scenarios identified above for **rental purposes**. It also has high potential in making specific bamboo housing materials like floor tiles and mats as discussed briefly in other parts of in this report. It is recommended that a study of a bamboo tiles manufacturing factory may be carried out to make final conclusions on this.

## 5.7 SWOT Analysis of Bamboo Applications in the Low Income Housing Sector

### Strengths

- The government is willing to develop bamboo as an alternative construction material because it plans to start a bamboo mat board manufacturing industry in future within Addis Ababa City.
- The IHDP is a possible avenue through which bamboo can be incorporated in the housing industry
- Small scale peasant bamboo products producers may market their housing finishing and furnishing products to the IHDP. Through the formation of community-based bamboo cooperatives to explore alternative bamboo construction, they can be incorporated/ mainstreamed into the programme like the rest of the SMEs.
- The fact that the government is focusing on alternative technologies, means that bamboo construction materials can carve a niche for themselves if availed within the market at an affordable rate to compete with their counterparts.



- Bamboo structures are cool inside as compared to concrete ones.
- Bamboo are good for building relaxation structures because they are aesthetically pleasing
- Eucalyptus which is heavily relied upon for scaffolding is very expensive when compared to bamboo poles
- Sand is very expensive due to long distances
- Metal or steel reinforcement bars are expensive since they have to be imported
- Bamboo is readily available around the villages though getting scarce over time
- No specialized and foreign skill required in traditional housing construction

## **Weaknesses**

- *Poor workmanship and lack of technical know-how:* There is no proper technology in place to improve bamboo and make it appealing to consumers at affordable rates. Therefore, the general view on bamboo building is that it is too traditional and is perceived as backward practice. The few companies manufacturing bamboo products for high end consumers, because of the fact that investing in a bamboo manufacturing plant is quite expensive thereby increasing the cost of production.
- *Lack of bamboo housing policy:* The government has not made any meaningful effort to develop a policy on bamboo as an alternative building material
- *Building code/ Lack of standardization:* Bamboo is not recognized by the Ethiopian Building Standards Code and special permits for its use within the city are only granted to traditional /cultural / tourist / entertainment restaurants/ premises and not residential housing schemes.
- *Weak strength:* Bamboo mats/ boards are not burglar proof thus the issue of security and easy break-ins is a limiting factor to its use in modern day Ethiopia, especially in the urban centers.
- *Unequal availability:* Bamboo is not equally available in the various regions of the country. It is only common in the south and western parts. Ethiopia being a country of many highlands, this makes it expensive when transported to other regions.

- *Durability:* Bamboo is prone to fire as well as boring beetles, termite attack when used together with eucalyptus which easily rots when exposed to moisture. This makes it unappealing for use in construction as it is viewed as being temporal.
- *Market opportunity:* Bamboo is perceived only to be lucrative in the furniture making business as opposed to housing. Hence, to most people it has not commercial value.
- *Resale value and lifespan:* The resale value of construction in housing is a major factor influencing the choice of construction materials used. With bamboo housing, the resale value decreases with time as opposed to their concrete counterparts.
- *Insurance policy:* Most insurance companies may not be willing to offer premiums on bamboo houses, and if they do, it would be too high.
- *Bamboo Bonding Capacity with cement:* Bamboo bonds very poorly with cement thus some types of adhesives should be appended to correct this.

## Opportunities

- The upcoming bamboo floorboards manufacturing factories can be used to build capacity of relevant government officials and general public about the possibility of bamboo boards manufacturing and utilization.
- Bamboo training, propagation and farming taking place around the country offers an opportunity for bamboo technology to thrive due to increased bamboo supply and easy availability.
- Based on the research work at Addis University, bamboo has been recommended for replacement of steel structural works, reinforcement in the ground floor slabs of buildings and also in reinforcing manhole covers. This technique can be integrated within the IHDP.
- With improved technology, the prefabricated bamboo boards for interior partitions are a viable solution or substitute to timber.
- Bamboo is already associated with rich people, thus it can continue to develop that way thereby increasing revenue for bamboo farmers.
- It is likely to be a good replacement to timber scaffolding with proper knowledge transfer from China
- The new Republic of Southern Sudan will be a major market for bamboo in constructing schools, churches, residential homes, etc.

## **Threats**

- Gregarious flowering that happens after about fifty years that dries up all bamboo.
- Reducing bamboo forest resources as land is reclaimed for human re-settlement and farming.
- Poor infrastructure in most of the rural areas that have access to bamboo forests limits people's innovation due to lack of a ready market.
- The government has not paid attention to the advancement of bamboo; therefore there is no improvement in technical aspects.
- It is already associated with the rich people, thus it is common for export, furniture making and hotel and leisure places. It is therefore too expensive already due to high demand and may not be a viable alternative for housing.
- The resource is unevenly distributed in the whole country.
- It is viewed as being rural, cultural and traditional
- Bamboo will only penetrate the housing sector if it is triggered through research and knowledge dissemination
- Processing bamboo makes it expensive and keeps it out of the reach of ordinary Ethiopian people
- As a reinforcement substitute to steel and concrete, it falls short since steel has better properties like strength and grip.

## CHAPTER SIX: STUDY ON BAMBOO HOUSING VALUE CHAIN IN ETHIOPIA

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### 6.1 Utilization of bamboo in Ethiopia

Below is a quick outline of most common bamboo uses observed in Ethiopia during the study in February – March 2011.

#### 6.1.1 Building and construction

This is discussed extensively in the chapter above as it is the object of investigation through the study carried out. Some of the uses include general house construction (walls, structural work, ceiling, partitioning, floor, scaffolding, formwork, etc), fencing, pit latrines, simple bridges, animal houses and the construction of grain storage structures (see Plates below). Bamboo is also used in the making of various implements (e.g. ladders) used at construction sites.



**Plate 26: Use of highland and lowland bamboo in rural housing construction**



**Plate 27: *Sherkole refugee camp near Assosa town with over 1,000 bamboo houses***



**Plate 28: *Use of lowland bamboo in scaffolding, formwork and reinforcements in local flour mills in Assosa town***





**Plate 29: Use of bamboo as a fencing and bridge material**



**Plate 30: Pit latrine structure made of lowland bamboo in Assosa area**



**Plate 31: Bamboo as a building and construction material for grain storage granary in Assosa**

### 6.1.2 Bamboo floor boards

There is only one factory in Ethiopia that is producing bamboo floor tiles. Adal PLC is a bamboo flooring Production Company located in Agre Salem to the South of Addis Ababa city. The company produces 20m<sup>2</sup> of flooring per day which is very low as the company is operating at 50% capacity. The tiles are sold within Ethiopia at an average cost of 550 Birr +15% Value Added Tax per m<sup>2</sup>. By-products of this process are charcoal and briquettes. The factory also produces bamboo curtains, table mats, toothpicks and incense sticks. The factory makes gross profits of about 35% from floor tiles.



Plate 32: Bamboo Floor tiles at the Adal Industrial PLC

### 6.1.3 Fuel: Firewood, bamboo charcoal and bamboo briquettes

The lowland bamboo was the one commonly used for firewood by rural communities. The firewood was also being sold through local open markets as a source of income to both men and women (see Plate 34 below).





**Plate 33: *Women selling bamboo firewood at an open market in Assosa town***

Bamboo charcoal and briquettes were mainly a by-product of the bamboo floor tiles manufacturing process at Adal PLC and through an INBAR/EU-funded Biomass project as shown below. Through the INBAR/EU project, most of this charcoal is made using a bamboo charcoal kiln before sun-drying the briquettes. The charcoal briquettes from Adal factory are used locally as a form of energy and forest conservation strategy and some for export to the Arab Countries.



**Plate 34: *Factory waste materials used to make bamboo charcoal briquettes***

#### 6.1.4 Bamboo Sticks

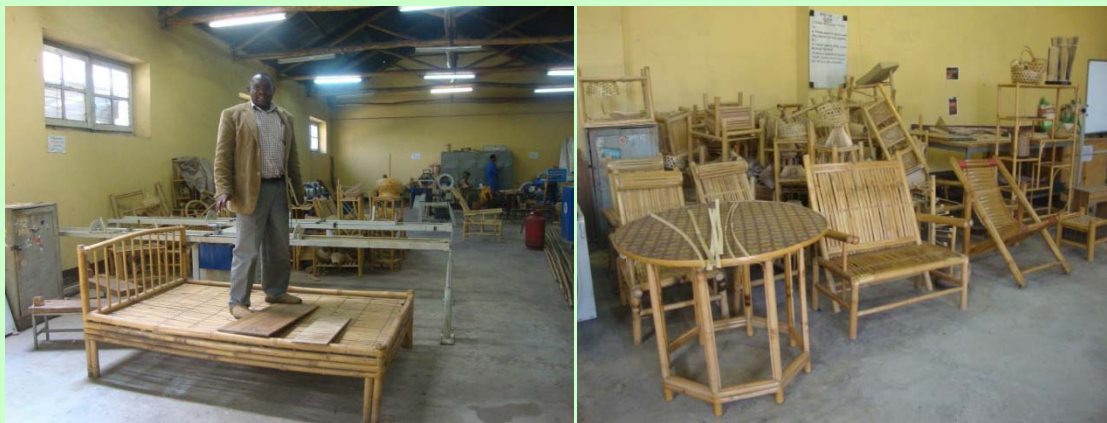
These were manufactured at Adal Industrial PLC. This included toothpicks and incense sticks. They were produced at cottage industrial level by mainly poor women, but Adal PLC also produces them as a by-product of bamboo floor boards. They were for the local and export market.



**Plate 35: *Production process of bamboo sticks at Adal PLC***

#### 6.1.5 Bamboo furniture

The furniture making is a booming business in Addis Ababa. Some of the products made include: chairs, tables, beds and storage cabinets. The prices paid are very good. The major challenge has been availability of the materials in the City and low durability of the products which are made from untreated bamboo.

