FACTORS INFLUENCING SMALLHOLDER FARMERS' PARTICIPATION IN TIMBER PRODUCTION AND MARKETING, IN BURUNDI: THE CASE OF MURUTA COMMUNE OF KAYANZA PROVINCE.

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MAY, 2016

DECLARATION

This dissertation is my original work and has not been presented for a degree in any other University or any award.

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DEDICATION

To you Jean Bosco NDUWARUGIRA, friend and husband, my coach; I dedicate this work fruit of your patience and encouragement. I am proud and lucky to share your life.

To my family especially my parents Thomas and Elizabeth MAYUGI who started the way of school for me, I dedicate this work; thank you for your blessings. To my brothers Janvier MAYUGI, Patrick MAYUGI, David MAYUGI, Lionel Musa MAYUGI, Benjamin Heri MAYUGI, Adolphe MAYUGI and my sister Safina MAYUGI; you are my best friends, I am blessed to have you and to be part of your life, you will always be my lovely family.

I also dedicate this work to the new generation of MAYUGI's family including Evelyne, Kevine, Riccardo, Mathis, Kelyan, Eliza, Bénédicte and others to come...

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ABSTRACT

Timber production is an important component creating jobs and wealth of countries' prosperity because of its resource and labor intensity. In Burundi timber and its derivatives provide 95.4% of the total energy needs of the country. For various reasons, forest products exploitation such as timber are not well known because of the lack of knowledge and awareness; regulations governing the management of forest resources have always been inconsistent and inadequate, available forest inventories are very old (1976).The study objectives were ; (1)to map out the timber chain in Kayanza from producers to all the steps it goes through until it reaches the final consumer; (2) to determined factors that motivate timber production by smallholders farmers;(3) to determine factors that influence farmers to participate in timber production and marketing and (4) to compared the role of men and women in the production and the marketing of timber. The study was conducted

in Muruta commune of Kayanza province. A sample of 131 producers randomly selected in Muruta commune and 72 stakeholders of Kayanza and Bujumbura provinces was interviewed. The study relied on primary data collected in the three zones of Muruta commune including Muruta, Nkonge and Rwegura. The results revealed that About 85.5% of the households interviewed were involved in timber production; 91.3% of traders were men; the most processed type of tree species was *Eucalyptus saligna* , and *Grevillea robusta* and over 57% of timber products were transported from Kayanza to Bujumbura town. Descriptive analysis revealed that firewood, timber, charcoal, erosion control and fruits consumption was the main factors motivating timber production by farmers. Probit regression results revealed that age, education level, household size, formal rules, public employment, radio acquisition and furthest market ;were the factors influencing farmers to make their decision to participate in timber production and marketing. Finding revealed also that decision making for tree planting was only done by 10.7% of women as compared to 87.8% done by men. To minimize subsistence productions, a sensitization on timber should increase households income and therefore the country economy. Producers should be aware on other source of energy especially the use of gas like in other countries including Kenya. An implementation of a timber value chain regulated by the government should be done as it is for other agricultures products including sugar, cotton, tea and coffee in Burundi.

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ACRONYMS

ACIAR   **:** Australian Center for International Agricultural Research

ANOVA   **:** Analysis of Variance

ATO   **:** African Timber Organisation

BRB   **:** Banque de la République du Burundi

CSLP   **:** Cadre Stratégique de Croissance économique et de Lutte contre la Pauvreté

DRC   **:** Democratic Republic of Congo

FAO   **:** Food and Agriculture Organization

FBU   **:** Francs Burundais

FPTPs   **:** Further Processed Timber Products

GDP   **:** Gross Domestic Product

GNP   **:** Gross National Product

ICRAF   **:** International Center of Research in Agroforestry

IITO   **:** International Tropical Timber Organisation

ISABU   **:** Institut des Sciences Agronomiques du Burundi

MINEEATU **:** Ministère de l'Eau, de l'Environnement, de l'Aménagement du Territoire et de l'Urbanisme

NFTP   **:** Non-Timber Forest Products

NGO   **:** Non Gouvernement Organisation

OBR   **:** Office Burundaise des Recettes

PANA   **:** Plan d'Action National d'Adaptation aux changements climatiques

PAN-LCD   **:** Plan d'Action National pour la Lutte contre la Désertification

RPL   **:** Random Parameters Logit

SNPA-DB   **:** Stratégie Nationale et Plan d'Action pour la Conservation de la Diversité Ecologique

SPSS   **:** Statistical Package for Social Sciences

US$ **:** United Stated Dollars

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CHAPTER I

INTRODUCTION

1.1 Background

Timber harvested from forests and plantations are vital to our way of life, providing a renewable, adaptable resource with a wide variety of uses. Timber production is an important component of regional economies across the world, creating jobs and wealth that is a cornerstone of countries' prosperity. Forest plantations provide commercial returns while potentially improving the health of catchments, diversifying farm income or providing another productive use for agricultural land (Smith, 2014).

Timber industrialization is a major forest-sector development priority identified by the countries of West and Central Africa (Wongolo & Meka, 2004). Because of its resource and labor intensity, the wood furniture sector presents an opportunity for developing countries and their firms to participate effectively in the global economy (Kaplinsky *et al.*, 2003b).

Further processing of timber is today considered to be a tool for socioeconomic development and sustainable tropical forest management. Sustainable forest management implies sustainable utilization of forest resources to the benefit of countries communities and states. This concept has a huge potential for creating employment, income and wealth for the populations and their counties (Wongolo & Meka, 2004).

Timber is the most valuable commercial commodity taken from most forests, and its removal strongly influences the character of those forests. It is removed to convert land to other uses, in regular harvests activities of managed forests (Prestemon & Robert, 2002). According to Howard (2003), economic activity in most of the major timber products markets increased in 2002. New housing construction, which accounts for more than a third of the United States consumption of softwood lumber

and structural panels and for substantial consumption of other softwood and hardwood products, strengthened considerably in 2001 and continued to be strong in 2002 (Howard, 2003).

A survey of further timber processing in International Tropical Timber Organization (ITTO) done by Atyi and Simula (2002) in collaboration with the International Trade Center, showed that exports of further-processed timber products totaled US$3.5 billion in 1998, of which the African share was only 1%. Clearly, African countries are missing out on development opportunities offered by their forest resources as reported.

African Timber Organization (ATO) member countries represent approximately 86% of Central and West Africa's forests and 15% of the world's tropical forests. Their size varies greatly: the forest cover of the Democratic Republic of Congo (DRC) alone is equal to that of all other ATO member countries put together. Although African forests contain a wide diversity of species, logging and timber processing focus on only a limited number of marketed species (Wongolo & Meka, 2004). Lesser-known species are increasingly used domestically in countries where high-value species are rare. Although countries aim to increase the export of these species, there is no consistent strategy for their development. Their further processing tends to be the result of the disappearance of more popular species (Wongolo & Meka, 2004). An analysis of world trade in further-processed timber shows that in 2000 the value of exports for all ITTO producer countries combined was about US$5 billion, 83% of which originated in countries in the Asia-Pacific region, 16% in Latin America, and only 1% in Africa. The trade in furniture, flooring, doors and windows is also dominated by Asia-Pacific countries. Ghana and Côte d'Ivoire make almost 80% of the contribution of African countries to the further-processed-timber trade, (Wongolo & Meka, 2004).

For West African and Central African countries, the domestic market structure for further processed timber products (FPTPs) is very informal and does not provide a sound basis for production that complies with international requirements and standards. The main traditional market for tropical timber products is Europe, even though other outlets have been discovered in Asia in the last few years. Europe remains the only viable market for FPTPs from African countries. Italy, France and the United Kingdom absorb the greater part of the limited volume of FPTPs produced in Africa (Atyi and Simula (2002). Local markets are characterized by low purchasing power, despite rapidly growing populations in large cities. Intra-African markets are developing, including export markets to Maghreb countries (Egypt, Algeria, Libya), Nigeria, Chad and South Africa (Wongolo & Meka, 2004).

In East African countries, the trade in tropical timber in Africa's Great Lakes region is largely one sided, from the eastern DRC to and through East Africa. An estimated 80% of timber leaving this corner of the DRC either ends up in Uganda or transits through Uganda to the rest of East Africa and beyond (Chevallier & du Preez, 2012). The informal timber trade from the eastern DRC is approximately double the size of the formally reported trade from the whole of the DRC. Within the region, those who control the trade (some of which have political or military connections) benefit more than other actors in the chain. These factors make the regional trade challenging to regulate (Chevallier & du Preez, 2012).

Burundi is a small country located in the center of Africa with a land area of 27,834km², and with a population of 8 million. More than 90 percent of the country's labor force is engaged in agricultural activities. Farm income, mainly coming from agriculture and animal husbandry, accounts for more than 75 percent of the GDP (Gaspas, 2012). Therefore, agriculture has occupied a pivotal position; whose production system is mainly for subsistence based on a multitude of small scale farms small with an average of less than 4 acres per household (Gaspas, 2012).

The forestry sector contributes up to 2% of GDP and 6% to job creation. In 1995, timber imports represented less than 0.1% of total import values which was nearly 90 million FBU (Bararwandika, 1999). The same author observed that Burundian government's efforts were thwarted by the socio-political crisis in October 1993. In terms of the environment and forest resources in particular, the country crisis has deeply affected forest ecosystems whose balance was already precarious. However, the forest sector retains an important place in the national economy. Timber and its derivatives provide 95.4% of the total energy needs of the country, which is 1,578,078 tons of energy equivalents. Oil products and electricity provide only 4.2% of the availability energy requirements of the country.

According to MINEEATU and FAO (2012) report, the main challenges in forestry sector for Burundian economy are deforestation and degradation of forests, natural grasslands and soils whose environmental services are critical for the sustainability of agricultural sector. Drivers for deforestation and degradation of natural resources include unsustainable farming practices without the use of organic and inorganic fertilizers and without the adoption of natural resource management measures which result in the extraction of wood fuel to meet the energy demand for the population as fuel wood and charcoal. As a result of the loss of the resilience of the ecosystems, the Burundian farmers are confronted with droughts, heavy rains and other climate influences. Therefore, the Burundian government has adopted a series of policies and measures, such as:

- PANA, the national action plan ;
- CSLP, the growth and poverty reduction strategic framework;
- SNPA-DB, the strategy and action plan for national conservation of ecological diversity;
- PAN-LCD, the national action plan for desertification prevention and control and
- SNPRGC, national strategies for risk prevention and disaster management.

The history of Burundi forestry indicates that policy changes operated since colonial times until the eve of the period of great social and political crisis in 1993 which resulted in various changes in government plans. The objectives were centered on the fight against the shortage of timber, forest degradation, land and the environment (MINEEATU & FAO, 2012). FAO in collaboration with the Ministry of Water, Environment, Spatial Planning and Urban Development; have developed a new forest policy. It is motivated by the need to harmonize the national forest policy with other national policy documents (2025 vision, CSLPII) and sub regions. That policy is particularly forest policies of neighboring countries, in order to improve and / or strengthen the joint management of transboundary areas, and, easily control the cross-border flow of forest products. It is also the forest policies of sub regional communities to which Burundi is a party such as the Community of African States and the East of Central African States.

This policy is intended to provide general guidance to inform and guide public authorities to regulate the use of woodlands, manage forest resources and valuation of forestry products.

Therefore, there is an urgent need to determine factors influencing different stakeholders' participation in timber value chain in Burundian context for a good understanding.

1.2 Statement of the problem

Many smallholder farmers do not commercialize their products and are usually reluctant to participate in value chains, despite different pathway to overcome underdevelopment in sub-Sahara African countries. The reasons given by Springer-Heinze (2007), as important limitations when stakeholders make participation decision in a value chain include: b*usiness environment and policy* (small producers regularly face problems of access to input and business service markets because of the size of their operations); *the Access to cross-cutting service markets (*small farmers and micro enterprises are negatively affected by the conditions of access to

formal financial markets requiring securities and guarantees); and, the *productive assets and property rights (* low education and health problems put the farmer at a disadvantage in labor markets). Springer-Heinze (2007), argue that while income and poverty are the focus of market-oriented development, other poverty aspects are also highly relevant.

In Burundi, forest resources are rich, varied and composed of natural forests, and artificial forest trees (Bararwandika, 1999; Gaspas, 2012). Unfortunately, for various reasons, this resource is not well known; it is poorly managed and heavily degraded. Otherwise, available forest inventories are very old (1976). The regulations governing the management of forest resources have always been inconsistent and inadequate. During the crisis of October 1993 and thereafter, the general population of Burundi have not understood the value of forest products exploitation, and in particular, the lack of knowledge and awareness of forestry resources such as timber. On the other hand, there has been a growing population pressure which led to more cutting down of wood for energy. Thus, the forests are more prone to fire disasters and vegetation is severely destroyed by land reclamation and wars. This situation led to lack of opportunity and people have had low interest to engage in timber value chain business (Bararwandika, 1999 and Gaspas, 2012). Gaspas (2012) observed that crops (banana, semen plan taginis, root tuber plants, beans, grains, vegetables and fruits and oil crops) are the backbone of Burundi's agricultural economy, with their planting area covering 1.21 million hectares, 90% of the total arable land, and contributing to 46% of the total GNP. Bararwandika (1999) recommends a financial support of Burundi's forest sector for the update of the forest inventory and the capacity building of public and private personnel involved in this sector.