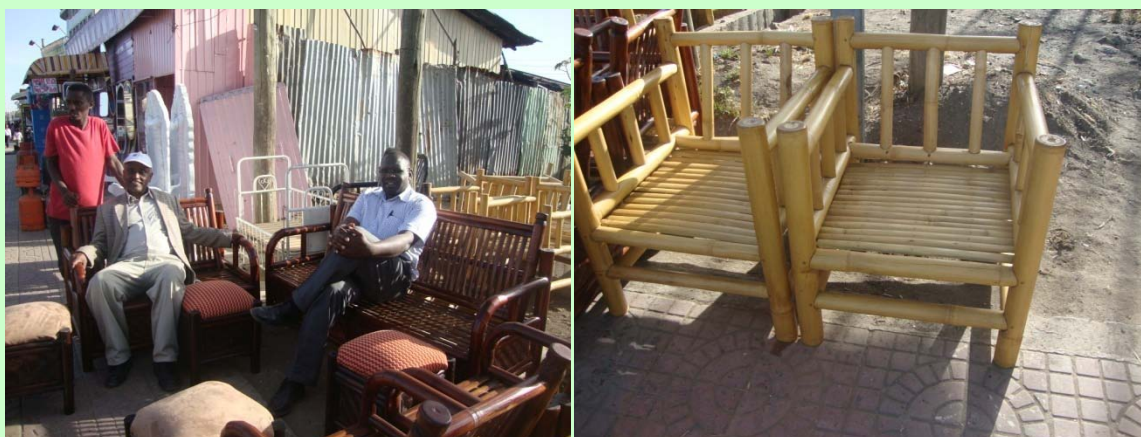


**Plate 36: *Bamboo Furniture made at FEDMSA workshop in Addis Ababa City through INBAR Capacity building programmes***





**Plate 37: Furniture made from lowland bamboo on sale in an open market day at Assosa town**



**Plate 38: Quality furniture made from highland bamboo on sale in the streets of Addis Ababa City**

#### **6.1.6 Mat Weaving and basketry**

Highland bamboo is the most useful in this sector. In this category, the cottage products observed included: lamp shades, curtains, baskets, mats and carpets which were both done in Addis Ababa City using modern technologies and in village homes using traditional skills. Women, youths and children are the most engaged in this business to raise some income for education and domestics needs (see Plates XX below). The mats are used in house portioning, control of dust in construction sites, walls of houses, ceiling material, etc.





**Plate 39: *Lampshades and curtains at FEMSEDA, Addis Ababa City and some baskets made in Sidama Area***



**Plate 40: *Role of Children and youths in the mat making industry***



**Plate 41: *Mats on sale on roadsides of Sidama area and how they are used in housing***

### 6.1.7 Food and animal fodder

The field interviews indicated that in some communities of Ethiopia, bamboo shoots are eaten as a vegetable and also used as animal fodder by using the leaves to feed animals, especially sheep and goats.

### 6.1.8 Other bamboo uses

Bamboo was also used by rural communities in the construction of seedbeds, shades and making of ropes for various uses (see plates below).



**Plate 42: Seedbeds, shades and ropes made of bamboo**

## 6.2 Bamboo market value chain analysis

The field survey case study in Sidama area revealed that the key stakeholders in the Highland Bamboo market value chains include the following:-

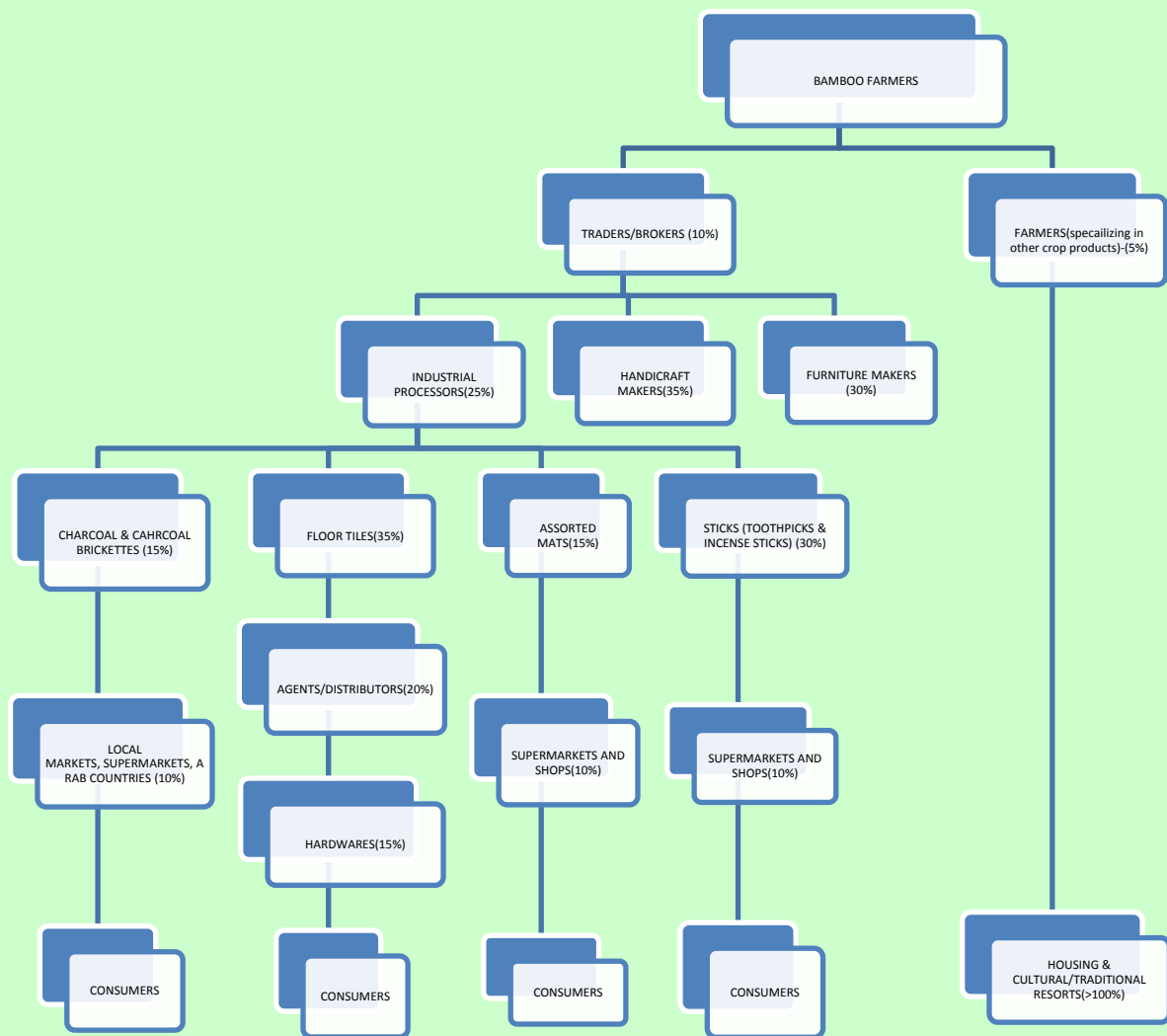
- Bamboo Farmers
- Transporters
- Bamboo Traders/brokers
- Industrial processors
- Handicraft makers
- Furniture makers
- Agents/ distributors
- Consumers

On the other hand, survey case study in Assosa area revealed that the key stakeholders in the Lowland Bamboo market value chain include the following:-

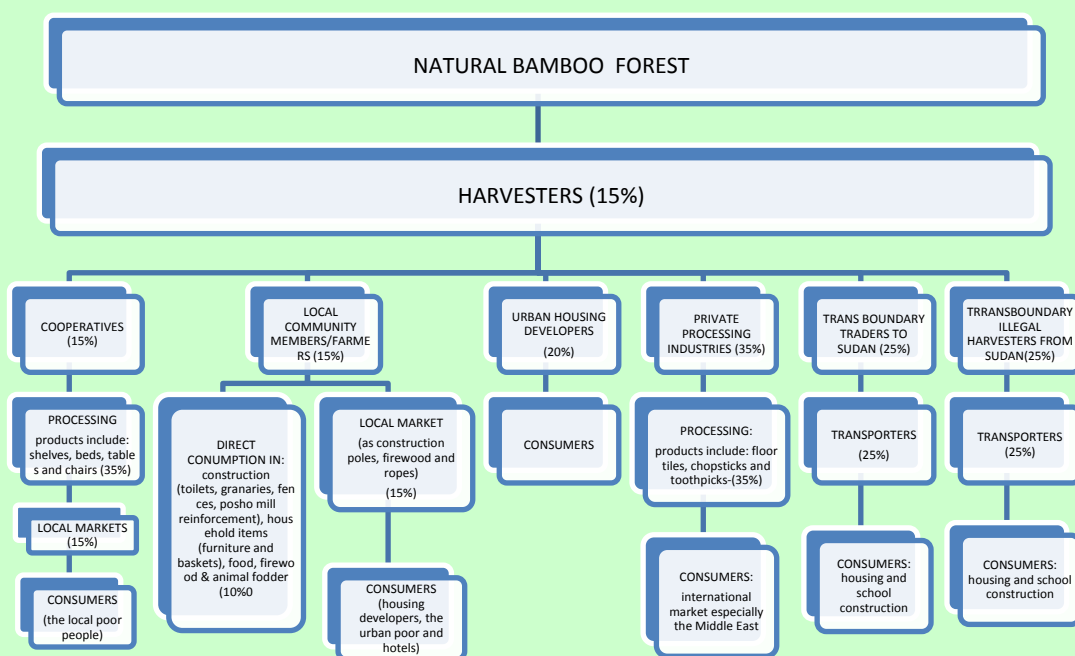
- Bamboo harvesters
- Cooperatives
- Local community members
- Urban housing developers
- Private processing industries

- Trans-boundary harvesters to Sudan
- Trans-boundary illegal harvesters from Sudan
- Transporters
- Consumers

The existing market value chains, estimated value additions at each stage, roles, activities, strengths, weaknesses, opportunities and threats faced by each of the above actors are illustrated and summarised in the flow charts (Figure 26 and Figure 27) and Table 4 below. Some of these activities are also illustrated using some pictures below. The flow charts and the Table also outline detailed Value Chain Linkages and Constraints.