1.3 Study objectives

The overall objective of this study was to determine the key opportunities and constraints, as well as understanding factors which enhance smallholder farmers' to

participate in production and marketing of timber in Kayanza provinces of Burundi. The specific objectives were:

1) To map out the value chain of timber in Kayanza province;
2) To determine factors motivating timber production by smallholder farmers;
3) To determine factors influencing farmers' participation in timber production and marketing;
4) To compare the role of men and women in farmers' participation of timber production and marketing.

1.4 Research Hypotheses

1) Timber value chain does not exist in Kayanza province;
2) Smallholders farmers motivations to produce tree is not influenced by socio-economic factors;
3) Socio-demographic factors (age, gender, marital status, income, education level, occupation) do not influence farmers' decisions to participate in timber production and marketing;
4) There is no difference in the participation of men and women in the production and the marketing of timber.

1.5 Justification of the study

FAO (2010) reported that on the state of the world's forests, natural forests of Burundi cover about 103,000 hectares, or 3.70% of the country. Artificial forests cover an area of 69,000 hectares or 2.47% of the national territory, making a total coverage of 6.17%. In environmental terms, the Burundian forest plays a very important role especially in the regulation of water and hydrology, as well as in mitigating carbon emissions. Burundi has a rugged terrain and therefore forest formation allows better protection of soil against erosion.

Burundian forest are subject to degradation due to the high population pressure and to natural environments whose immediate consequences are progressive and

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sometimes irreversible loss of Biodiversity (MINEEATU & FAO, 2012). At the socioeconomic level, forests contribute in meeting the needs of people, timber can satisfy 97% energy needs of the country (Astère, 1999). It contributes 2% to the GDP and 6% of employment (BRB, 1998). Besides energy and ecotourism, forests provide timber for various uses (wood energy, service wood, lumber) and other non-timber products (for meat, leather, various fruits, honey, mushrooms, wax, fodder for livestock and drugs).

However, the exact knowledge of the forestry sector's contribution to socio-economic development and the reduction of poverty require a well-planned study. Indeed, the real contribution of the forest sector to GDP is not recorded in a satisfactory way due to lack of reliable data on forestry production, marketing and self-consumption. An assessment study on timber production and marketing is required to provide the basic data necessary for the planning and management of the timber sector. The latest national forest inventory is dated 1976. Data from this inventory are no longer appropriate especially after the country's political crisis and wars that has lasted more than ten years. The current study will shed light on the state of factors affecting timber production and marketing in Burundi, particularly in Kayanza commune.

1.6 Limitations of the study

The sample unit randomly selected were households in 10 villages of Muruta Commune, including Mikuba, Mpfunda, Muruta, Mutana, Nkonge, Nyakibari, Remera Ruvumu, Rwegura Yanza; in the Mugamba region. Due to the lack of information of Kayanza's population proportion which is involved in timber production and marketing, and given the volatile political situation in Burundi during data collection period; only 131 households were interviewed in addition to 72 stakeholders including traders, processors and transporters.

This study required a huge amount of data collection and management (treatment, analysis ,paper submission and results presentations) and human resources; which was a constraint due to the lack of sufficient budget.

No studies on the production and marketing of timber have been done in Burundi and none have been reported to the best of my knowledge to date. This explains the lack of updated documentation and relevant information relating timber sector by some interviewed key informants

CHAPTER II

LITERATURE REVIEW

2.0 Introduction

This section provides definitions of the key concepts and terms used in the study. It will review studies done previously about factors influencing farmers making decision in agricultural product value chain and presents a review of the most relevant academic literature.

2.1 Overview of value chain

The *value chain* describes the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use (Kaplinsky & Morris, 2001). Considered in its general form, it takes the shape as

described in Figure 2.1.
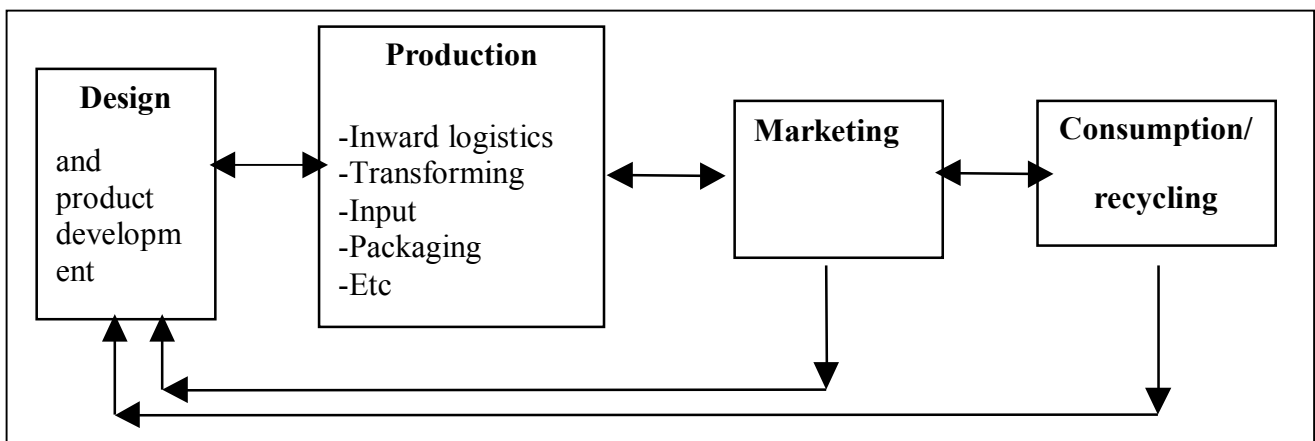
Figure 2.1: Four links in a value chain

Source : (Kaplinsky & Morris, 2001)

In the figure above, production is only one of a number of value added links. For timber in particular, the value chains are much more complex than this. For one timber only, there tend to be many more links in the chain which involves the provision of seed inputs, chemicals, equipment and water. Cut logs pass to the sawmill sector which gets its primary inputs from the machinery sector. From there, sawn timber moves to the furniture manufacturers who, in turn, obtain inputs from the machinery, adhesives and paint industries and also draw on design and branding skills from the service sector. Depending on which market is served, the furniture then passes through various intermediary stages until it reaches the consumer.

Kaplinsky *et al.* (2003a), relates how the experience of South Africa, has been used to generate a series of generic policy challenges, which might be transferred to different sectors of other countries. According to the same authors, the wood furniture sector presents an opportunity for developing countries and their firms to participate effectively in the global economy because of its resource and labor intensity.

Springer-Heinz, (2007) define a value chain as a sequence of related business activities (functions) from the provision of specific inputs for a particular product to primary production, transformation, marketing, and up to the final sale of the particular product to consumers. Therefore; value chain promotion fosters economic growth as a necessary precondition for incomes to rise by making sure that the additional income generated actually benefits the poverty in the country groups. Springer-Heinz, (2007), identified limitations affecting participation of the farmers in commercial market including the business environment and policy; the access to cross-cutting service markets; the productive assets and property rights and the conditions of the location.

2.2 Conceptual framework of value chain

According to Gasana & Sorg, (1997); one definition describes the value chain as a system of interdependence bringing together actors whose production conditions are complementary and whose performances are interacting. Some uses of the concept tend to reduce the scope of this definition. Compared to the consumer market, the value chain is defined as a system consisting of a set of distribution channels, producers and intermediaries involved in a particular market. It can be also set with respect to the use of the same raw material. It defines the product as preferred and depending on the geographical context (local, national, global). Thus, the timber value chain is defined around the wood raw material. Gasana & Sorg (1997), see it as a complex network in which many stakeholders are involved (forest, lumberjack, sawyer, transporter, trader, carpenter, industrial pulp,among others ...) which are governed by laws and institutions.

The sector therefore includes products linking by consumers to suppliers through value chain. The intensity of relations between various actors establishes interdependencies that result from common interests and constraints. The development of a sector can thus be achieved through policies and comprehensive measures to strengthen the coherence of the whole.

2.3 Factors influencing smallholders farmers' participation in forestry value chain

2.3.1 What is timber?

Timber is the most valuable commercial commodity taken from most forests, and its removal strongly influences the character of those forests. Timber is removed to convert land to other uses, and it is removed in regular harvest activities of managed forests. These two processes do not occur randomly on the landscape. Rather, they occur in patterns that are predictable, related to the locations of development, timber processing capacities, and the species in demand for timber products (Prestemon & Robert, 2002). The economic and demographic relationships to the timber sector can

be identified through a description of historical patterns of timber production and technologies. Hence, such a description provides substantial information for predicting the future of African forests (Ryan, 2011).

2.3.2 Overview of farmers participation on a value chain

Participation of rural farmers in any developing agricultural or forestry program may differ among farmers according to their socioeconomic and demographic backgrounds. For instance, some group members might be concerned about the degree of production of trees of their regions and prefer NGO interventions in providing inputs for tree planting and government interventions in putting in place forestry rules and regulations policies for tree cutting. Others may be more concerned about the economic benefits of trees products (Portes, 1971).

Thus, participation in timber production and marketing involves a combination of characteristics of individual farmers, as well as subjective evaluations of groups, that are functions of organizational characteristics. These individual characteristics influence decision-making regarding household behavior, including the decision about whether or not to participate in timber production and marketing (Dolisca et al., 2006). Understanding of factors influencing farmers' participation in timber value chain, at the production and marketing levels has rarely been undertaken in previous research. According to Schipmann, & Qaim (2011), most of the available studies concentrate on farm and farmer characteristics, failing to capture details of institutional arrangements between farmers and traders.

Marshall *et al.* (2003) analysed the factors influencing success of Non-Timber Forest Products (NTFP) commercialization, which has been hindered by the lack of an appropriate analytical approach for comparison of case studies. They tested and further developed a methodology earlier developed by CIFOR, by examining 16

NTFP case studies in two workshops held in Mexico and Bolivia involving a variety of stakeholders involved in NTFP commercialization.

The CIFOR method is based on the identification of variables that describe key attributes of different products, which can be measured with standard criteria and units, thereby permitting comparative analysis (Ruiz Pérez & Byron 1999).

The reviewed case studies indicated that sale of NTFPs were often tends to provide a basic level of income for the poorest section of communities, rather than providing a method of socio-economic advancement. According to Neumann & Hirsch (2000), and Marshall et al., (2003) in some situations, dependency on income from sale of NTFPs may apparently perpetuate poverty rather than alleviate it because the level of cash income received by those involved in NTFP collection is often very low. Peters (1996) concluded that many NTFP resources are harvested destructively, or on an unsustainable basis.

Participants considered production, collection, processing, storage, transport, marketing and sale as the factors influencing the processes involved in NTFP commercialization. Product marketing and sale of NTFP were found to be the most processes constraining overall success.

The study concluded that there were a growing need for information and tools to support the decisions being made by a wide range of stakeholders, including not only the local communities considering launching a commercial enterprise, but also the development agencies, government agencies and NGOs that work with them, and the private sector institutions involved in trading and marketing forest products.

Schipmann & Qaim (2011), studied how smallholder farmers in developing countries can be linked to modern supply chains. They observed how most of the available studies concentrate on farm and farmer characteristics, failing to capture details of institutional arrangements between farmers and traders, and moreover; farmers' preferences have rarely been considered.

Their study addressed research gaps by analyzing trade relations between farmers and buyers in different marketing channels, using the example of sweet pepper in Thailand. They reported that sweet pepper was introduced in Thailand some 10 years ago, mainly for exports and upscale domestic supermarkets.

Using a survey, they collected data and analyzed three main aspects. First time, description of the trade relations of coexisting marketing channels and highlighting differences between traditional and modern supply chains. Secondly, they examine farmers' subjective motivation to participate in particular marketing channels. And third they did a choice experiment to analyze farmers' attitudes towards contracts and different hypothetical contract designs. The data obtained were analyzed using a Random Parameters Logit (RPL) model, also known as mixed Logit (Hole, 2007).

The descriptive comparison of marketing channels and contract features confirms that significant differences exist, which influences farmers 'choices. The results of a choice experiment which was used to analyze farmers' attitudes towards contracts and related details more directly revealed that farmers generally prefer non-contract marketing options.

They found that the most important factor is the relationship between farmers and buyers. The positive utility associated with knowing the buyer personally seemed to outweigh the negative utility associated with entering into a contract in general, which is probably related to issues of trust. They suggested to improve the relationship between farmers and buyers, thus it could contribute to more widespread smallholder participation with contractual arrangements.

A recent social study conducted by Issa & Jean Chrisostome (2015), conceptualized on farmers' participation in order to determine socio-economic factors that affect farmers' decision to participate in cooperatives and intensity of coffee in Huye District of Rwanda. Using primary data collected from Huye district, the authors discussed how cooperatives in developing countries are institutional arrangements,

involved in the organization of often smallholder farmers with the advantages of reducing transaction costs of accessing input, output markets and improve power negotiation of smaller farmers' vis-à-vis large transaction partners. The study reported that factors determining farmers' decision to join the cooperative are more complex in the case of perennial crops like coffee, which they said requires special care from the farm to the cup, than in the case of annual crops.