**Figure 27: Highland Bamboo value chain: Case study from Sidama area**



**Figure 28: Lowland Bamboo value chain: Case study from Assosa area**

**Table 4: SWOT Analysis of the Highland and Lowland bamboo market actors**

| Stakeholder           | Roles/ activities                                 | Strengths   | Weaknesses   | Opportunities   | Threats   |
|-----------------------|---|---|--|---|---|
| <b>Bamboo Farmers</b> | -Grow bamboo for both domestic and commercial use | -The farmers have learnt the art of bamboo stand management; from propagation to harvesting<br>-The farmers have private farms to supplement the receding natural forests | -No proper/ reliable market to sell their produce, they therefore do not benefit much from bamboo farming<br>-Lack of government support to the farmers in marketing bamboo- no support from the Peasant Farmers Training Association which serves as a link between the farmers and the government and helps in the distribution of seeds and fertilizers<br>-Lack of proper farming methods and bamboo working tools | -The farmers through the peasant association own a small processing plant which has been given free of charge to a developer (Adal Industrial PLC) in exchange for market opportunity through the venture<br>-The possibility of the government developing a bamboo board manufacturing industry<br>-Need for more housing for the very poor in urban areas who will not afford the | -Poor infrastructure has cut them off from possible markets<br>-Changing trends in bamboo construction technology: local people are opting to experiment with other materials as the Sidama architecture evolves<br>-The lack of market opportunities may result in farmers opting for other crop products<br>-Gregarious bamboo flowering after every 40-50 years<br>-Poor remuneration from bamboo, e.g. one farmer gets only 2,000birr out of bamboo annually from 2 acres under bamboo cultivation. |



| Stakeholder   | Roles/<br>activities   | Strengths   | Weaknesses  | Opportunities  | Threats  |
|---|--|---|---|--|--|
|   |  |   |   | Condominiums.  |  |
| <b>Bamboo harvesters</b>  | -They harvest high bamboo from the forest and supply it to local towns and individuals | -Bamboo harvesting is managed by the <i>kebele</i> administration which is a strategy towards sustainable bamboo exploitation | -They do not have any associations that aid them in marketing their activities<br>-They depend entirely on bamboos from the forests- they don't plant their own<br>-Transportation is very expensive<br>-Lack harvesting techniques and tools | -Possible training from the many NGOs working on bamboo  | -Competition from eucalyptus forest resources<br>-Receding forest resources  |
| <b>Trans-boundary harvesters from Sudan</b>                       | -They transport bamboos across the border to Sudan                                     | -Have access to a wider Market in Sudan   | -Have no background training on bamboo harvesting   | -With the independence of Southern Sudan as a Republic in July 2011, the demand for bamboo for construction sector to increase<br>-Increased employment opportunities for the youth  | -Receding forests without new bamboo farms   |
| <b>Trans-boundary illegal transporters from Ethiopia to Sudan</b> | -They transport bamboos across the border to Sudan                                     | -They don't pay levies and taxes  | -Indiscriminate felling of bamboo forests.<br>-They harvest bamboo without the governments consent to sell to neighbouring Sudan  | -Employment for people<br>-With the independence of Southern Sudan as a Republic in July 2011, the demand for bamboo for construction sector to increase   | -Extinction of bamboo forests  |
| <b>Transporters</b>   | -Transportation of bamboo from farms and forests to major towns                        | -They act as a channel through which the local market is opened up to more consumers  | -A general lack of organization of farmers; since there are no cooperatives, bamboo has to be sought for and collected in the homesteads of the farmers<br>-Most farmers have no private trucks   | -The bamboo restaurants and cultural resorts offer market for the bamboo<br>-Bamboo manufacturing companies<br>-Bamboo furniture and artifacts producers also offer good market opportunities<br>-Transport by donkeys and horses is affordable in rural areas | -Poor infrastructure/ most rural roads are in very poor condition<br>-High taxes and levies on the roads. E.g from Sidama to Addis, bamboo transporters go through three check points. Therefore a 5Birr culm in Sidama could cost as much as 36Birr in Addis.<br>-Transportation cost from the point of harvesting to point of use is very high due to high fuel costs. |
| <b>Bamboo Traders/ brokers</b>                                    | -They act as middlemen that link farmers to producers, manufacturers and consumers     | -They have direct access to farmers without a permit  | -Most of them have no private trucks  | -Increasing demand for bamboo in the construction sector   | -Eucalyptus is better for business because it is in very high demand<br>-Bamboo is not readily available for sale  |
| <b>Industrial processors</b>                                      | -Manufacture/ production of bamboo   | -Have government good will<br>-Market is  | -High production cost<br>-Few existing companies; some like   | -Possibility of propagation and growth of own  | -Decreasing forest bamboo resource<br>-Poor remuneration of  |



| Stakeholder                         | Roles/<br>activities  | Strengths   | Weaknesses   | Opportunities  | Threats  |
|-------------------------------------|---|---|--|--|--|
|                                     | building products   | available for products made   | Adal Industrial PLC are far from the source of raw materials<br>-Low production for those in operation<br>-Limited knowledge on modern equipment and technology<br>-Limited knowledge on economies of scale in bamboo processing | stands with support from the government<br>-Growing demand for bamboo products   | factory employees<br>-Poor health of workers due to bad working conditions; for example, no dust masks are provided and workers face life threatening conditions. This affects productivity as there is no motivation to work  |
| <b>Bamboo Artisans Cooperatives</b> | -Nursery site management- done by women<br>-Bamboo furniture products like furniture, beds and shelves are made by men                | -The cooperative has the right to cut bamboo and is used by the kebele elders to give permit to other community members because they have training on sustainable bamboo management and exploitation.<br>-The proceeds from the sales are banked and the shares distributed amongst the members.<br>-They have a workshop and basic tools | -The cooperatives are still young and members have not received any major benefits   | -There is great potential for growth<br>-Since their conception in 2007, they haven't been having a workshop until recently when the World Vision NGO came it to support them to construction one in 2011. | -There is competition for time between Kebele activities like farming and construction of settler houses and the cooperative requirements<br>-Lack of technical know-how<br>-There is a problem of insects attacking their products because they do not use any forms of treatment |
| <b>Local community members</b>      | -Bamboo harvesting and transportation from the forests<br>-They have traditionally accepted bamboo as a housing construction resource | -Through the kebele, they are tasked with bamboo forest management/ act as watch dogs for the local Government  | -Overdependence on bamboo and its products for their livelihoods   | -Changing trends to lowland and highland bamboo farming  | -Shrinking bamboo forests as people reclaim land for farming and settlement as well poor stand management  |
| <b>Urban housing developers</b>     | -Carry out construction works within major towns<br>-Create employment<br>-Creates market for bamboo traders                          | -They have basic skills in using bamboo in the construction industry  | -Has not developed bamboo technology much<br>-Lack of modern technology and tools for bamboo housing construction  | -The housing industry within the town is growing rapidly<br>-Bamboo will be becoming more available as more people take to bamboo farming  | -Modernization is fast catching up as dependence on conventional building materials rises<br>-Low bamboo durability  |
| <b>Handicraft makers</b>            | -They add value to bamboo by making simple products like mats, lump shades, and baskets for sale                                      | -These products are made by children and supplement the family income<br>-Children learn bamboo working skills at early age<br>-It keeps children busy thus preventing them from indulging in risky activities like   | -Lack of proper market structure since most products are sold at the family gates.<br>-Non-improving skills among the mat makers<br>-Use of Poor/rudimentary tools<br>-Hand limited skills on modern handicrafts                 | -The mats are in high demand both rural and urban areas for various household uses<br>-The export market has not been exploited  | -Poor infrastructure and high transport cost has delinked them from market opportunity in nearby urban centers<br>-Poor skills in bamboo preservation/ treatment   |

| Stakeholder                          | Roles/<br>activities  | Strengths  | Weaknesses  | Opportunities  | Threats  |
|--------------------------------------|---|--|---|--|--|
|                                      |   | selling of khat which is common in this country  |   |  |  |
| <b>Furniture makers</b>              | -They make simple bamboo furniture like chairs, cabinets, tables and beds                   | -These products are relatively cheaper as compared to their timber, plastic and metallic counterparts. | -Dependence on simple hand tools<br>-High rent for business premises in towns<br>-General poor skills and workmanship due to lack of training | -Demand for furniture is high due to increasing population<br>-Ethiopians still like to preserve their culture and association with bamboo | -High bamboo cost in Addis and other towns (due to high transport cost and levies) is threatening the existence of this business.<br>-Rent for business premises is very high<br>-Products have a short lifespan (due to lack of proper treatment) |
| <b>Agents/<br/>distributors</b>      | -They distribute the finished bamboo products locally and to foreign countries              | -Are well connected with consumers in various towns  | -Distance to various towns make the poles expensive<br>-Rely on hired vehicles because have low capital                                       | -The demand for bamboo poles and products is high in urban areas   | -There is selective supply of products: some products like bamboo boards are supplied only to high income earners  |
| <b>Consumers</b>                     | -They buy bamboo products for use   | -They influence the quality and prices of products   | -They have no capacity to determine the quality products  | -N/A   | -Poor workmanship is reducing the demand for bamboo goods  |
| <b>Regional Governments</b>          | -Manage bamboo natural forests<br>-Provide permits to access bamboo<br>-Promote propagation | -By law they have powers to control exploitation   | -Have limited knowledge on bamboo propagation and management  | -Evolving rural resettlement programme   | -Increasing rural populations that require land for agricultural cultivation   |
| <b>Bamboo Research Organizations</b> | -Research of bamboo applications in the housing construction sector                         | -Have access for research funds to advance the sector  | -Have no working relations with leading bamboo organizations like INBAR   | -INBAR regional office for East Africa is based in Addis Ababa for easy networking and linkages  | -The housing boom is focused on modern buildings<br>-The government policy doesn't promote bamboo as a building material   |
| <b>Professional Associations</b>     | -To influence the housing policy and promote best practices                                 | -They regularly and have latest building knowledge from developed countries                            | -Have no legal strength to influence policy   | -There is a strong political goodwill to involve such associations in provision of affordable housing for the poor                         | -Existing law doesn't recognize them as key stakeholders in the housing sector   |
| <b>NGOs</b>                          | -Promoting bamboo propagation, housing, furniture and handcrafts                            | -Have financial resources required in development of the Sector  | -Duplication of activities by various NGOs with very little impact to the community livelihoods   | -Most people in rural areas are very poor and need housing/shelter.  | -Lack of responsibility by community members and government in ownership of the Ngo projects.<br>-Lack of sustainability of the projects due to undeveloped bamboo market chain for new products   |