Using a Probit regression model, they tested the status of decision to participate; and the Tobit regression was used to determine the factors influencing the intensity of coffee. The choice on Probit model was because it allows estimating maximum likelihood of socioeconomic factors influencing farmers' choice to participate in coffee cooperatives. Tobit regression model was chosen for the analysis because it can measure the probability and intensity of coffee land
 (Issa & Chrisostome, 2015). The results showed that gender, education level, farm size, off-farm income, non-access to credits and non-record keeping are all important factors explaining decision to participate. On the other hand, off-farm income, no-access to credit, farm size, experience, farm under other crops cultivation and farm contract agreements were found to influence the intensity of coffee.

The study concluded that both the cooperatives management committee together with the government should organize trainings on gender sensitivity in coffee sectors in order to increase the level of participation of females in the coffee cooperatives. It also suggested the formulation of strategic policy targeting to build stronger farmer's cooperatives. These should allow the farmers to have access to markets, inputs, credit, farm contract, price stability and trainings, to improve coffee productivity in terms of quantity and quality in the study area.

The above literature reviewed highlighted on some of the studies dealing with factors influencing the participation of smallholders farmers into a given value chain. This

study will use some of the methodological approaches reviewed, for example a survey to collect the data and the Probit model for the analysis.

Several authors used Probit model in their studies. Damianos and Giannakopoulos (2002) examined factors influencing the farmers' uptake of agri-environmental measures. The results revealed that socio-economic and farm characteristics including age, education, farm size; training of farmers' and also participation of neighbors or relatives; were found to be factors that can influence participation in the agri-environmental measures and also to be the main factors responsible for the extent of participation of land occupation.

Issa and Chrysostome (2015) used Probit Model to test factors influencing farmers' decision to participate in cooperative of coffee in Huye District of Rwanda. The results showed that gender, education level, farm size, off-farm income, non-access to credits and non-record keeping are all important factors explaining decision to participate.

Asante *et al.* (2011) used the Probit model to assess the factors influencing the decisions to join farmer based organizations in Ghana. The results revealed that farm size, farming as a major occupation, access to credit to loan and access to machinery services influenced farmers' decisions to join farmer based organizations in the Eastern Region of Ghana.

Beyene (2008) analyses the determinants of off-farm work participation decisions of farm households in Ethiopia. He applied Probit model to account for the simultaneity of participation decisions of both male and female members of farm households. The results of the analysis showed that human capital variables such as health, training on non-farm activities, the availability of credit and transfer income; have a positive effect on the off-farm participation decisions of male members of farm households. The education status of the head of the household had no significant impact on the participation decisions of the members of the family as most of the off-farm activities did not require formal education.

CHAPTER III

METHODOLOGY

3.1 Description of the study area

Figure 3.1 : Administrative division of Kayanza province

Source: Monographie 2005

The study was conducted in Muruta commune of Kayanza province in Burundi. Muruta is located at the North of the province of Kayanza. It has an estimated area of 147.08 km², 11.92% of the province (1233.24 km²) and 0.52% of the country (27,834

km^2) surface. Muruta spans two natural regions namely Mugamba and Buyenzi. The first covers almost 60% of the commune and is characterized by an altitude of 1,900 and 2500 m above sea level; a relatively temperate climate with temperatures ranging between 14 and 15 ° C; a mountain terrain with slopes up to 50°; average annual rainfall between 1300 and 2000 mm and abundant vegetation. Buyenzi covers 40% of the commune and is characterized by an average altitude of between 1,500 and 1,900 m above sea level, a humid tropical climate with an average annual rainfall ranging 1200 and 1500mm. The average temperature is between 17 ° C and 20° C. The largest temperature differences occur in the dry season.

In 2005, Murutas' population was estimated at 51,239 inhabitants in an area of 147.08 km². Agriculture is the main activity and the agricultural crops are grouped into food crops, industrial,vegetable and fruit. There are 7 natural afforestation following scattered on the commune: Rwegura (50 ha), Nkonge (400 ha), Mpfunda (100 ha), Remera (630 ha), Nyakibari (400) Gishubi (470) Ruvumu (650 ha) and Muruta (500 ha). Firewood and charcoal are the main energy sources available because of the lack of electricity. There is no proper transport within the commune, only the public road transport is the most practiced. (Monography, 2006) in 2005.

3.2 Research design

This study aimed to determine factors influencing smallholders' participation in timber value chain, especially in Kayanza province of Burundi. A household survey was conducted as well as key informants interview on timber data collection. To determine the factors influencing different stakeholders participation in the timber value chain ,the household survey was helpful to bring out existing conditions which affect farmers' decision making to be involved in a new practice or either a new technology in particular a timber value chain. The survey used qualitative and quantitative methods for data collection and analysis.

According to Tremblay (1957), key informants are used primarily as a source of information on a variety of topics, such as kinship and family organization, economic system, political structure, and religious beliefs and practices. The purpose of interviews is to provide a relatively complete description of the social and cultural patterns of their group. The technique is preeminently suited to the gathering of the kinds of qualitative and descriptive data.

Although the emphasis is on qualitative aspects, it is also possible to get a great deal of valuable concrete quantitative data. For instance, by interviewing a saw-mill operator, one is likely to get a large amount of specific data such as the number of thousand feet of lumber sawn in a day, the number of workers required to maintain a certain rate of woodcutting and the predicted production of a piece of woodland (Mark-Adelard, 1957).

For the study interest, the use of a key informants technique meant that the purpose was not to search for informants who might add to the total understanding of timber, but for informants who might be expected to have specialized information on timber such as processors, traders, transporters, public staff of forestry department of the environment ministry and of other people involved in timber sector.

3.2.1 Sampling framework

The ACIAR project under which this study was done, carried out two major natural regions zones defined through the overlay of potential natural vegetation (PNV) zones and farming systems. This included most of Rwanda and two thirds of Burundi. In Burundi, Muruta commune was selected because of its two natural regions, Mugamba and Buyenzi of Kayanza province which are similar to Bugesera zone in Rwanda.

Using stratified sampling, three administrative zones of Muruta commune were sampled by ACIAR regional project including Nkonge, Rwegura and Muruta and 10 collines of the communes was selected by the study according to the availability of tree producers and processors within them. The target population was all the private

and public people involved in timber sector of Kayanza, especially of Muruta commune. The study population was the Muruta's smallholders and group of farmers engaged in production, trade, processing and the transportation of timber to different municipalities or provinces including Muruta. Random sampling was used to identify timber producers, traders, sawyers, and transporters; and thereafter systematic sampling were used to select the sample size.

3.2.2 Sample size

The ACIAR project estimated that 30, 000 farm households should be reached by the project outputs within the life of the project, across the four countries.7500 farm households should be reached in Burundi country within 2 Provinces (Muyinga and Kayanza). A number of 3750 households should be reached in Kayanza province especially in Muruta commune. That number was distributed among 25 hills of Muruta commune and 150 households should be sampled from each. The simplified following formula proposed by Israel (2013), was used to calculate the sample size from the target population of the study in the 10 collines of Muruta and due to budget limitations and the volatile political situation in Burundi during data collection, a sample size of 203 including 131 households and 72 stakeholders was collected.

$$n = \frac{N}{1 + N(e)^2}$$

Where

n: sample size,

N: size of farmers engaged in timber management ,

e: is the level of precision at 95% confidence interval equal to 5%.

3.2.3 Data collection procedure

The current study is based on data collected from 10 constituent villages of Muruta commune including Mikuba, Muruta, Rwagura, Nkonge, Remera, Ruvumu, Yanza, Mutana, Mpfunda, Nyakibari; in Muruta commune of Kayanza province in Burundi . A total of 131 households were interviewed.

A questionnaire was developed in English and had been used to collect data. It captured quantitative and qualitative data, both open and closed-ended questions were used (Appendix 1). A training of the enumerators on the questionnaire was done at ISABU in BURUNDI using French. The survey interviews were done using Kirundi. A pilot test was done to assess the reliability of the questions and their understanding to both the respondents, and the enumerators.

The data collected from producers included respondent identification and demographic characteristics of household members, household membership in group, household timber production and harvesting, factors influencing farmers' participation in timber production and marketing, farmer's perception, knowledge and constraints of tree management.

A checklist was used to assess the timber market information from traders, processors and transporters. Their opportunities and weaknesses were also highlighted using open questions.

3.2.4 Data management

A review session was conducted after each day of data collection for consistent understanding of the questions along the interview. Each questionnaire was examined to ensure it was consistently filled. Data processing was done by coding the responses gathered during the interview and that was not given in the codified questionnaire. Data entry was made with the SPSS Version 16 software prepared in advance; data treatment continued with software R Studio, SPSS Version 20. STATA software version 11 has was applied in analysis using Probit model.

3.3 Data analysis

In order to assess the respondent knowledge about timber species, to map timber value chain and to asses potential market; descriptive statistics was used to bring out the awareness of the population about timber in Muruta commune. For determining the role of men and wemen in farmers' participation, for a better understanding of the institutions and policy which influence timber production and marketing, open-ended questions was asked to the respondents and descriptive statistic was used to analyse their answers.

Probit model was used to determine factors that influence farmers participation in the timber value chain at the stage of production and marketing.

For the purpose of this study, 'participation' is defined as an active process by which stakeholders among the value chain influence the direction and execution of a development or natural resource management project with a view of enhancing their well-being in terms of income, personal growth, self-reliance or other values (Little, 1993).

For measuring stakeholders' participation in a timber production and marketing, quantitative approach was used to understand respondents' degree of participation in that sector.

Probit model was used to determine socio-economic, demographic and farm characteristics factors influencing farmers' choice to participate in the timber production and marketing. Probit model was chosen because it allows estimating maximum likelihood of the factors influencing farmers' choice to participate in the timber production. According to (Nkurunziza, 2015) the Probit model is suitable to analyse the decision to participate in a given activity.

3.3.1 Theoretical Framework of Probit Model

According to Spermann (2008), Probit model is a type of regression where the dependent variable can only take two values, for example married or not married. The name is from ***probability*** + ***unit***. The purpose of the model is to estimate the

probability that an observation with particular characteristics will fall into a specific one of the categories; moreover, if estimated probabilities greater than 1/2 are treated as classifying an observation into a predicted category, the Probit model is a type of binary classification model.

A Probit model is a popular specification for an ordinal or a binary response model. As such it treats the same set of problems as does logistic regression using similar techniques. The Probit model, which employs a Probit link function, is most often estimated using the standard maximum likelihood procedure, such an estimation being called a Probit regression.

Probit models were introduced by Chester Bliss in 1934. A fast method for computing maximum likelihood estimates for them was proposed by Ronald Fisher as an appendix to Bliss' work in 1935.

Suppose response variable Y is *binary*, that is it can have only two possible outcomes which we will denote as 1 and 0. For example Y may represent presence/absence of a certain condition, success/failure of some device, answer yes/no on a survey, etc. We also have a vector of regressors X, which are assumed to influence the outcome Y. Specifically, we assume that the model takes the form

$$\Pr(Y = 1 \mid X) = \Phi(X'\beta),$$

Where Pr denotes probability, and Φ is the Cumulative Distribution Function (CDF) of the standard normal distribution. The parameters β are typically estimated by maximum likelihood. It is possible to motivate the Probit model as a latent variable model. Suppose there exists an auxiliary random variable $Y^* = X'\beta + \varepsilon$, where $\varepsilon \sim N(0, 1)$.

Then Y can be viewed as an indicator for whether this latent variable is positive:

$$Y = \begin{cases} 1 & \text{if } Y^* > 0 \ \text{ i.e. } -\varepsilon < X'\beta, \\ 0 & \text{otherwise.} \end{cases}$$

3.3.2 Model Specification

The Probit model can be specified as follow:

P (planting tree or not) = *ß0 + ß1 (household's socio-demographic factors) + ß2(farm's socio-economic factors) + ß3(farm's characteristics) + μi*

Where:

- P (planting tree or not) is the probability of planting tree or not by the interviewed farmers
- $ß_o$ is the intercept;
- $ß_{in}$ (1, 2, 3,,......,n) is the vector of parameters and
- Household's socio-demographic factors, farm socio-economic factors , and farm's characteristics are independents variables,
- μi is the error term. Table 3.1 shows the relationship of variables.

3.3.3 Meaning of the variables used in the model

<u>**Dependent variable**</u>: Decision to plant agro-forestry trees

<u>**Independent variable:**</u>

 a)Household's Socio-Demographics Factors

- Age
- Gender
- Marital status
- Education level
- Occupation
- Household size

b) Farm's Socio-Economics Factors

- Communication assets (radio, mobile phone, television)
- Public employment
- Group activities
- Trained on timber
- Distance to the furthest market

- Involvement in timber sector

c) <u>Farm's Characteristics</u>

- Landowner surface of the household

- Formal rules and regulations

- Informal rules and regulations

Table 3.1 below shows the various variables used in the model their definition and how they are expected to influence the dependent variable.