**Plate 43:** *Lowland bamboo natural forest in Assosa area*



**Plate 44:** *Private highland bamboo farm in Sidama area*





**Plate 45: *Transportation of bamboo poles by women from the forest***



**Plate 46: *Transportation of bamboo poles by donkey from the forest to open markets***





**Plate 47: *Transportation of bamboo poles by trucks from the forest***



**Plate 48: *Bamboo poles on sale in an open market in Assosa Town***



### 6.3 Key bamboo Market Value Chain Actors

A detailed analysis identified the following as the key and active actors in the bamboo market chain listed in the Table above and values added at every stage.

#### 6.3.1 Bamboo Farmers/ Community Members

For highland bamboo, it has been part of the tradition of Ethiopians to cultivate it in their farms unlike the lowland bamboo which is still accessed from Government natural forests. Only highland bamboo has attracted private farming initiatives. They have been growing bamboo for the last 50 years after natural forests started disappearing. Initially, the local people propagated the bamboo through seeds; thereafter they started using offsets for propagation. Most farmers have an average of 1-3 acres of bamboo stands. They harvest culms when they need to use them in the household. The local uses at household level include: traditional housing, fencing and as a source of income through selling in local markets or to brokers/ traders from major cities like Addis Ababa and Hawasa. They cut the dry ones during the dry season, i.e. before March to avoid damaging the young shoots during the rainy season in April-May. Each highland bamboo culm whose estimated height is about 12m is sold at 5 Birr. Annual average remuneration from bamboo is 2,000 Birr per household, excluding personal use. Some challenges that bamboo farmers are facing include:-

- i. Use of non-efficient harvesting tools like machetes
- ii. Lack of marketing support from the local Peasant Farmers Associations
- iii. Lack of a reliable market for bamboo culms
- iv. Gregarious flowering that occurs at about 40-50 years of age that dries up all bamboo
- v. Limited skills in utilization at the household level
- vi. Poor road infrastructure that cuts off potential buyers

Local Peasant Farmers Associations plays the following roles in rural areas:-

- i. Serve as a link between the farmers and the government
- ii. Help in the distribution of seeds and fertilizers to farmers
- iii. They act as agencies through which the government provides its services to the farmers

However, such associations were not supporting famers in the marketing of bamboo culms.

For lowland bamboo, there are no farmers with mature bamboo to date. At Assosa, there are over 38 regional government's nurseries and 65 private farmers for young lowland bamboo in this region. Local people still have the freedom to harvest the mature bamboos from government natural forests for personal use as long as they get permission from the *kebele* chairman. Due to the receding bamboo natural forests, some farmers in lowlands have also started establishing small farms of

lowland bamboo but with less success due to difficult propagation procedures and low rains received in such areas. For future sustainability of the bamboo sector in Ethiopia, more focus needs to be at this level of production. These actors added bamboo values ranging from 10-20%.

### 6.3.2 Transporters

Their major role was to the transfer of bamboo from the forests to homes or farms to local markets. Transportation from the forests to the homes was mainly done by women and from homes to the markets by men using donkeys. When transported by people, it was very tedious and time consuming. Bamboo for sale was bundled into 20 culms. Each person carried one bundle. The other option was to transport by donkey carts; each cart carrying up to 8 bundles (160 culms). The bamboos are brought from as far away as 25km-400Km to market points. Donkey transport was, however, very expensive for the local people to afford. The cost of a donkey is about 2,000Birr and to hire, it costs about 80birr for every 100culms. Bamboos transported on people's backs were those that were dry, shorter and of lower quality as compared to those transported on donkey carts which were heavy. Bamboo is cut into lengths of about 6m or 15m for easy transportation and depending on the type of truck in use. A 10-ton truck was costing about 20 Birr / Km for hiring for bamboo transportation. Since most people are gradually moving away from traditional bamboo housing to more contemporary architecture, there is a possibility of a smaller market for bamboo in future. These actors added bamboo average values ranging from 10-25% depending on distance to the market.

### 6.3.3 Bamboo pole suppliers / Traders

In Addis City, there are a handful of informal suppliers of highland bamboo poles mainly for furniture and limited industrial processing. Occasional orders are for construction of bamboo tourist lodges. The cost of highland bamboo in the city is summarised in the Table below. This clearly indicates that bamboo poles of all sizes are far cheaper in Addis Ababa than Eucalyptus, hence a big potential for the housing sector.

**Table 5:** Cost of bamboo culms in Addis city

| Category/<br>Grade | Circumference(cm) | Standard<br>Length(m) | Average<br>Price per<br>pole (Birr) | Average<br>Price per M<br>(Birr) |
|--------------------|-------------------|-----------------------|-------------------------------------|----------------------------------|
| 1-Large            | Over 20           | 15                    | 32.50                               | 2.20                             |
| 2-Medium           | 16-20             | 15                    | 25.00                               | 1.70                             |
| 3-Small            | 10-15             | 15                    | 20.00                               | 1.30                             |
| 4- Very<br>small   | 7-9               | 15                    | 13.50                               | 0.90                             |

**Table 6:** Eucalyptus prices in Addis Ababa

| Category/<br>Grade | Average<br>Diameter<br>(cm) | Length (m) | Price per<br>pole( Birr) | Price per<br>M ( Birr) |
|--------------------|-----------------------------|------------|--------------------------|------------------------|
| 5-Very small       | 6                           | 4          | 11                       | 2.75                   |
| 4-Small            | 8                           | 4          | 14                       | 3.50                   |
| 3-Medium           | 10                          | 8          | 26                       | 3.25                   |
| 2-Large            | 12                          | 8          | 38                       | 4.75                   |
| 1-Very Large       | 14                          | 3          | 30                       | 10.0                   |

Entrepreneurs in Addis Ababa pay very highly for culms because of:

- i. The high taxation imposed by the Federal Government. For example, from Sidama to Addis (approx 400Km), bamboo transporters go through three check points where they pay some levies / culm making a 5Birr culm in Sidama to cost as much as 36Birr in Addis. The traders pays 0.5Birr, lowered from the initial 1.5Birr per culm as tax to the Ministry of Agriculture at every check point.
- ii. Transportation cost/ fuel from the point of harvesting to the point of use in the City is very high. For example, they pays 8Birr per culm for transportation from Injibara to Addis Ababa (150Km) and this doubles its price 18Birr at farm gate to about 36 birr in Addis
- iii. High labour cost of loading and unloading.
- iv. There is reduced bamboo supply during harvesting of other food crops

#### **6.3.4 Bamboo furniture proprietors**

Most of the bamboo furniture artisans in the City comes from Injibara bamboo area (150km from Addis Ababa) and make traditional furniture copied from the culture of the people of this area. Some artisans have some basic training on furniture making through FeMSEDA. Such informal workshop enterprises employ 2-5 workers, which is a male-dominated profession. Their products include: shelves, chairs, stools, baskets and mats. Average product prices are indicated in the Table below. Those with good capital also sale bamboo culms from their workshop yards.

**Table 7:** Prices of bamboo furniture

| Item                    | Price in Birr |
|-------------------------|---------------|
| 3 -sitter bamboo chair  | 35-40         |
| 2 - sitter bamboo chair | 30            |
| Table                   | 25            |
| Single sitter chair     | 13            |

|       |     |
|-------|-----|
| Shelf | 100 |
|-------|-----|

Some of the challenges experienced by Bamboo furniture proprietors include:-

- i. The dependence on hand tools which is very laborious
- ii. High monthly rent charges for the workshop premises, i.e. about 46.5birr / M<sup>2</sup> of space
- iii. Lack of training on modern bamboo furniture making technology despite the high demand
- iv. Attack by weevils: they apply *nafta* (diesel) to the poles or do paint final products as a means of preservation.
- v. Lack of adequate space to scale up business and storage of products and materials
- vi. Competition from plastic furniture and other substitutes. Market for bamboo products is going down thus workshops are closing down

#### **6.3.5 Bamboo Mat Sellers**

Mats and baskets are commonly made by children. They are approximately 2mx2m in dimensions. Each mat cost 15 Birr and it consumes two bamboo culms. A standard basket for storage of grains cost 60 Birr. The income from the sales is used within the family to buy school stationery and books for the children and cater for any other arising home needs. The mats are mostly marketed and sold at the home gates/ road sides and people buy according to need, which could be wholesale or retail. Lack of market and poor rural infrastructure are the two major challenges facing these stakeholders in the bamboo market value chain. These actors add about 15-20% value to the material.

#### **6.3.6 FeMSEDA's role**

The centre has three components:-

- i. Production i.e. propagation, harvesting etc
- ii. Processing/ bamboo utilization
- iii. Market access and penetration e.g. improving aesthetic qualities and other values addition strategies

Achievements by FeMSEDA to date through support of international donors like INBAR include:-

- i. Created national awareness on bamboo propagation and utilization
- ii. It has led to the adoption of bamboo by the government as part its extension programme
- iii. Private enterprises have emerged from FeMSEDA efforts e.g. Land and Sea, Adal and Nile bamboo Industries



- iv. Propagation techniques have been disseminated to the village level
- v. The training and bamboo propagation techniques have been disseminated all over the country by the farmers that have been trained

### **6.3.7 Adal Industrial PLC**

This factory is located about 35 Km in the outskirts of Addis Ababa City. The company was founded 15 years earlier before being converted into bamboo flooring production in 2006. It has 130 employees, 90% of whom are female. Remuneration is low at an average of 400Birr per month. Transport to and from work as well as medical cover while at work is provided for these workers. It manufactures 7 types of products at the moment which include:-

- i. Bamboo floor tiles, mainly zebra flooring
- ii. Toothpicks
- iii. Curtains
- iv. Incense sticks
- v. Table mats
- vi. Hotel menu and bill folders
- vii. Charcoal/ Bamboo briquettes which is exported to Arab countries or sold locally

Only highland bamboo is used in this factory, and it is sourced from Hawassa, Agre Salem and Gurage areas. The bamboo is supplied by middlemen and it costs between 10-12 Birr per culm depending on the length and diameter. The first 3m of the bamboo culm from the bottom part is used to produce floor tiles and the rest of the bamboo is used in the manufacture of the other products above. The floor tile (main product) production process involves the following stages:-

- Cutting bamboo culms into the required sizes
- Splitting
- Smoothing and flattening to remove the inner and outer layers
- Treatment by use of use of borax/water solution by steam boiling in a pond for 3 hours.
- Drying
- Carbonizing
- Drying
- Right angle planing
- Gluing
- Pressing for 10 minutes at 100°C temperature with loads of 50 ton to the sides and 100 ton to the top.
- Coating

- Packaging and Marketing: the tiles are sold within Ethiopia at a cost of 550Birr + 15% tax per m<sup>2</sup>. The buyers comprise mainly of people in the upper and middle income category.

Some of the advantages of bamboo floor tiles manufactured by the factory are:-

- They are low maintenance materials since they don't require frequent polishing.
- They come in many types of finishes: matt, vinyl etc

The factory is facing four key challenges:-

- Low production: they produce only 20m<sup>2</sup> of flooring tiles per day.
- The plant is operating at 50% capacity due to low quantity and poor quality bamboo supplied. The culms supplied are often of inferior quality because of poor selection and adulteration during the process of harvesting and supply. This is due to the lack of basic knowledge on bamboo harvesting, selection of mature culms and transportation by suppliers.
- Increased cost of production due to high transportation costs of raw bamboo culms from as far as 500Km away from the factory.
- Lack of knowledge on how to reduce the cost of production by undertaking pre-processing at the sources of bamboo materials to reduce transportation costs. As explained below, currently, the investor is spending too much money to transport hollow bamboos over distances of up to 400Km from the farms.

In order to cut down the cost of production the company has taken up the unused premises of Peasant Farmers Training Association at Sidama area in order to do semi-processing of the culms before transporting them to Addis Ababa. However, it was observed that the industrialist didn't have the knowhow on how to cut the cost through semi-processing. Instead of splitting the culms to increase the volume of what is transported, he was instead cutting whole hollow culms into small sizes of about 1.5 metres before transportation. This never reduced the cost at all because he was still transporting hollow culms with air to Addis Ababa, which was about 400Km away. Peasant Farmers Training Association's hope that the industrialist was to provide market for their local bamboo had failed. This is a major gap in the market value chain that makes the final product unnecessarily expensive.

### **6.3.8 Land & Sea Development PLC**

This company which started over 15 years ago collapsed before start of operations due to business disagreements among its Directors. Currently, it is 95% rehabilitated to start operations before the end of 2011. The amount of bamboo existing in this regional state targeted by the company is about 400,000km<sup>2</sup>. About 52,000km<sup>2</sup> has been allocated to the company with the agreement that they harvest,

propagate and manage it sustainably. The Federal Government's policy on bamboo use for housing is applied in the Regional States as well. Products anticipated to be produced include: floor tiles, toothpicks, windows, doors, chopsticks and charcoal. The factory will be working with local farmers through the regional government machinery. They have established a large bamboo nursery where they will be producing a million seedlings annually. Their action plan indicated that 40% of the seedlings will be planted by the factory while the remaining 60% will be distributed for sale with transport and planting inputs provided. The factory is expected to consume 1 truck of 1,000 bamboo culms per day. They anticipated production capacity is 10,000m<sup>2</sup> of floor tiles per month which is far above what Adal PLC is currently producing. These tiles will all be entirely be exported to the Middle East countries and no sales will be done in Ethiopia.

### **6.3.9 The Regional Governments**

The Regional State governments own forest bamboo stands within their jurisdictions but allow local people to access and utilize it for their household needs like construction of domestic houses. Locals can only use the bamboo in the forests around where they live and not in a different zone. In case bamboo is being harvested from a different zone; then a permit is required. The permit costs between 100-150 Birr for a truck of 1,000 bamboo culms. In accessing bamboo from the forest, the regional states apply the Federal Government's Forestry Conservation policy guidelines.

### **6.3.10 Bamboo Research Organizations**

There is an interesting ongoing research to document all Ethiopian traditional houses by the Addis Ababa university Department of Building and Construction. The researchers are currently making a catalogue of all the traditional houses of the more than 80 ethnic groups found in Ethiopia. The areas that they are focusing on include: building technology and material usage. They intend to develop and construct model prototypes around the University. Interestingly, all key researchers interviewed have never heard of INBAR and its on-going bamboo housing initiatives in Ethiopia. INBAR needs to fill-up this gaps by linking itself to the University's relevant Department.

There have also been a few experiments carried out on bamboo within Addis Ababa University, Civil Engineering Department by senior researchers to test bamboo as a structural material. According to the researchers, bamboo is less available in most parts of Ethiopia, especially the North; hence very expensive, thereby making eucalyptus the most preferable choice. Eucalyptus is more common and is used for structural purposes like scaffolding and roof trusses. In addition to eucalyptus scaffolding, metal scaffolds are becoming common and are popular with the Chinese contractors. Some successful research progress in testing of the material properties of Ethiopian bamboo has developed a shell structure in the University and an

auditorium in Awasa. In future, the researchers plan to examine composite/engineered bamboo products like bamboo boards.

The Ethiopia Institute of Agricultural Research has been doing research on: -

1. Bamboo Propagation
2. Bamboo Stand management
3. Bamboo Seed germination and storage

At the Bamboo Biomass Energy Project: Debre Zeit Agricultural Research Center, which was started two years ago; there is a bamboo adaptability trials nursery where low-land bamboo is propagated. There are 11 species under trial, 5 of which have been introduced from Latin America and Kenya. In total, the project has established 10 nurseries in Assosa, 2 in Amhara Region, 3 in Hawassa and 1 in Addis Ababa. There are plans to have the seedlings transferred to the farmers in June 2011. The project activities can be summarised as:-

- i. Carrying out bamboo nursery trials and management
- ii. Training farmers on bamboo propagation and management techniques
- iii. Training local farmers on bamboo charcoal making process
- iv. Promoting nurseries for research work as an arboretums

The project is expected to contribute greatly to the future sustainability of the bamboo industry in Ethiopia.

#### **6.3.11 Professional Associations**

Professional associations like Engineers Association and the United Architects Association don't have much input into government affairs as they are more of social networks. Almost all professionals have no technical training on the use of bamboo in housing construction. For example, the United Architects Association of Ethiopia is not strong because:-

- i. They only have one meeting per year
- ii. They don't discuss vernacular, traditional or alternative architecture/housing
- iii. They always get a presenter from abroad to talk about modern architecture
- iv. They have no design competitions promoting local materials like bamboo

#### **6.3.12 Role of NGOs in Rural Housing**

Some of the leading NGOs active in low-income housing development in Ethiopia are: Habitat for Humanity in Ethiopia (HFHE); GTZ; UNHCR and World Vision Ethiopia.

***Habitat for Humanity Ethiopia:*** began construction in 1993 and has since expanded to build houses in 13 communities. Most houses are in urban and semi-urban areas within a 250-mile radius of the capital city, Addis Ababa. HFHE has



integrated its operations with those of community-based organizations to be more effective in its work. HFHE's houses vary from 22 to 36 square meters in size and are built from a number of different materials, including stabilized earth blocks, hollow concrete blocks and fired bricks. Currently, HFHE builds predominantly "improved chika" houses (ICHs), which are improved versions of traditional housing styles. The ICHs are very popular because they are the most affordable, quick and easy to build and require mainly locally available materials such as wood, soil, sand and stone. All houses have a VIP latrine in a separate block and are built in such a manner that families can add further rooms in the future. HFHE also recently started undertaking Water & Sanitation and Kitchen Improvement projects.

**UNHCR:** The UNHCR's Natural Resource Development and Environmental Protection (NRDEP) programme Sherkole refugee camp (near Assosa town) was established in 1997 and the people used bamboo as the primary construction material; which they bought from the local authority. At the moment, it has about 3,650 refugees which translate to about 1000 families/ houses. The huts or *tukuls* are made of bamboo and mud bricks and houses averagely 4-7 people. The refugees originally came from Kenya, Somalia, Sudan and a few from Ivory Coast. UNHCR provided the materials and the refugees constructed their own shelter. They also have the mandate of maintaining the houses which they occupy. Bamboo is preferred by the UNHCR because it quickly regenerates and minimizes the risk of deforestation. The organization has established a 1.5ha nursery in which they have established 21 tree species of which bamboo takes 5% of the 350,000 seedlings being propagated.