Table3.1: Relationship of variables

Objective3: -Probit model variables

Variables	Definition	Expected sign
Dependent variable: Planting tree	1=Yes 0=No	
Independent variables		
Age	Years of living	±
Gender	1=male, 0=female	+
Occupation	Occupation of household 1=Farming 2=Casual labour 3=Employed 4=Family business 5=NGO's staff 6=Student 7=none 98= other (specify)	+
Education	Household education 1=None 2= Primary 3=Secondary 4=Middle-level college 5=University 6= No schooling	+
Household's size	Total number of household members	+
Communication Assets :Radio	Household owns a radio 1=yes 0=no	+
Membership in group	Member of a group (0=yes, 1=no)	+
Extension	If received services from extension on timber(1=yes,0=no)	+
Employment	Works in public sector (1=yes,0=no)	
Income Timber	Involved in timber sector for income(1=yes,0=no)	+
Land ownership	Amount of land owned (ha)	
Distance to the market	Distance to the furthest market	−
Formal rules	Formal rules governing the production/ marketing of timber (1=yes,0=no)	−

CHAPTER IV

RESULTS AND DISCUSSION

4.1 Socio-demographic characteristics of households of Muruta commune

The majority of farmers were male (85%) and the rest were female(Table 4.1). They had an average age of 43years.The youngest person had 20years, and the oldest had 82years. Furthermore, majority were in monogamous marriage. Table 4.1 shows some demographic characteristics' of the interviewed households.

About 69% of the respondent attained up to primary school education; 9% secondary school; 2% university, the remaining did not go to school but acquired informal education. The average number of years spent in school is 5years. Figure 4.1 shows the distribution of various forms and levels of education and Figure 4.2 shows the main occupation of respondents.

89% of respondents were the household heads and the rest were relatives. The average household size was 6 people and ranged from a minimum of 2 to a maximum of 17 people. However, the average number of women per household was slightly higher about 3.1 than their male counter parts who were 2.9.

Table 4.1: Demographic characteristics of respondents

Demographic charactéristics		Zone			Total	%
		Rwegura	Muruta	Nkonge		
Gender	Male	20	40	52	112	85.5
	Female	8	7	4	19	14.5
Marital status	Monogamous	23	43	52	118	90.1
	Polygamous	2	1	1	4	3.1
	Single	0	0	2	2	.8
	Separated	0	1	0	1	1.5
	Widow/er	3	2	1	6	4.6
Education level	none	4	2	5	11	8.4
	Primary	20	31	39	90	68.7
	Secondary	3	5	4	12	9.2
	Middle-level (collège)	0	1	3	4	3
	University	0	1	1	2	1.5
	No schooling	1	7	4	12	9.2
Main occupation	Farming	25	45	51	121	92.4
	Public employed	3	1	3	7	5.2
	Student	0	0	1	1	0.8
	Builder	0	1	0	1	0.8
	Artist	0	0	1	1	0.8
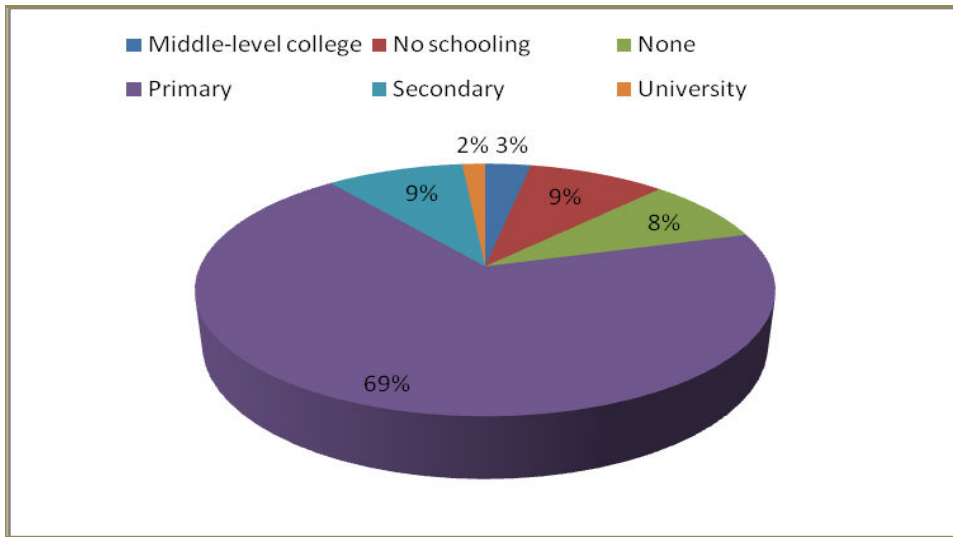
Figure 4.1: Distribution of Producers' education levels in Muruta Commune

The main occupation of residents is farming (92.4%) and over 5% are formally employed.
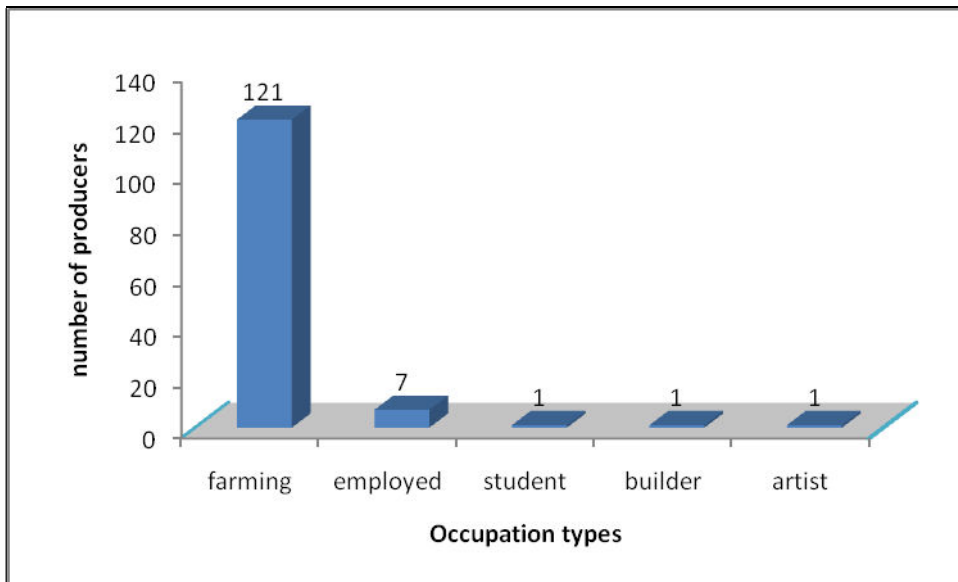
Figure 4.2: Main occupation of farmers in Muruta commune

About communication , 77.1% of respondents own at least one radio, 55.7% own mobile phones and a small number (3%) has a television. For the staff transport, they use bicycles and motorcycles; a very few number uses a car truck.

For domestic assets, in their daily uses, 91.6% of households had furniture, wooden stove, granaries ,water tanks, buckets and basins, grain millers, a mortar, a water tank but only 1.5% own kerosene stove and only 6.1% them do not had hoes; the leading household have about 12 hoes and 4 machetes. 7.6% households had wheelbarrow, 2.3% water pumps, saws to a maximum of 3, a shovel, spades, axe, sprayers and watering cans.

Concerning the off-farm income for the Murutas' households, Only 11.5% residents had formal employment in the public sector with a mean income of 513400 Fbu/year (approximately 2567$). On the other hand, the private sector employs only 9.9% of the persons, who earns a mean income of 169077 Fbu a year (845.385$). Otherwise, 21.4% prefers doing a formal business in which it earns averagely 813035 Fbu per year (4065$). A small percentage of them is engaged in artisans (6.1%) ,land rent, and others receive money from family members or relatives.

There is also another way of off-farm income including casual income like agriculture farm labor dependents with an average income of 198840 Fbu per year (994.2$); bricks and construction labor depended with around 467733 Fbu per year (2339$),timber labor (cutting, sawing ,planting, management...)   earns about 456000Fbu per year (2280$) ,charcoal burning 101667f per year(508$); petty trading 181375 Fbu per year (907$).

 Concerning household membership to a group, majority of households interviewed are not in any group (54.2%), but the most common group types are farmers groups and self-help/credit group. The main activities of a group are marketing of agricultural produce. (54.2%), of group members joined in the last two years in 2014. The main benefits of being in a group are labor sharing and access to bank or

cooperative credit. 22,1% of them are just ordinary group members. Appendix 2: shows the households' food crops grown for income.

4.2 Mapping out the value chain of timber in Kayanza

To map the timber production and marketing in Kayanza, several (72) actors along the chain including trees producers , traders, processors who are sawers and transporters of trees, were interviewed. Their activities, challenges and opportunities were reported.

4.2.1 Tree Producers

About 85.5% of the households interviewed are involved in timber production. The rest is involved in carpentry, marketing of timber, sawn and petty trade. Income is the main reason of farmers being involved in the timber sector. For others it's an investment activity , a new discovery , a source of energy, furniture, construction, and charcoal. 35% of farmers have been involved in timber production for 5 to 10 years, the next group (27%) have been doing timber business for over 20years, and 13% recently joined from 3to5 years timber sector. Timber is most importantly used for construction of residential houses, for construction of frames ,for energy, for investment and for bridge building along the road.

Eucalyptus saligna is the main tree species produced and harvested by majority of farmers It is followed by *Grevillea robusta* and *Cedrella odorata*. According to respondent, *Eucalyptus saligna* is famous because it grows fast and for firewood, timber, frame, art confection , farm tool include bean stakes and erosion control. *Grevillea robusta* tree also grows fast and increases productivity, used for erosion control hence profitable for many field purposes.

A supplementary survey done by (Franzel *et al.*, 1995) on farmers' preferences for trees grown on their own farms confirmed this findings. Eucalyptus spp. and G. robusta were the most common upper story species found on farms and they were

highly rated by farmers; *Eucalyptus* spp. for fast growth and firewood. G. *robusta* for fast growth and compatibility with crops.

 The average land area for timber production is 15.43 ha for the interviewed timber producers, with a maximum of 15ha and a minimum of 0.5ha. The average number of trees under production is 11342 trees, with a maximum of 30000 and a minimum of 25 trees. The average number of trees harvested in the last six months is 1072 trees, with a maximum of 2000 and a minimum of 27. The average number of trees planted is 2314, with a minimum of 15 trees and a maximum of 13600. Figure 4.3 shows the type of labor that farmers use in production and cutting of timber.
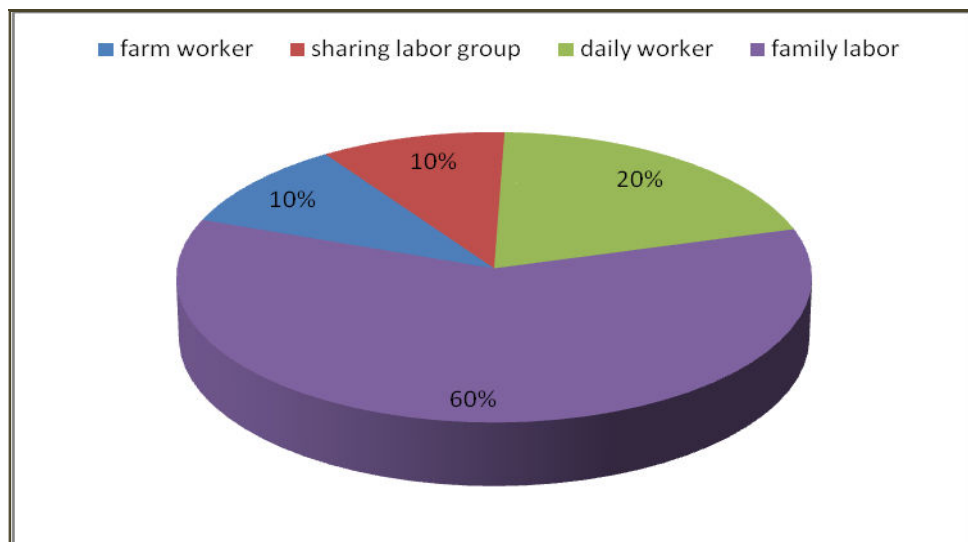
Figure 4.3: Labor type used in tree production in Muruta commune

In his report, Nkurunziza (1999) did not find data on the timber production. However, he found that forest cover in 1987 ranged from 165,000 ha to 200,000 ha over the whole of the country surface. From 1992 to 1997, it rose from 206,000 to 174,000 ha. He reported that there is no relationship between area and timber production, as the natural formations were assumed not to produce wood because they are protected.

According to MINEEATU and FAO (2012), agriculture occupies the bulk of the available land. Vacant lands are marginal for agriculture. Such lands are suitable only for certain tree species and often, their productivity is very low.

Concerning the marketing of timber, after harvest , 50.4% producers do wholesaling of trees directly to final consumers, 16.8% do both retailers and wholesalers at the same time, 24.4% sell to both retailers and wholesalers. The marketing role is played by mainly male members of the household and females or either both male and female.

18.3% of farmers have sold trees in the past 10 to20 years and in the last 3to5years; 12.2% were involved in the tree selling for over 20years. A significant number of 32.8% were not involved in tree marketing in the past years because trees (*Eucalyptus*) were still under production and according to them, *Grevillea* robusta was attacked by diseases. Majority of trees sold (66.4%) were from own source. Farmers sell them to appropriate buyer and sellers ,to the government administration and local carpenters. A huge amount of trees (29%), were sold around Muruta commune, 14.5% within Kayanza province; 16% were taken to Bujumbura town. Trees are averagely grown for 7years before they are sold, with the least being 1year and the highest 9years. On average farmers who sell trees that they do not produce, have to stay up to 25 months before they get trees to sell.