**World Vision Ethiopia:** World Vision Ethiopia started working in the bamboo sector since 2009 and the project is set to end in September/ October 2011 through financial support of the World Vision Australia and the Australian Government. NGO activities include tropical bamboo restoration through communal nurseries and promotion of utilization technologies in furniture making. Some of the issues that World Vision Ethiopia is addressing are:

- i. Sustainable food security program
- ii. Sanitation program: by providing toilet slabs, digging wells, spring development and shallow well draining
- iii. Forest conservation: bamboo nurseries projects, animal diseases control and environmental conservation.
- iv. Establishment and strengthening of newly formed bamboo artisans cooperatives

At Assosa and Hamosha Woredas, the NGO is undertaking the following activities related to bamboo conservation and utilization:-

- Establishment of bamboo, fruits like mangos and other trees nursery sites,

- Seedlings distribution,
- Re-afforestation of degraded areas.
- Training on bamboo propagation, harvesting and general management
- Advocacy and training on forest conservation and utilization: More than 4,000 people have been trained so far in 18 *kebeles*
- Provision of materials for soil terraces construction
- Support government and community nursery sites with nursery tools and training
- Bamboo is integrated with other vegetation in soil and water control
- Training local youths and women in bamboo handicrafts and furniture making
- Support the establishment of bamboo workshop office and furniture making tools
- *Kebele* administration has legal access to the forest resources in a given area
- Create a market linkage for youth and women groups producing bamboo handicrafts.

The key challenges mentioned were:-

- Lack of responsibility by community members and government in ownership of the project when the NGOs leave after giving their support.
- Lack of sustainability of the project due to undeveloped bamboo market chain for new products
- Duplication of activities by various NGOs with very little impact to the community livelihoods

## CHAPTER SEVEN: BAMBOO POLICY ENVIRONMENT

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### 7.1 Forest Development, Conservation and Utilization Proclamation

The Forest Development, Conservation and Utilization Proclamation No. 542/2007 of Ethiopia, does not have explicit statements on bamboo. However, among other species, bamboo is listed as species considered as tree in the proclamation. The major causes that have led to the neglect, under-utilization and destruction of the Ethiopian bamboo forests are: insecurity of land tenure right and lack of economic incentive to value them as useful commodities. All natural forests in Ethiopia belong to the state and the government lacks economic incentive and financial capacity to protect and manage them properly.

The limited government attention is focused on natural forests from where timber could be profitably harvested for industrial use. Further, the document states that Bamboo forests are not even in the priority list of natural forests selected by the government for management and development. The lethargy of rural people towards bamboo forest development and management is again related to lack of incentive to obtain financial benefits from their sale.

Legal situation concerning bamboo use by the local population is somehow confused and suitable to some arbitrary interpretation. The lack of forest demarcation and management plans as well as the limited control possibilities by the local forest administrations convert bamboo in most cases to a no man's resource. In addition to this, bamboo is not considered as an important resource by the local foresters and commercial bamboo extraction and marketing is not regulated clearly, with the exception of the more or less arbitrary fixing of royalty rates.

The Ethiopian regional governments have recognized the deteriorating situation and devised policies to encourage sustainable management of bamboo as a renewable resource. One of the options of increasing bamboo resource is through its domestication on farms. Farmers however need more information to assist them to grow and manage lowland bamboo in particular because it is not a traditional agricultural crop in as the case for highland bamboo.

Various initiatives by non-governmental organizations in Ethiopia are showing the potentials of bamboo. The government has also recently started to support bamboo conservation initiatives. However, a thorough and thought-out strategy that provide incentives to protect and use the remaining natural bamboo forests on a sustainable basis, and to establish bamboo plantations wherever they could have a protection and production function, is urgently required. The Ethiopian government needs to establish an effective institution to oversee these developments. It is crucial that the remaining natural bamboo forests have a rightful owner who could properly protect, manage and use them in perpetuity and enhance their value. Further, part of the remnant bamboo forests should be preserved for future generation without

interference; this will enable future studies on the natural course of development in the absence of human-induced disturbances.

Since 1997, there is a forest management policy that allows accessibility to the local people living around the forests. In the Oromia region for example, the people are allowed to access and collect NTFPs, honey, grass and in some cases, eucalyptus although they don't have the freedom to cut the bigger trees. In Ethiopia, the lowland bamboo is very accessible, but highland bamboo is harder to source. Some farmers grow highland bamboo in their farms around the villages as a mitigation factor to this inaccessibility. Bamboo in government forests like the Bale Mountains is not managed thus anyone can cut it. This mismanagement is a threat to bamboo because bamboo has to be regularly cut and this should be done in an organized way for good growth.

## **7.2 Government Housing Policy**

The current government housing policy direction is mainly focused on the implementation of Integrated Housing Development Program that is facilitated by federal government and applied by regional states and city administrations. The whole policy is based on using approached and alternative low-cost building materials to make the houses affordable to low and medium income populations.

There is no existing written government policy on application of bamboo in the housing sector. Hence, bamboo has been ignored completely by policy makers as a possible alternative and affordable housing material. Bamboo has not been utilized in the upcoming condominium blocks throughout the country. However, at Assosa town there are two blocks with 41 units under construction and bamboo has been utilized in scaffolding together with eucalyptus. There is limited use of bamboo in modern constructions because there is no technology to improve the raw bamboo.

## **7.3 Case study of regional government policy on bamboo utilization developments**

During field surveys and as a case study on policy developments, the study observed that the Benishangul-Gumuz Regional State Administrative Council had drafted an Executive Order to be signed by the Regional President to create the Benishangul-Gumuz Bamboo Industry Development Council (BGBIDC) whose role will be: *to promote the bamboo industry development projects and directing the restoration of the bamboo natural stands through massive plantation and the use of bamboo for at least seventy five (75%) percent of the desk and other furniture requirements of public elementary and secondary schools and prioritizing the use of bamboo in furniture, fixtures and other construction requirements of government facilities and allocating funds for the bamboo sector.*

The regional government has committed itself to:-

- Protect and conserve the regional patrimony and advance the rights of the people to live in a safe environment;
- Promote agricultural-based industrialization development and through industries that make full and efficient use of human and natural resources which are competitive in both domestic and national/international markets;
- Prioritize the collection of bamboo seeds to save the resources and to start new bamboo plantations in order to improve the environment especially in marginalized and idle lands;
- To transform bamboo as a cash crop for farmers who engage in its cultivation thereby alleviating poverty and generate more jobs and self-employment opportunities
- To aggressively promote the product development and market access of bamboo products to sustain the development of the bamboo industry;

The proposed membership and roles of the members of the Benishangul-Gumuz Bamboo Industry Development Council (BGBIDC) are:-

- a. Regional Director of the Bureau of Trade
- b. Regional Director of the Bureau of Industry
- c. Regional Director of the Bureau of Education
- d. Regional Director of the Bureau of Agriculture and Rural Development
- e. Center of Rural Technology
- f. Chair of the Executive Committee
- g. League of the Woredas
- h. Representative of the Chamber of Commerce and Industries
- i. Two(2) Representatives from Non Government Organizations
- j. One representative from the Furniture Makers/Bamboo Enterprises

**Functions of the Executive Committee** –The Executive Committee shall direct the preparation of the Benishangul-Gumuz Bamboo Industry Development Program Plan 2011-2015 and shall identify, prioritize and recommend initial strategic interventions, research directions and critical data needs while the Development Plan is being drawn up.

**Secretariat-** The Executive Committee shall be assisted by a Bamboo Technical Working Group which shall serve as the Secretariat headed by a Director and composed of representatives designated by the BGBIDC. The Secretariat shall identify the gaps in the bamboo industry supply-value chain and determine the most appropriate activities to address those gaps.

**Bureau of Agricultural and Rural Development-**The Bureau of Agricultural and Rural Development will procure bamboo seeds from the farmers, conserve them and use bamboo as the planting material for at least twenty percent (20%) of its



annual reforestation and rehabilitation areas especially in *woredas* and *kebeles* which are engaged in or have the potential to engage in bamboo-based industries or where trees are difficult to grow because of poor site quality, susceptibility to erosion or adverse and steep gradients. It shall continuously generate bamboo production technology which shall be transferred and disseminated to farmers.

**Bureau of Education-**The Bureau of Education (BoED) shall procure the equivalent of at least seventy five (75%) of the annual school desks and arm chairs requirement of all public elementary and secondary schools region wide.

**Bureau of Trade-** The Bureau of Trade shall promote bamboo products through trade fairs and exhibitions. It shall conduct trainings on bamboo marketing. It shall link producers with designers, contractors and users of bamboo products.

**Bureau of Industry-**The Bureau of Industry shall promote bamboo micro-enterprises and industries. It shall conduct trainings in bamboo production and entrepreneurship.

**Center of Rural Technology-** The Center of Rural Technology shall undertake the research and transfer of technologies which can reduce production costs and increase the sale ability of bamboo products, alternative adhesives and finishes, and effective yet affordable treatment and preservation techniques.

**League of Woredas-**The League of Woredas shall promote bamboo development by requiring their constituents to plant 5 bamboo seedlings in each household.

**Non Government Organizations, Bamboo Enterprises, Furniture Makers and Business representatives** - Non Government Organizations (NGOs) and representatives from the private sectors shall lead in advocating the planting and utilization of bamboo region wide and in providing market information, research and market development and similar undertakings.

In conclusion, most regional states with bamboo resources are at transitional stages of developing policies on bamboo conservation and its utilization in the construction sector. Neither even the Federal Government has a policy of the same despite its high rate of utilization and exploitation by increasing rural populations for housing and general construction needs.

## CHAPTER EIGHT: CONCLUSIONS AND RECOMMENDATIONS

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The use of bamboo resources in the country is sub-optimal due to two factors that have resulted to this: (a). The supply of raw bamboo is rapidly diminishing both in terms of quality and quantity, and (b). Bamboo-based operations are confined to primary processing often using simple tools such as sickles and axes for own domestic consumption and at best, to rudimentary manufacturing of products for the limited local market. Systematic and organised harvesting based on a management plan could improve dramatically the growing stock and bolster perpetual yield increment by reducing mortality and creating space for new recruits to emerge and grow. It is likely that bamboo forests of Ethiopia could only be conserved and developed if valued as useful crops. Thus, integrated management of their production and utilisation systems is recommended for their suitable conservation and development, as part of a strategy to remedy the deforestation-related problems of Ethiopia.

INBAR should work with the local builders; not to change their Architecture but to help in its improvement. For example, in the *Sidama* house; the local people should be offered other forms of treatment that is less detrimental to their health in replacement of the traditional smoking method. A good example of some of the modifications was the bamboo lodge (Aregash lodge). The structure had openings and one of the roofs was made to enhance cross ventilation. Each of the *tukuls* (huts) was also built on a stone/concrete plinth. INBAR should endeavour to replicate such technologies to major cities because bamboo lodges are in high demand in Ethiopia and internationally. They also proved to be the most viable economically followed by investments targeting “low income” population. Investments targeting “very low income” populations will not pay back even after 40 years.

It is recommended that the Federal Government should introduce bamboo into the Ethiopian housing market so as to compete with conventional building materials. Without this competition, then bamboo will always be seen as a traditional and inferior material. It can promoted for flooring, ceiling, walling and partitioning in low-cost housing schemes. INBAR should assist in building capacity by developing a local bamboo building code and policy. The policy should be able to promote conservation efforts and utilization.

INBAR should establish regional bamboo utilization centers in areas with a lot of bamboo resources (e.g. in Sidama and Assosa areas) that can train and carry out bamboo products production. Currently the government owns such a center in Addis Ababa; but this has no capacity to train all Ethiopians interested in bamboo utilization and production. Furthermore, it does not carry out training on bamboo construction but rather trains on furniture and handcraft making only.

INBAR, working in partnership with the government should consider establishing medium scale cottage industries that will be making bamboo products such as mats that can then be supplied to regional centers where the mechanized processes like gluing; pressing and lamination can be carried out to cut down transportation costs. Architects and engineers involved in the construction industry should be trained on bamboo use in housing and the construction sector in general. The Architecture Department at Addis Ababa University needs capacity building and research linkages with INBAR. Gaps in knowledge should be investigated. For example, research has shown that bamboo is not prone to termite attack, but in some areas especially in Assosa, termites were mentioned as being among the insects that attack their bamboo.

Since bamboo is intensively used in rural areas close to bamboo forests, it is important for INBAR and the Ethiopian Government to cooperate, improve, strengthen and enhance technological knowhow of local communities in propagation, harvesting and other household uses. This will be done by developing and institutionalizing a national bamboo conservation and development program. INBAR should take a leading role in rural nucleus village settlements being established in various parts of the country, especially in the Assosa area where bamboo is the predominant material in use.

The rural people use it because they don't have money for better housing, but once they get some good money, they change to concrete and stone housing. Local people are developing to better housing and with improved affordability, they embrace modern architecture. Traditional bamboo housing technology is fast disappearing due to modernization. However, literature indicates that only processed or engineered bamboo like floor boards/ tiles is viable in the current economy; but a setback to this is the cost of the materials which is too high for the ordinary people to afford, thus it remains a reserve of the rich in the society. Bamboo as an export material is perfect, but has no place in modern day Ethiopia unless used for recreational purposes and low-income housing.

In brief, since in Ethiopia 80% of the total households live in a substandard houses and the existence of undeveloped construction industry, the government needs to strengthen the existing IHDP that plays a vital role in large cities for job creation, introducing the new construction technology and cost effective building materials like Agrostone, bamboo so as to increase the housing stock. The cumulated housing problems can only be solved with the implementation of a diversified approach supported by the formulation of policies and strategies that can involve different actors in the housing sector. Among different approaches the development and

introduction of bamboo as an alternative building material and simple housing construction technology which can reduce the cost of construction. Bamboo will also remain as an important resource in construction of recreational high standard facilities.

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## APPENDICES

### Appendix 1: List of Interviewees

| SN  | Name &              | title   | Organization  | Contacts   |
|-----|---------------------|---|---|--|
| 1.  | Dr. Yilma Seleshi   | Head of Civil Engineering Department                        | Addis Ababa University                                    | <a href="mailto:yilma.seleshi@aait.edu.et">yilma.seleshi@aait.edu.et</a><br>mob: 0911 22 24 40   |
| 2.  | Seare Kebedom       | Bamboo Architect  | -   | <a href="mailto:searekebedom@yahoo.com">searekebedom@yahoo.com</a><br>Mob: 0911 41 99 30   |
| 3.  | Karsten Scleiser    | Structural Engineer   | EiABC- Addis Ababa University                             | <a href="mailto:sclaiser@cimonline.de">sclaiser@cimonline.de</a><br><a href="mailto:karsten.schlesier@eiabc.edu.et">karsten.schlesier@eiabc.edu.et</a><br><br>+251 (0) 911 576 196 |
| 4.  | Wondimu Kassa       | Chair Holder of Structural Design                           | EiABC- Addis Ababa University                             | <a href="mailto:Wondimu.kassa@eiabc.edu.et">Wondimu.kassa@eiabc.edu.et</a><br>+ 251 (0)911 172 032   |
| 5.  | Dr. Wubalem Tadesse | Director, Forestry Research Process                         | Ethiopian Institute of Agricultural Research              | <a href="mailto:wubalemtw@yahoo.com">wubalemtw@yahoo.com</a><br>+251 91 213 2303<br>+251 11 645 4452<br>+251 11 419 1126   |
| 6.  | Eng. Bereket Adamu  | Structural Engineer   | -   | <a href="mailto:bereada@yahoo.com">bereada@yahoo.com</a><br>+251 911 757 499   |
| 7.  | Asgedom Haile       | Chair Holder of Building and Construction                   | EiABC- Addis Ababa University                             | <a href="mailto:asgedom.haile@eiabc.edu.et">asgedom.haile@eiabc.edu.et</a><br><a href="mailto:asgihail@yahoo.com">asgihail@yahoo.com</a><br>+251 (0) 911 891 356                   |
| 8.  | Dawit Beksissa      | Sanitary Engineer   | Gulele Sub-city Housing Development Project Branch Office | +251 916 867 738   |
| 9.  | -                   | Bamboo furniture proprier                                   | Brother's Bamboo work                                     | +251 912 962 116   |
| 10. | Alemayehu Ewnetu    | Production & technical manager                              | Adal Industrial PLC                                       | <a href="mailto:5cups@ethionet.et">5cups@ethionet.et</a><br>+251 11 44 50 251/41/40 or<br>443234/41/42<br>+0911 63 57 90   |
| 11. | Darara Dangura      | Traditional bamboo builder                                  | -   | -  |
| 12. | Tesfaye Hunde       | Bamboo Biomass Energy Project; Natioanl project coordinator | INBAR; East Africa Regional Office                        | <a href="mailto:thunder@inbar.int">thunder@inbar.int</a><br>+251 118 500 709<br>+251 911 872 459<br>+251 118 500 708<br>+251 115 549 217   |
| 13. | Entre Boe           | Traditional bamboo house owner                              | -   | Sidama zone  |
| 14. |                     | Bamboo farmer   | -   | Sidama zone  |
| 15. | Melese Mate         | Traditional bamboo house owner                              | -   | Sidama zone  |
| 16. | Beshera Benjo       | Bamboo Mat seller   | -   | Sidama zone  |
| 17. | Abela               | Peasant Farmers   | -   | Sidama zone  |

|     |                    |                                       |   |   |
|-----|--------------------|---------------------------------------|---|---|
|     | Garbicho           | Training Association                  |   |   |
| 18. | Atenaf Agonafer    | Extension Process Owner( Director)    | Regional Agricultural Bureau                            | Benishangul/Gumuz Regional State (BGRS)<br>+251 913 095 987                           |
| 19. | Fekadu Nemera      | Operation Manager                     | Land & Sea Development                                  | <a href="mailto:Fekadu_lsde@yahoo.com">Fekadu_lsde@yahoo.com</a><br>+ 251 911 095 019 |
| 20. | Sherifidin Abdila  | Home owner                            | Amhara settler villages                                 | + 251 910 487 044   |
| 21. | Al- Hesen Defala   | Home owner                            | Amhara settler villages                                 | -   |
| 22. | Jiragna Sayolem    | Housing Development Expert            | BGRS- Assosa Housing Development Project Office         | +251 577 782 918/ +251 917 858 867  |
| 23. | Begaslaw Teshome   | Program Officer                       | World Vision  | <a href="mailto:Begtesh@yahoo.com">Begtesh@yahoo.com</a><br>+251 911 921 370          |
| 24. | Misrak Tassen      | Secretary                             | UNHCR   | +251 577 750 165  |
| 25. | Getachew Titiahun  | Environment Coordinator               | Natural Resource Development & Environmental Protection | +251 576 690 966/ +251 911801 389   |
| 26. | Martha Kidemu      | Environment Protection Facilitator    | World Vision  | <a href="mailto:mkidemu@yahoo.com">mkidemu@yahoo.com</a><br>+251 912 078 915          |
| 27. | Haile Tesema       | Bamboo Seller                         | Assosa Market   | -   |
| 28. | Tesefa Getahu      | Bamboo Furniture Seller               | Assosa Market   | +251 917 226 583  |
| 29. | Abdurehem Lebesher | Member                                | Association of Bamboo Producers & Bamboo Products       | +251 917 422 146  |
| 30. | Abraham Bobo       | Bamboo Projects Coordinator           | Assosa Woreda Agricultural Office                       | +251 911 041 514  |
| 31. | Belete Bantero     | Technical Project Officer             | EABP, MoA & NTAU  | <a href="mailto:bele2080@gmail.com">bele2080@gmail.com</a><br>+251 911 861 695        |
| 32. | Fiker Assefa       | Bamboo trainer                        | FEMSEDA   | +251 911 412 157  |
| 33. | Wondemu Bantiun    | Traditional bamboo furniture proprier | -   | +251 911 665 366  |