According to producers of tree, access to extension is low at 20.6%. Majority (77%) never contacted by extension officers. The raison reported is the lack of trainers, lack of meeting concerning timber production and others were not aware of extension services. Only 23% of producers have heard about a training on timber in their area but only 16.8% of them have received training in the past 5 years which mainly focused on production. The training was mainly offered by the government; agronomist; extensionists offices and NGOs.

Producers claimed that the main constraints of timber production is lack of quality seeds and nursery plants , lack of timber market and high taxes; small land sizes , government standards and restrictive regulations.

For the improvement of the timber sector in the area of study, 41.2% of producers wish to multiply the tree plants which are disease-resistant and compatible with other crops; the setting of tree propagation nurseries; training on farming techniques and management of tree; access to bank or either cooperative credit to finance the tree works.

For their regular activity regarding tree production and marketing, producers request the government of Burundi to conduct a capacity building of the population on the cutting of mature trees; to promote farmer groups involved in the tree production, and create awareness about planting and the importance of trees.

About the rules running the timber sector in Kayanza province, respondents claimed there were formal rules that govern the timber sector that includes government restrictions and the cutting tree permit while they planted without any permit.
Cutting permits are in place to try to limit the pressure on the resource by monitoring the forestry administration. The value of the timber license has long been calculated based on the surfaces to exploit (FBU 27 000 / ha) regardless of the volumes (Astère, 2014). Since 1998, the value of the timber license depends on the volume of timber to be cut.
 Figure 4.4 shows the value of timber licenses under the categories of timber for all species (Pinus, Eucalyptus, Callitris etc.)
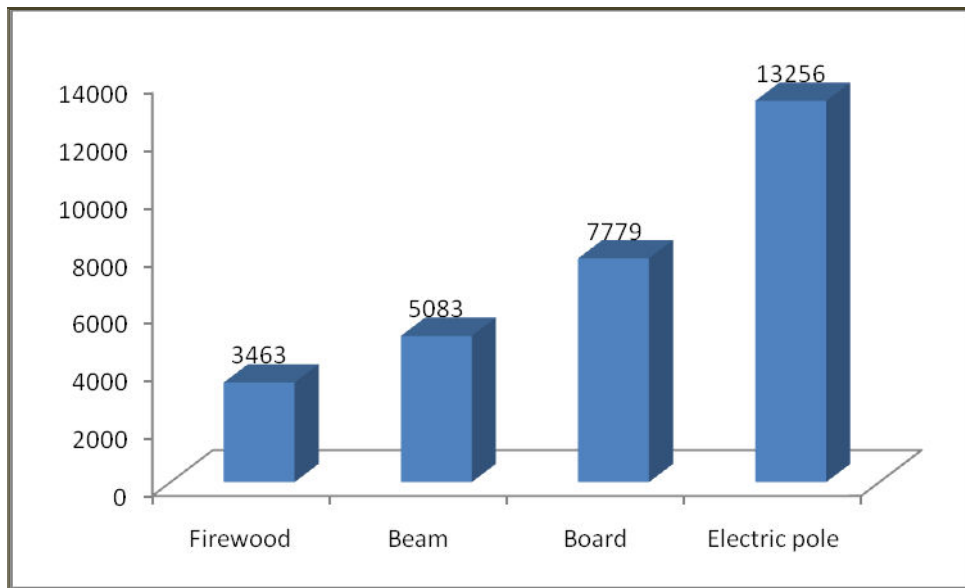
Figure 4.4: Timber cutting permit **Source** : Astère (2014)

About 22.1% of producers have no idea of the formal rules. The rules are mainly implemented by the government. Those who break the set rules are mainly punished by paying a fine or replanting a given number of trees.There are also informal rules, according to 6.1% of respondents but 97.7% did not know that they exist. Moreover, 2% did not know who implements informal rules other than tradition and culture. There was also any known punishment for breaking these rules to majority of respondents, only 2% claim for excommunication.

Despite the lack of inventory data on the actual available forest potential , MINEEATU and FAO (2012) mentioned the timber shortage being a reality in Burundi. Thus, to address and mitigate forest degradation, there must be an increase of woodlands. Actually, with the current population density and the dependence of the Burundian population on agriculture, forestry surfaces available are very limited. Extension will mainly rely on agroforestry, practice outside forests trees and rehabilitation of degraded lands. They actors suggested a strategic plan including promoting quality production of timber including identification and dissemination of

appropriate species, the development and implementation of standards appropriate for timber of various purposes.

4.2.2 Traders characteristics

Traders, processors and transporters are a group of 72 stakeholders interviewed using a guide developed for this purpose. The interview was done in Muruta commune and from Kayanza toward Bujumbura Markets.

The average age of available traders interviewed was 40 years. Men dominate timber trade at 91.3%. Majority of traders have only attained primary education (52.2%) and 43.5% an informal education, the least 4.3%, have secondary education, none of the traders had tertiary education. Majority of traders sell directly to local consumers of timber and their business type are retailers (82.6%), wholesaler (8.7%), the rest are collectors and importers/exporters.

Figure 4.5 shows the year traders started to be involved in timber trading since 1995 with many having joined recently, in 2010. This could be attributed to political stability that saw timber trade surge in regard to the increasing of built houses and governments buildings across the country.
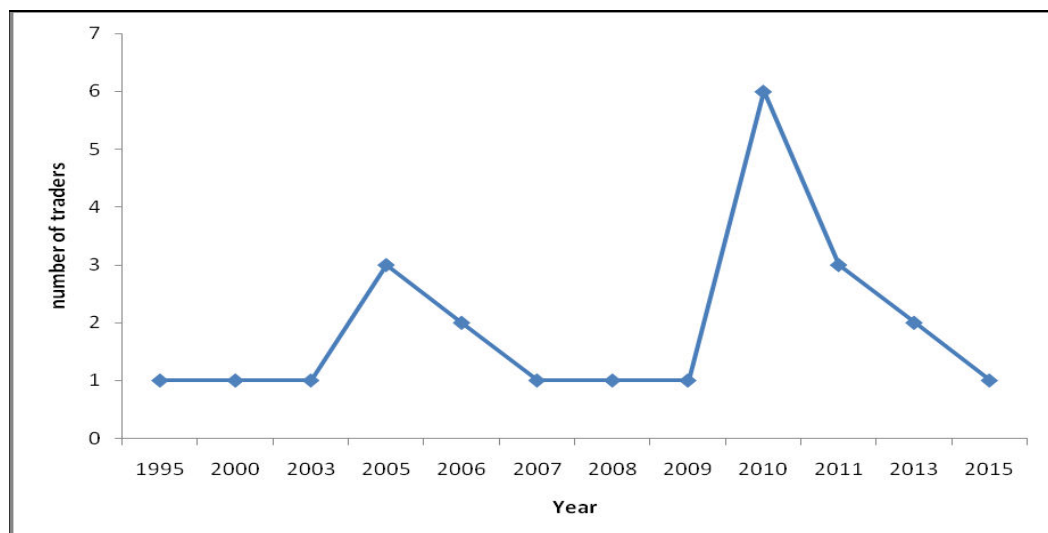
Figure 4.5: Traders year of starting to trade in timber in Kayanza and Bujumbura

The founders of tree businesses are mainly by individuals themselves (88%) for as compared to farmers group (Figure 4.6). 91.3% trade trees each day around the year unlike 8.7% who trade once a week. Lack of timber is the main reason for the latter group. There was no public company or NGO that sold trees.
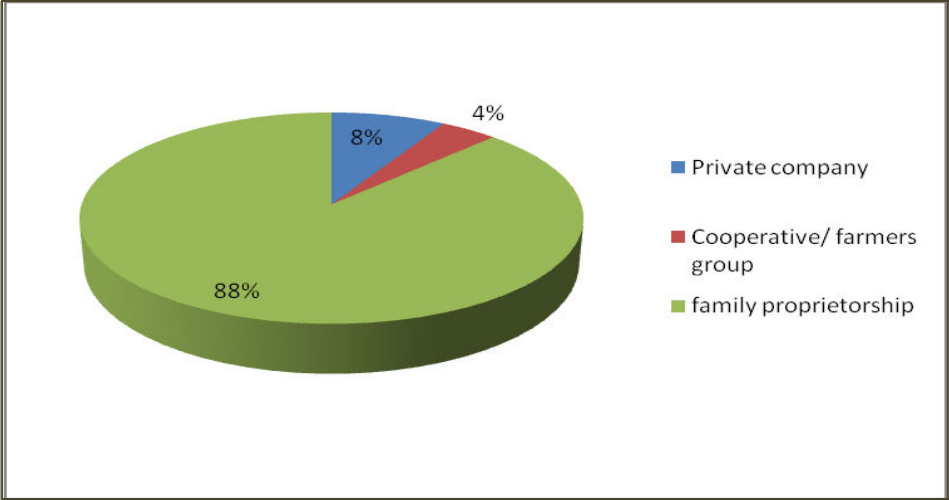
Figure 4.6:Form of Trade of tree ownership

The financial sources for starting the tree business was though self-sponsorship, friends or family members and Cooperative/farmers group. Only one trader sold timber from own production, using daily and family labor in production. For those who buy timber to sell, the highest amount was 360000 timbers with an average of 26,607 in the past two years. These were sold as beam and boards at the highest price of 4000Fbu (2$) and the least of 1500Fbu(0.75$). Hired labor, daily worker and family labor were the most used kind of labor. For the timber sold, a minimum of 500 units of boards and a maximum of 360000 were sold.

Builders and other traders are the most important buyers of timber products from traders (who also by from producers).Traders take advantage of high prices of timber in some seasons specially the rain season, others do not claim to lack customers at

that time and find their current sources of timber to be very much reliable because the type they use is available. *Eucalyptus* are highly preferred by customers because other good type of tree are scarce because of disease attack. However, traders are not satisfied by the current timber quantities available for sell, because they lack bank credit with insufficient capital, deficiency of timber for sale at certain times of the year and poor market supply chain. Nevertheless, traders find the quality of timber they sell to be adequate.

69.6% of traders source of information was found to be the cell phone, they get the information daily, they rank it as reliable and useful and the rest 21.7 % have no information source. Private individuals are the main owners of information and the information was mainly about price and potential buyers of timber. About 91.3% suffer timber business losses on weekly or monthly basic. Traders believe they have no way out of the losses because of lack of alternative choices. Losses were due to lack of storage area and theft. Traders also incur transportation losses on daily basis that could be overcome by having own transport means.

On a scale of 0 to 10 with 0 not important and 10 very important, 50% of the traders ranked wood borers, poor storage area, lack of new timber types, poor infrastructure and low quality of timber as the most important constraints, followed by lack of access to bank credits, lack of capital, lack of timber supply market access and pricing information.

There was no known government regulations and price controls on timber trade. Nevertheless traders wish for the government to help create groups and platform of all stakeholders involved in timber business, and to reduce taxes because they pay per unit for sale. They indicated need for government to encourage planting of more tree in Muruta commune . Traders find the taxes charged by the government to be the most unfavorable to their business.

In his report, Astère (2014) highlighted that the forest management and business enhancement tools consist of cutting of charges on permits, tax for transport

authorization of forest products, communal and municipal taxes and the tax on forest products for import and export. Tax for authorization to transport forest products represents 5% of the product sales price and varies according to the localities. Table 4.2 below shows the change in tax in Bujumbura between year 1997 and 2012.The communal and municipal taxes vary from one municipality to another: Bujumbura town is 200 per bag FBU 100 FBU per pole or other unit of sawn product.

Table 4.2: Tax for transport of forest products in October 1997 and August 2012

Products	Bujumbura, 1997 (FBU)	Bujumbura, 2012 (FBU)
Board of *Cypress*	60	210
Board of *Eucalyptus*	100	200
Board of *Grevillea* and others	60	120
Pinus		210
Beam of *Cypress*	75	210
Beam of *Eucalyptus*	125	200
Beam of *Grevillea* and others	60	150
Pinus		210
Pole	15	100
Charcoal	125	900
Firewood	125	960
Poteau		720

Source : Data from Astère (2014)

4.2.3 Processors characteristics

The oldest sawer has been involved in timber business for 34 years and the youngest for 5years, while the majority have been processing trees for 10years. The most processed type of tree species is *Eucalyptus saligna* with 57.1%, and *Grevillea robusta* by 35.7%. Most of their source is through buying timber unlike own production . In the last two years, the average quantity of timber processed was 1410, with a maximum of 4800 and the minimum 70. Craft material is mainly used to process and the use of rudimentary materials still relevant in Muruta commune. The kind of labour used in processing was casual and sharing labor, and sometimes,

salaried labor. All processors incur processing occupational cost; commonly mentioned were very tiring work , frequent accidents and lack of medical cover for injuries and / or loss of life; rudimentary equipment of sawmill and lastly loading and unloading difficulties. In its "Pôlitique forestière Nationale du Burundi", MINEEATU and FAO (2012), also noted that in the timber processing sector in Burundi, techniques and tools used are traditional and some are less efficient. The use of these techniques results in a loss of 69% of the volume of timber in the form of sawmill waste and 53% of the volume of timber carbonization in the form of ash and water vapor.

The main difficulties faced in labor use were the lack of qualified hand work and lack of financial means to purchase own sawmill equipment. They also incur marketing costs and face difficulties in finding customers in rain seasons due to the climbing of prices. Processors have a challenge for lack of appropriate place to store timber after it has been sawn, causing deformation of timber leading to rots because and lack of information on market price. Causes of high prices in acquiring timber are lack of tree market and sudden interruption of work at certain times of the year. The main wishes for   processors are acquisition of electric and appropriate equipment that are less physical tiring, working under the guise of employment contract and medical insurance, promote the creation of sawers groups, plant many trees to avoid interruption of work due to lack of tree and fix the price of timber at the market.

4.2.4 Transporters

Over 57% of timber products are transported from Kayanza to Bujumbura town;14% remains in Kayanza province, 14% goes to other provinces. The distance covered by transporters is a maximum of 100km, making the mean distance covered to be 24km. The means of transport includes hired vehicles and motor bicycles. The maximum distance to the nearest road was 18 Km with an average of 2km. The average time taken to the main road was 30minutes and a maximum of 2hours. The main constraints faced by timber transporters were poor roads sometimes causing fatal

accidents; tiring physical work that causes incurable diseases; old vehicles without insurance or any roads documents and police harassment on the road. The main wishes by transporters were creation of groups for timber carriers, reduction of taxes by government (OBR= Burundi Revenue Authority) and improving access to bank credit to finance and develop their business. Figure 4.7 shows the map of timber value chain in Kayanza province.
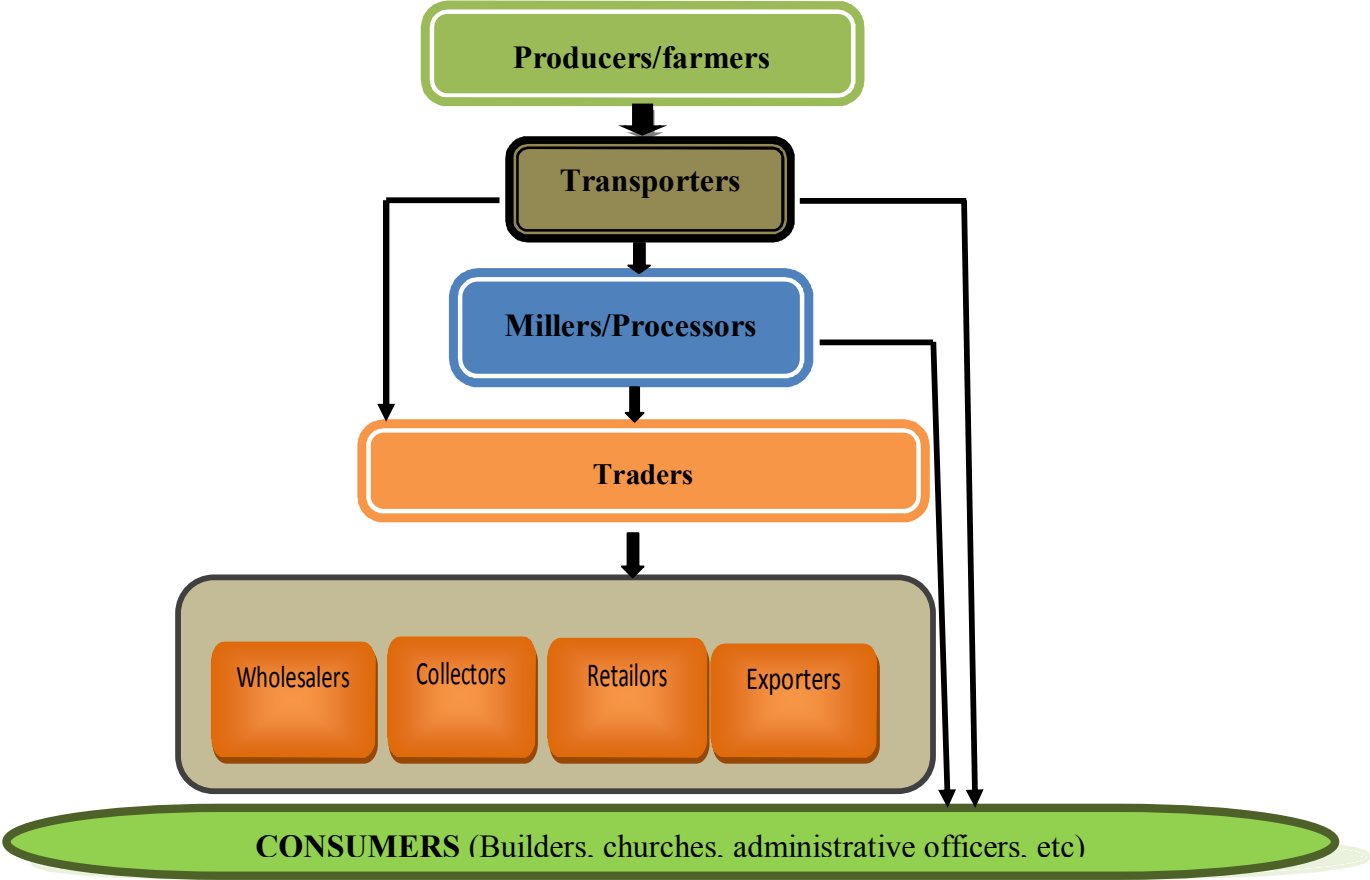
Figure 4.7: Value chain flow diagram for timber in Muruta commune, Burundi.

4.3 Determination of factors motivating timber production by smallholders farmers

Smallholder farmers are motivated to produce tree because of its multiple uses (Table 4.3). Majority (83%)of farmers use trees for firewood, timber and charcoal which may be destructive to the sustainability of land conservation. This is in agreement with Astère (2014) who noted that timber is used for multiple purposes including carpentry, construction, brick and tile confection, and in the drying of the leaf of the tea and tobacco plants. Timber provides the energy needs of the country for more than 95% when imports of timber account for only 0.10% of total imports. Findings revealed that residents of Muruta uses trees to control soil erosion and for fruit consumption. Despite this, soil fertility and medicinal use of trees is too little at less than 5%.

Table 4.3: Different tree uses in Muruta Commune

Tree use	Number of users(n)	Percentage(n/N=131)
Firewood	109	83%
Timber	97	74%
Charcoal	76	58%
Erosion control	56	43%
Fruit	54	41%
Farm tools/furniture/domestic construction materials making wood	49	37%
Bean stakes	48	37%
Windbreak	19	15%
Live-fence	15	11%
Soil fertility	12	9%
Pole	7	5%
Houses and bridges construction	3	2%
Shade	2	2%
Medicine	1	1%

The results imply that trees are mainly used for destructive purposes and may diminish over time. This was observed by MINEEATU and FAO (2012), that timber is not wisely used in Burundi because different users of timber are not professional. They do not know the mechanical characteristics of timber, they use it badly incmuding significant volume of timber is left behind after operations,high volume of timber is removed each year for erecting fences for certain public institutions, a huge amount of poles used for scaffolding in the construction of buildings, the cutting height, the sold of timber at a lower price than its real economic value, the use of heavy timber as false ceilings, the use of light timber exterior carpentry without any treatment or timber and / or its sub sawmill products for energy purposes, etc.

4.4 Factors influencing farmers' participation in timber production and marketing.

4.4.1 Socioeconomic factors influencing famers' decision to participate in timber production and marketing

The likelihood of farmer's socioeconomic factors to influence their decision to plant trees was analysed using Probit model (Table 4.4). First the variables were tested for multicollinearity by use of variance inflation factors (VIF) which in this case ranged between 1.32 and 1.07 (Appendix 3).This meant that there was no multicollinearity since the values were below 5 and values estimated from the variables would not be biased. In addition, heteroscedasticity tests were done; for which the variance was heteroscedastic (Appendix 4), this was solved by use of robust standards errors. The use of robust standard errors was necessary to avoid biased estimates. The Probit model fit the data well with a log likelihood of -35.9 and the chi-squared was 43.25 which meant that all variables were jointly significant at 1%.

Table 4.4: Maximum likelihood estimate of the choice of participating in timber production and marketing related to farmers' socioeconomic characteristics of Muruta Commune of Kayanza, Burundi.

Probit regression

Variable	Coefficient	Std. Err.	P>z
Age	0.030703	0.015377	0.046**
Gender	-0.34572	0.470582	0.463
Formal rules	-0.78035	0.432175	0.071*
Household size	-0.22401	0.092028	0.015**
Radio ownership	1.093622	0.451473	0.015**
Furthest Market Dstce	0.0578	0.020192	0.004***
Education level	-0.26137	0.1085	0.016**
Public employement	1.378873	0.552734	0.013**
Occupation	0.661753	0.302282	0.029**
Extension	0.391981	0.416034	0.346
Group Membership	-0.16977	0.3786	0.654
Landowner	-0.00293	0.065796	0.964
IncomeTimber	-0.23808	0.334451	0.477
Constant	-2.42361	1.886369	0.199

Observation =131

Log likelihood = -35.9

LR chi-square = 43.25

Legend Notes: Significance levels; ***p<1%, **p<5%, *p<10%.

Age of farmers was found positively and significantly influencing participation in production and marketing of timber. This is probably due to the fact that the older an individual gets, the more he is patient to invest and produce timber, instead of

young people who would like to engage in white color jobs. This result does not agree with Asante *et al.* (2011) who found younger farmers are more likely to join farmers based organisations and this likelihood of becoming a member increases with age. However, the older the farmer gets, the less likely he/she is to join. Beyond this point, increasing age decreases the likelihood of joining a farmer based organisations.

The analysis of variance (ANOVA) revealed that with regards to age, there is significant difference in group means for tree producers and none producers, at P=0.0636.

Presence of formal rules, negatively and significantly influences farmers likelihood to plant trees. The rules include government restriction and a need for a permit to cut trees. There are also penalties for breaking rules including paying fines. However there is a lack of incentives to plant trees. This could explain the negative correlation between formal rules and the likelihood of growing trees.

The higher the household total size influences the decision to plant trees negatively. This could be explained by competing uses of land for food and grazing. Larger households could have more alternative uses of land as compared to smaller ones. Having a large size of land in rural area like this study area, implies that is mostly cultivated for commercial purposes and farmers are focusing on their farming activities which lead to an increase of yield and income.

If a household owned a radio; a communication gadget, then they are likely to plant trees as compared to their counterparts who did not own one. There is also significant difference between group means of those who own radios and those who do not among timber producers and none producers (P=0.046). Usually there are programs on radio that promote the growing of trees for fruit harvesting, erosion control, among others and this could explain this finding which is in agreement with Gockowski and Ndoumbé (2004) who found that local language radio broadcasts are among the most cost-effective methods of information provision.

The distance covered to the furthest market positively influences tree production. The ANOVA also showed a significant difference in group means of producers and none producers with respect to the distance covered to the furthest market with P=0.0134.The further farmers travel to sell their timber, the better the price they acquire, hence a motivation to grow more trees.

Household head's education level negatively and significantly influences the likelihood of tree production. The more educated a household head is the less they are likely to produce timber. This is because of alternative sources of income for learned farmers. Gockowski and Ndoumbé (2004) also found that the age of the household head was negatively associated with the probability of adoption decision. Younger farmers were more likely to adopt. Finding revealed that there is also a significant difference between group means with regard to education levels of those who grow trees and those who do not (P=0.0036).

Off farm income sources; mainly public employment positively influences farmers' intention to grow trees for timber. This could be because it is an investment that has low input costs like it is less demanding when it comes to caring for trees. The main benefit from working in the public sector is to access credit to invest in other activities like farming, since the public sector incomes are low.

Occupation of the household head positively and significantly impact on tree production. If ones main occupation is farming then they are likely to grow trees. These findings mean that the Burundian economy is based on agriculture; for most of Burundian farmers, farming is the main occupation they focus on, and hence, they are more likely to participate in timber production and marketing.

In Table 4.5 below, the marginal effects were estimated to measure effects of small changes in the explanatory variable on the predicted probability of reading labels, holding other factors constant. The results showed that the model fit the data well by having a prediction rate of about 97%.

Table 4.5 Marginal affects for small changes in the explanatory variable on the predicted probability.

Variable	Coeffiscient	Standard Error	p>z
Age	0.0023	0.0016	0.144
Gender	-0.0212	0.02449	0.387
Formal rules	-0.0478	0.03045	0.117
Household size	-0.0171	0.01077	0.113
Radio ownership	0.0834	0.0373	0.026**
Furthest market distance	0.0044	0.0018	0.014**
Education level	-0.0199	0.0109	0.068*
Public employement	0.1050	0.0485	0.030**
Occupation	0.0504	0.03154	0.110
Extension	0.0299	0.03026	0.324
Group membership	-0.0128	0.02783	0.649
Land tenure	-0.0002	0.00504	0.965
Income timber	-0.0188	0.02958	0.525
Prediction	96.6 %		

If a farmer increases their frequency of listening to the radio they are 8.3% more likely to grow trees.

As the distance to the furthest market increases by one kilometer, this increases farmers' likelihood of growing trees by 0.4%.

As a respondent education level increases by one level, their likelihood to grow trees decreases by 2%.

Those who are employed in the public sector are 10.5% more likely to grow trees. This means that people who have a stable employment with a regular salary are likely to grow trees for either investment, either any other need.