|     |                |  |  |   |
|-----|----------------|--|--|---|
| 34. | Atakilt Teka   | Deputy General Manager                                   | Addis Ababa Housing Development Office                           | <a href="mailto:atakiteka@yahoo.com">atakiteka@yahoo.com</a><br>+251 911 777 472  |
| 35. | Melaku Tadesse | Former National Coordinator                              | The East African Bamboo Project                                  | <a href="mailto:melaku.tadesse@ethionet.et">melaku.tadesse@ethionet.et</a>  |
| 36. | Girma Deriba   | Director General   | Federal Micro and Small Enterprises Development Agency (FeMSEDA) | <a href="mailto:girma63@yahoo.com">girma63@yahoo.com</a>  |
| 37. | Yaregal Mesker | Management Staff   | Federal Micro and Small Enterprises Development Agency (FeMSEDA) | <a href="mailto:yaregalmer@yahoo.com">yaregalmer@yahoo.com</a>  |
| 38. | Biruk Kebede   | Bamboo Biomass Energy Project National Project Assistant | International Network for Bamboo and Rattan (INBAR)              | <a href="mailto:birukebede@yahoo.com">birukebede@yahoo.com</a><br>+251 911 430 804<br>+251 118 500 708<br>+251 115 549 217                                    |
| 39. | Salfiso Kitabo | Program Manager Acting Country Representative (Ethiopia) | CHF Partners in rural development                                | <a href="mailto:skitabo@chf-partners.ca">skitabo@chf-partners.ca</a><br><a href="mailto:salfiso@ethionet.et">salfiso@ethionet.et</a><br>(251-11) 372 63 41/42 |
| 40. | Traders        | -  | Ethiopian Tourist Trading Enterprise Addis Ababa                 | -   |

## **Appendix 2: Terms of references: A Study on the Value Chain Development and Sustainability of Bamboo Housing in Ethiopia**

### **I. Background**

The need of sustainable building material is high in Ethiopia. Timbers are scarce and the other building materials such as concrete are relatively expensive and may not be environmental friendly enough. GTZ low cost housing project reported that 85% of the urban population of Ethiopia lives in inhuman, unhygienic and confined conditions. The population growth of 2.8% per year and accelerated migration to urban centers (6% per year) has increased the demand for affordable and decent houses. This indicates a greater potential of alternative building material. Ethiopia has a great amount of bamboo covering about 1 million-hectare throughout the country. It shows the greater potential for construction as well. If such a rich resource could be used for an alternative building material, it would greatly alleviate the building material problem. Therefore, knowledge and experiences with bamboo building may be highly useful and relevant in Ethiopia in the present context.

Bamboo is a native forest resource of the country. It has over 600,000 hectares of native lowland bamboo (*Oxytenanthera abyssinica*) and over 300, 000 hectares of highland bamboo (*Arundinaria alpina* K. Schumach.), the latter representing 86% of Africa's highland bamboo resources. Because of the shortage of proper woody plants for construction in the lowlands, the lowland bamboo is commonly used as an alternative for timber in house construction, for fences and also as fodder for cattle, as food for people, and as a source of biomass energy.

Realizing the potential of bamboo to solve the building material shortage in the country INBAR is leading activities to develop a bamboo housing industry in Ethiopia and adjacent East African countries. However, questions remain whether bamboo is a sustainable solution in terms of economic, environmental and technical aspects. Moreover, a value chain study needs to be carried out to address the question of how a sustainable supply of bamboo raw materials for processing and an economically viable larger scale bamboo housing industry can be established.

### **II. Description of the Assignment**

#### **Objectives**

The main objective of this assignment is to carry out a study on the sustainability of a bamboo housing sector in Ethiopia and the development of an integrated value chain for sustainable production for bamboo housing.

The specific objectives of the assignment are:



- A) To assess the sustainability of a bamboo housing sector in Ethiopia in terms of socio-economic, environmental and technical aspects;
- B) To assess existing the bamboo value chain in the country and to recommend how a sustainable and integrated value chain can be developed to ensure sustainable and economically viable production of bamboo housing

### **Requested Services**

This assignment consists of two studies which are closely linked and interrelated. This assignment may be carried out by one consultant to do both the sustainability study and the study on the value chain or by two consultant who would work as a team to provide an integrated joint study.

### **Study on Sustainability of bamboo housing in Ethiopia**

The scope of the study will be to investigate the sustainability based on socio - economic, environmental and technological indicators. The investigation will be conducted through field surveys, interviews with villagers, discussions with local housing companies, manufacturers, government agencies and using available literature. The ongoing “Development and Commoditization of the Pre-fabricated Modular Bamboo Housing in Asia and Africa” Project has already done fieldwork and produced a housing feasibility study which contains information on the production and cost structures. This report will be made available to the consultant. The study will give a comprehensive comparative overview of traditional versus alternative bamboo housing schemes. By investigating the strengths and weaknesses of the local adaptation of bamboo housing technology, this study will also suggest means for adapting and improving suitable local technology to further make it ecologically friendly and economically sustainable. Specifically the consultant will:

- Assess the existing housing sector for the low income groups in Ethiopia ;
- Assess the feasibility of bamboo housing in Ethiopia for low income groups in terms of resources availability, technical requirements, social adaptability, health and sanitation, durability, economic factors, market demand and environmental sustainability;
- Assess and evaluate existing housing policy and its applicability for the long term housing solutions in the country as well as its implications for the development of the bamboo housing sector and make recommendations;
- Prepare a SWOT analysis (strength, weakness, opportunity and threat) of bamboo and conventional housing systems in Ethiopia for low income groups;
- Provide recommendations on how to develop the bamboo housing sector so as to be economically viable and to how to establish bamboo as a sustainable building material in Ethiopia and possibly for the region.

## **Study on bamboo housing value chain in Ethiopia**

The consultant will carry out a detailed study on the bamboo value chain in Ethiopia. The main objective of the study is to analyse the current status of the bamboo value chain and to provide sufficient insight into the activities of the chain actors, service providers and supporting institutions in it so that interested stakeholders can provide support to upgrade the sub-sector to a more productive and effective sector with a mature role by the private sector, in particular for the production of housing and construction elements. This study will specifically investigate the local uses of bamboo, value addition at different levels of the market chain, value differences in each step of market, final products and their diversity, how value addition would be different if bamboo is used for housing and how local communities would benefit from bamboo housing based value. The specific questions to be answered are:

Value Chain overview; Actors, Service providers and Facilitating organizations : An indication of the low – cost housing sector value chain, and if available specifically for the bamboo – housing value chain: what is the actual value chain (for example: suppliers, producers, processors and manufacturers, transport, wholesalers / retailers, consumers – taking into account also the role of women and men in the value chain if any), what is the size in each step: in terms of numbers of people / households involved, production volume and value, income and profit for each step; added value in each step. Who are the major service providers and supporting/ facilitating organizations, what are their main activities and what is the extent of their influence in the chain? Is there a private sector developing and promoting a bamboo value chain?

### **Value Chain linkages:**

Is the housing sector value chain interlinked or are there gaps in the value chain or are the links disconnected? If there are constraints, what are these constraints (linked to the value chain: input / resource related, output related, technology related, investment related? etc.) How can the constraints be addressed in order to develop a sustainable (bamboo) housing sector for low income groups.

### **Markets:**

Assessment of where the main market and what its size is for low cost bamboo housing: in Ethiopia and possibly internationally. What are the major market dynamics (including cross boarder flows), trends and growth potential in the sector? What are the comparative and competitive strengths of Ethiopian bamboo sub-sector?

Policy Environment: What policies, regulations govern trade in bamboo? What are the opportunities and constraints of existing policy arrangements to enable a bamboo housing sector? What are key areas of improvement and how they benefit the chain?

### **III. Methodology**

Information will be collected and verified from primary and secondary sources, interactions with stakeholders/informants from private sector, government and non government agencies, bamboo producers and existing projects/programs. The study will take into account the existing studies carried out by INBAR and its partners in the country. The analysis and synthesis of the existing information will be the basic foundation for carrying out the actual field study.

The assignment will start with a briefing by INBAR (by phone conference or in person depending on the location of the consultant. At the start of the field trip, the consultant will also start with a briefing at the regional INBAR office in Addis Ababa.

Both studies should include interviews and consultations at all levels, including with target buyers, suppliers, producers, processors, traders architects, engineers, building experts, governmental and non – governmental agencies and agencies with related activities in Ethiopia .

The consultant is responsible for first submitting a draft report and then to incorporate relevant feedback from INBAR and other stakeholders before finalizing the reports. All findings will be supported with sufficient quantitative data.

The consultant is expected to validate and share the findings of the study with the stakeholders and, incorporate any feedback and finalize the report.

### **IV Location and Duration**

Location: The assignment includes preparation and report writing at the home-base of the consultant and a field visit in Ethiopia. The consultant will visit the potential bamboo growing and utilization area to collect data and information required.

Duration: The total period for the assignment will be two months of working time which may be spread out over a period between mid January 2011 – Mid April 2011. The final report will be submitted no later than 13 May 2011.

The exact duration of will be discussed with the consultant – depending on whether one or two consultant will implement the assignment

Indicative timing is as follows:

- a. Preparation time: 1/ 2 weeks

- b. Field trip: 1 month
- c. Report writing and submission draft report 1 / 2 weeks
- d. Collect feedback and submit final report: 1 week

## **V. Reporting**

**Content of the report:** The content of the report should be detailed and should include executive summary, main report, conclusion and recommendations, references and annexes as needed.

**Language:** The report will be submitted in English.

**Final submission:** The draft report should be submitted no later than 15 April 2011. INBAR and other related stakeholders will then provide final comments – if any- within 3 weeks and the consultant will submit the final report incorporating those comments no later than 13 May 2011.

**Number of copies:** The consultant should provide two copies of the final report. The report should also be submitted by e-mail as a word file with all the data and images.

**Appendix 3: Economic Analysis Tables For Bamboo Housing Investment Scenarios**