4.5 Comparing the role of men and women in farmers' participation of timber production and marketing.

Among producers, only 14.5% of the sampled population were women who participated in the producers' survey. Never the less there was equal distribution of both genders in households, with an average of 3 women and 3 men. The main reason for such a low turn-up is because most women were not willing to take the interview in the presence of their husbands.

This attitude is due to the Burundian culture where a woman does not take a "ijambo"
(a speech) in the presence of men! This is still observed in different Burundian ceremonies. According to Aazami *et al.* (2011)women face many constraints to participate in participatory activities out of home. In the cultural setting of the area, women may attend public meetings but, sitting at the back of the room, they are expected to remain silent and not actively contribute to debates. In addition, even if allowed to speak and/or have an opportunity to speak in the meetings, they are unable to represent their views properly.

Despite producers having low levels of formal education, the case for women is worse as shown by Figure 4.8 below. Only 8.3% of women have attained primary education level, as compared to 91.7% of men. According to Aazami *et al.* (2011) , rural women play significant role in social and cultural realms along with economic roles. Most of the women are illiterate or less educated and often unable to attend or continue with formal training courses, social or economic services. In these conditions, rural women remain inactive with less chance to develop their own abilities. These findings show how women continue to be the most vulnerable group in any rural development programs.
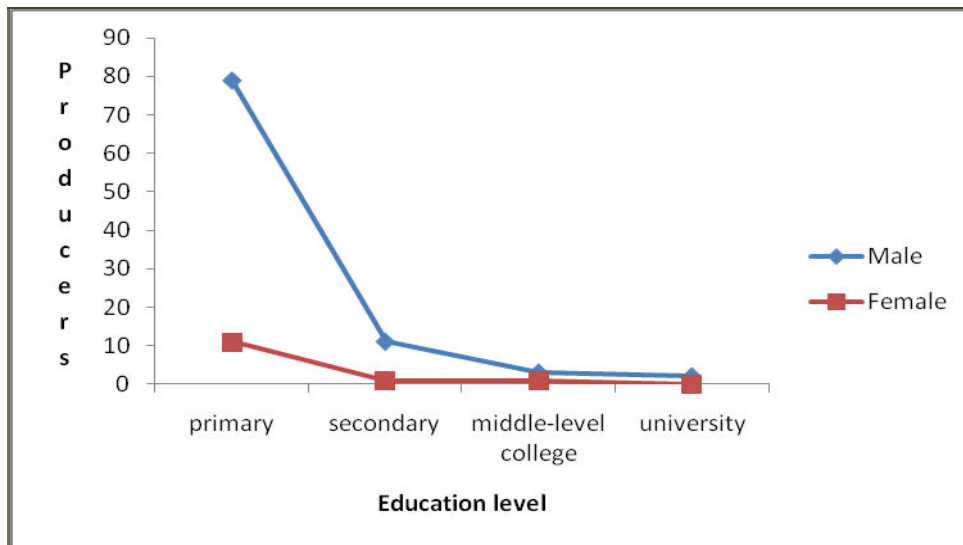
Figure 4.8: The Murutas' farmers gender comparison of education levels

Decision making for tree planting is only done by 10.7% of women as compared to 87.8% done by men. This is in agreement with Gockowski and Ndoumbé (2004) who also found that women producers were not participating in intensive monocrop production because when women were the principal agent in management decisions, there was a lower probability of adoption. Women's wide range of responsibilities in village society limits their capacity for adopting and participating in a given farmers systems.

Tree marketing is done mainly by men at 81% as compared to women, with only 8% and the remaining 11% is done by both men and women. The field management is also mainly done by either men or by family, as summarized in the Table 4.6 below. From own observation during interview and according to most of women, the tree field management is a tiring and hard work with higher physical strength demanding.

Table 4.6: Actors of tree field management

Actor	Frequency	Percent
Female	7	5.3%
Hired labor	4	3.1%
Joint family	59	45.0%
Male	61	46.6%
Total	131	100.0%

Among traders, the majority are still male with 91.3% and females 8.7%. Women joined the timber trade only recently in 2013, as compared to men who date back in 1995 (Figure 4.9).

There were no female actors in processing and transporting stage of timber value chains.
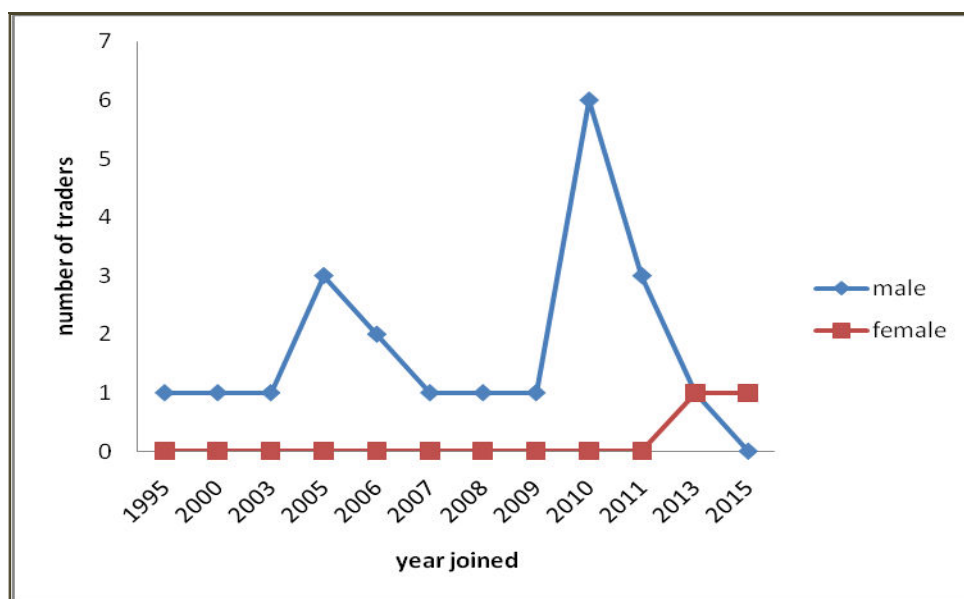
Figure 4.9 Gender comparison for year joined to trade timber in Kayanza

CHAPTER V

CONCLUSION AND RECOMMANDATION

5.1 Introduction

The study intended to determine factors influencing smallholders farmers participation in timber production and marketing in Burundi.

Timber production is an important component of regional economies across the world, creating jobs and wealth that is a cornerstone of countries' prosperity. It presents an opportunity for developing countries and their firms to participate effectively in the global economy because of its resource and labor intensity.

In Burundi, agriculture occupies a pivotal position and production system is mainly for subsistence based on a multitude of small scale farms, small with an average of less than 4 acres per household . The forestry sector contributes up to 2% of GDP and 6% to job creation. Timber and its derivatives provide 95.4% of the total energy needs of the country. For various reasons, forest products exploitation such as timber are not well known because of the lack of knowledge and awareness; they are poorly managed and heavily degraded. The regulations governing the management of forest resources have always been inconsistent and inadequate, available forest inventories are very old (1976).

The study mapped out the timber chain in Kayanza from producers to all the steps it goes through until it reaches the final consumer. It determined the factors that motivate and that influence farmers' participation toward timber production and marketing. It also compared the role of men and women in the production and the marketing of this commodity.

Descriptive statistics were used to assess producers , traders , processors and transporters characteristics ; to determine socio economics factors that motivate farmers to produce trees and to show the difference in the participation of men and women in the production and the marketing of timber. In particular, the study used a

52

Probit model to determine different factors that influence farmers' decisions to participate in the cited above chain and marginal effects of small changes in the independent variables on the predicted probability were determined after Probit. It utilized descriptive analysis to assess their perception towards the production, the trading, the process and the transportation of timber.

The study found that several actors along the chain including trees producers , traders, processors and transporters of trees, were acting in timber sector in Burundi. It was revealed that Income is the main reason for producers being involved in that sector and majority of them have joined the sector for 5 to 10 years. It revealed also that the average land area for timber production is 15.43ha. However, the study found that producers never get contact with extensionists officers, and their main constraints in timber production is lack of quality seeds and nursery plants , lack of timber market and small land sizes. Producers requested to the government of Burundi to encourage the multiplication of the tree plants disease-resistant; a propagation of trees nurseries; a training on farming techniques management of tree and to promote farmers group involved in the tree production. The study concluded that producers participate strongly in the chain facing many challenges cited above and *Eucalyptus saligna* is the main tree species produced and harvested by majority of respondents.

From the stakeholders interview, the study found that men dominate the timber trade at 91.3% and 52.2% of traders have only attained primary education, none of the traders had tertiary education. The study revealed that builders and others detailers traders are the most important buyers of timber products from traders. the study found that there are no known government regulations and price controls on timber trade. Conclusively, traders find the taxes charged by the government to be the most unfavorable to their business.

On the Processors side, the study found that the use of craft and rudimentary material still relevant in Muruta commune , processors wish the acquisition of

electric and appropriate equipment less tiring, from government or any other concerned institutions.

The study found that Over 57% of timber products are transported from Kayanza to Bujumbura town, and the rest either remains in Kayanza province or either goes to other provinces. Transporters wished creation of groups of timber carriers, reduction of taxes along the road and access to bank credit.

The study also find that the main factors motivating timber production by farmers are firewood, timber and charcoal, erosion control and fruits consumption. The hypothesis that socio-economic factors do not influence the motivation of farmers to produce timber was rejected. The results revealed that socio-economic factors influence their motivation to produce timber.

The study revealed specifically that the factors that influence farmers to make their decision to participate in timber production and marketing are different socio factors including age, education level, household size, formal rules, public employment, radio acquisition and furthest market. The hypothesis that socio-demographic factors does not influence farmers' participation in timber production and marketing was rejected. The study conclude that socio-demographic and socio-economic factors influence their decision to participate in the chain.

Lastly, the study revealed that despite producers having low levels of formal education, the case for women was worse. Only 8.3% of women have attained primary education level, as compared to 91.7% of men. It revealed also that the decision making for tree planting was only done by men as it is for tree marketing. However, women started to trade timber recently in 2013 but they were no women in processing or transportation of timber.

5.2 Recommendations

The study findings indicate that the majority of the respondents attained primary school education which implies a low level of education. The low level of education of farmers has implications on either participating or not in any agricultural development program and it lead to the lack of awareness and knowledge such as

forest products resources. There is need therefore to invest in formal education of respondents in Muruta commune specially a creation of timber producers group.

 A capacity building by training producers on trees production and management and on the importance of forests products including timber, should be considered. Producers should be aware on other source of energy especially the use of gas like in other country including Kenya.

Findings indicate that timber is not wisely used in Burundi because different users are not professional and use craft material instead of electric material.   An implementation of a timber value chain regulated by the government should be done as it is for other agricultures products including sugar, cotton, tea and coffee in Burundi.

A deep study on trees species that give good timber for industry and available on Burundian soil should follow ; a similar research to this should be done in other provinces.

Comparison of the role of men and women on how they participate in timber value chain was found to have a huge difference in their role respectively. The majority of the respondents were mainly male, they were the main traders, processors, transporters and decision makers to plant trees. In Burundian rural communities, women are not usually vocal especially on questions related to family. To reach out women who are in such areas, policies that target women participation should be encouraged.

REFERENCES

Aazami, M., Sorushmehr, H., & Mahdei, K. N. (2011). Socio economic factors affecting rural WP in productive cooperations: Case study of Paveh ball-making cooperative. *African Journal of Agricultural Research, 6*(14), 3369-3381.

Asante, B. O., Sefa, V., & Sarpong, D. B. (2011). Determinants of small scale farmers' decision to join farmer based organizations in Ghana. *African Journal of Agricultural Research, 6*(10), 2273-2279.

Astère, B. (2014). Revision du plan de convergence de la Comifac (pp. 5): Se Comifac.

Atyi, R. E. a., & Simula, M. (2002). *Forest certification: pending challenges for tropical timber*: Citeseer.

Bararwandika, A. (1999). Ressources forestières et produits forestiers au Burundi. *Forestry Department (Burundi)*.

Beyene, A. D. (2008). Determinants of off-farm participation decision of farm households in Ethiopia. *Agrekon, 47*(1), 140-161.

Chevallier, R., & du Preez, M. (2012). Timber Trade in Africa's Great Lakes: The Road from Beni, DRC to Kampala, Uganda. *South African Institute of International Affairs (SAIA), Johannesburg*.

Damianos, D., & Giannakopoulos, N. (2002). Farmers' participation in agri-environmental schemes in Greece. *British Food Journal, 104*(3/4/5), 261-273.

Dolisca, F., Carter, D. R., McDaniel, J. M., Shannon, D. a., & Jolly, C. M. (2006). Factors influencing farmers' participation in forestry management programs: A case study from Haiti. *Forest Ecology and Management*, *236*(2-3), 324–331. doi:10.1016/j.foreco.2006.09.017

Franzel, S., Hitimana, L., & Akyeampong, E. (1995). Farmer participation in on-station tree species selection for agroforestry: a case study from Burundi. *Experimental Agriculture, 31*(01), 27-38.

Gasana, J. K., & Sorg, J. (1997). Appui au développement des filières forêt-bois dans les pays du Sud.

Gaspas. (2012). To the Discovery of Burundi the Heart of Africa.

Gockowski, J., & Ndoumbé, M. (2004). The adoption of intensive monocrop horticulture in southern Cameroon. *Agricultural economics, 30*(3), 195-202.

Hole, A. R. (2007). Estimating mixed logit models using maximum simulated likelihood. *Stata Journal, 7*(3), 388-401.

Howard, J. L. (2003). *US timber production, trade, consumption, and price statistics, 1965-2002*: US Department of Agriculture, Forest Service, Forest Products Laboratory Madison, WI.

Israel, G. D. (1992). *Determining sample size*: University of Florida Cooperative Extension Service, Institute of Food and Agriculture Sciences, EDIS.

Issa, N., & Chrysostome, N. J. (2015). Determinants of Farmer Participation in the Vertical Integration of the Rwandan Coffee Value Chain: Results from Huye District. *Journal of Agricultural Science, 7*(9), p197.

Kaplinsky, R., Memedovic, O., Morris, M., & Readman, J. (2003a). The global wood furniture value chain: What prospects for upgrading by developing countries. *UNIDO Sectoral Studies Series Working Paper*.

Kaplinsky, R., Memedovic, O., Morris, M., & Readman, J. (2003b) The Global Wood Furniture Value Chain: What Prospects for Upgrading by Developing Countries The case of South Africa. Vienna: United Nations Industrial Development Organization (UNIDO)

Kaplinsky, R., & Morris, M. (2001). *A handbook for value chain research* (Vol. 113): IDRC Ottawa.

Little, P. D. (1993). *The link between local participation and improved conservation: A review of issues and experiences*: Liz Claiborne Art Ortenberg Foundation.

Marc-Adelard, T. (1957). The key informant technique: A nonethnographic application. *American Anthropologist, 59*(4), 688-701.

Marshall, E., Newton, A., & Schreckenberg, K. (2003). Commercialisation of non-timber forest products: first steps in analysing the factors influencing success. *International Forestry Review, 5*(2), 128-137.

MINEEATU, & FAO. (2012). *Pôlitique Forestière Nationale du Burundi*. Bujumbura.

Neumann, R.P. and Hirsch, E. (2000). Commercialisation of non-timber forest products: review and analysis of research. CIFOR, Bogor, Indonesia

Nkurunziza, F. (1999). Rapport d'étude sur les données du bois-énergie au Burundi. *Collecte et analyse de données pour l'aménagement durable des forêts joindre les efforts nationaux et internationaux. Lien www. fao. org/docrep/fao/003/X6783F/X6783F. pdf*.

Peters, C.M. (1996). The ecology and management of non timber forest resources. World Bank Technical Paper 322, Washington, D.C., USA

Portes, A. (1971). Political primitivism, differential socialization, and lower-class leftist radicalism. *American sociological review*, 820-835.

Prestemon, J. P., & Robert, A. C. (2002). Timber products supply and demand. Southern Forest Resource Assessment *General Technical Report* (Vol. SRS, pp. 299-325). Asheville, NC: US Department of Agriculture, Forest Service, Southern Research Station.

Ruiz Perez, M. and Byron, N. (1999). (eds). A methodology to analyse divergent case studies of non-timber forest products and their development potential. *Forest Science,*45(1): 1–14.

Schipmann, C., & Qaim, M. (2011). Supply chain differentiation, contract agriculture, and farmers' marketing preferences: The case of sweet pepper in Thailand. *Food Policy*, *36*(5), 667-677.

Smith, R. (2014). *Code of Practice for Timber Production*. The State of Victoria Department of Environment and Primary Industries.

Spermann, A. (2008). The Probit Model.

Springer-Heinze, A. (2007). ValueLinks Manual: The methodology of value chain promotion.

Tremblay, M. A. (1957). The key informant technique: A nonethnographic application. *American Anthropologist*, *59*(4), 688-701.

V.Ryan(2011) Online document available at
URL: http://www.technologystudent.com/joints/forest3a.html
accessed on tuesday 30th june 2015.

Wongolo, E. M., & Meka, E. Z. (2004). Promoting the further processing of tropical timber in Africa (African Timber Organization 2004 ed.): African Timber Organization Ministerial.

APPENDICES

Appendix 1 : Households questionnaire

Factors influencing farmers' participation in timber production and marketing.

Household smallholders' survey

The aim of this questionnaire is to gather information on the factors influencing participation of stakeholders in timber value chain on their livelihoods.
All information collected in this survey is strictly confidential and will be used for statistical purposes only.

	Name	Code	Date	Signature
Enumaretor's name ENAM	_____	[__ __]	__ __/__ __/__ _	_____
Supervisor'sname SUPNAM	_____		__ __/__ __/__ _	_____
Data entry by (enumarator's name) DENAM	_____	[__ __]	__ __/__ __/__ _	_____
Data quality check by DOCHEK	_____	[__ __]	__ __/__ __/__ _	_____

GPS (reading from homestead) Latitude   :   GPSLAT…………………………………

                  Longitude   : GPSLONG ………………………………….

                  Altitude   :   GPSELEV…………………………………..

Commune: ***Muruta*** COMURTA zone ZONE_____ village VILLAGE_____ (***Kayanza Province***)

Agroecological zone   AGROZONE   [__] *1= Mugamba, 2= Buyenzi*

Zone : 1=Rwegura 2=Muruta 3=Nkonge

Section I: Respondent identification and demographic characteristics of household members

Responding ideal: Most of these questions can be completed without directly asking the question. Be very careful on how to collect this information.

1. Respondent age and name

    a. First name   **RESPNAME1**   ---------------------
    ----
    b. Name   **RESPNAME2**   ---------------------
    ----
    c. Age   **RESPAGE**   ---------------------
    ----

2. Demographic Characteristics of Household Members

(We are interested in knowing the members of your household since they assist in farming and other household chores such as water, fuel wood collection and also live with you in the household etc).

Table 1: Household Characteristics

Marital status	1=Monogamous Married, 2=Polygamous Married, 3=Single, 4=Separated, 5=Divorced, 6=Widow or Widower, 7=Never Married
Education Level	1=None 2= Primary 3=Secondary 4=Middle-level college 5=University 6= No schooling 7=others (Specify) _____
Relation to head	1=Head, 2=Spouse, 3=Son/Daughter= 4=Father/Mother 5=Sister/Brother 6=Grandchild, 7=other relative (Specify) 8=Worker 9=Other Non-

Relative

Occupation   1=Farming   2=Casual labour 3=Employed 4=Family business 5=NGO's staff

6=Student   7=none   98= other (specify) _____

3. Household capital Assets:

a) **Financial capital**: Which of the following item is your household having?

Table 2: financial capital

Communication/transport	No.	Domestic assets	No	Farming assets	No.	Farming assets	No.
Radio COMRAD		Furniture DOMFURN		Water tank for farm FARMWATANK		Milk can FARMILCAN	
Mobile phone COMOBPH		Wood stove DOMWODST		Hoes FARMHOES		Shovel FARMSHOV	
Television COMTELEV		Kerosene stove DOMKERST		Machettes FARMACH			
Bicycle COMBICY		Granary(store house) DOMGRAN		Wheelbarrow FARMWHEEL		Spades FARMSPAD	
Motorbike COMOTOR		Domestic water tank DOMWATANK		Water pumps FARMPUMP		Axe FARMAXE	
Car/Truck COMCARTR		Backets/ bassin/ DOMBACKT		Saw FARMSAW		Sprayer FARMSPRA	
Other (specify) ……………		Grain miller DOMGRAIN		Others (specify) …………		Other …………..	
………………..		other specify)…………		………………. …..		……………….	

b) Off-farm income sources: Table 3: off-farm income

Formal/regular/professionalincomes	1=yes 2=no	FBu (Burundi franc)/ Year
Employment/public sector PUBSECT		BFPUBSECT
Employment/private company/NGO PRIVCOMP		BFPRIV
Business/trades(own business) BUSTRAD		BFBTRAD
Business/skilled artisanship ARTISAN		BFART
Land rent LANDRENT		BFLAND
Remittances by family REMFAM		BFREM

Informal/Casual incomes	1=yes 2=no	FBu/year
Agricultural/farm labour FARMLAB		BFARM
Construction/brick labour CONSBRIK		BFBRL
Charcoal burning/trade CHARCTRAD		BFCHARC
Timber labour TIMBLAB		BFTIMBL
Petty trades PETRAD		BFPET
Others (specify)		

Section 2: Household membership in group

1. Are you or a member of your household is involved in a group that conducts the following activities? Table 4: farmers groups/association

Type of group TPGROUP 1=Business 2=Farmers'group 3=Self-help/credit 4=Women 6=Family/clan 7=Comm.　　　Forest Association 8= NGO's beneficiary 9=Other (specify)	Group activities GROUPACTS	Number of members		Year joined YARJOIN	Benefits BENEFTS 0=none 1=education　　and training 2=credit 3=labour sharing 4=market access 5=resource access 6=other	Leadership position held LEADPOSH
		Male NUMAL	Female NUMFEMAL			

Activities 1=marketing 2= Nursery or tree planting 3= Transportation of agricultural and forest products   4=financial services 5=forest products collection 6= Marketing of agricultural products (eg. Livestock, agriculture, trees)   7= Forest products collection 8= Timber marketing 9=Timber production 10= Crop seeds production 11= Others not mentioned above related to the production, marketing of wood ……………………………………….

Leadership   1=Ordinary member   2=Chairman   3=vice-chair   4=Secretary   5=vice-secretary
6=organising secretary   7=Treasurer   8=Vice-treasurer   9=Other Specify)………………………………………………………..

2. Which type of timber species do you know?   [__ __]
   TIMSPECKNWN

   1=Grevillea Robusta 2=Cedrela Odoruta 3=Cedrela Gerrulata 4= Cypressus lusitanica
   5=Chlorophlora Excelsum 6= Markhamia Luttea 7= Entandrophragma 8=Eucalyptus   9=Terminalia   Superba 10= Hangenia abyssinica 11= other (specify)

3.

4. Regarding the following activities, which one are you involved in?   [__ __] INVOLVINACT

   1 = timber production
   2 =Carpentry
   4 = marketing of timber (wholesale and/orretail)
   5= sawn
    98 others to specify…………………………………………………………..

Section 3: Household timber production and harvesting

1. Please provide information on the timber production and harvesting in the last 2 years.

Timber specie TIMSPECIE	Area of land under production (in ha) LDSIZEPROD	Number of trees under production for timber NBTREPROD	Number of timber harvested in the last 6 months TIMBHARV	Maturity duration of the specie MATDUR	Labour used of that period USDLAB	Number of trees planted TREPLANTD	Quantity harvested HARVQUT	Capital used (FBu) USDFBU

Table 5: Tree production and harvest

Species: 1=Grevillea Robusta 2=Cedrela Odoruta 3=Cedrela Gerrulata 4= Cypressus lusitanica 5=Chlorophlora Excelsum 6= Markhamia Luttea 7= Entandrophragma 8=Eucalyptus 9=Terminalia   Superba 10= Hangenia abyssinica 11= other (specify)

Labor: 1=daily worker 2=salaried 3= farm worker 4= family labor 5=sharing labor group 6= other (specify)

2. Labour costs for timber production (for last two years)

Please provide information on the labor of timber production and harvesting in the last 2 years.

Table 6 : labor cost of tree production and harvest

Activities ACTVTS	**Who does these activities?** WHOACT 1=male 2=female 3=both 4=farm worker 5=hired labor 6=daily worker	**Mode of pay** PAYMOD 1=cash 2=kind	**If cash, how much? (FBu)** BFCASH	If kind	
				Quantity of trees planted/ harvested IFKTPLHARV	**Costs/ unity** IFKBFUNIT
Tree planting					
Tree harvesting					
Other (specify)					

3. How long are you involved in the timber sector and why?

How long: [__ __]   HLINVTIMB

1=1to6months   2 = 6mth to 1 year   3 = 1 to 3 years   4=3to5years   5 = 5to10 years 6=over 20 years 7=other (specify)...
 Raisons: [__ __]   RESONVT
1 = Source of income   2=School fees 3= New Discovery 4=Routine 5= Food Safety 6= Government Plan
 7 = Investment   8 = other to specify………………………………………………………….

4. Which type of tree do you prefer and why? TRYUPREF1 TRYUPREF2 TRYUPREF3

R /…………………………………………………………………………………………
……………………………………………………………………………………………
…………………………………………

5. What is the importance of timber?   IMPORTIMB
    [__ __]

1 = energy   5= art Confection
2 = construction of residential houses   6 = Serve as a bridge between two broken roads

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3 = Construction of the frame   7 = national income Source

4 = Investment98 = other specify...

Section 4: Factors influencing farmers' participation in timber production and marketing

1) **Landowner:** What is the area of land on which your household has access to?

Table 7: Landowner

Land allocation	Area (ha)	Ownership 1= heritage 2= purchased 3=gifted 4= other--------	Rented 1=yes 2=no	Location 1= around the household 2= in another locality 3= in the marches 4=other----------------------------------
Food crops FCRPS	FCRHA	FCOWNSHP	FCRENTD	FCLOCAT
Industrial crops INDCRPS	INDCRHA	INDOWNSHP	INDRENTD	INDLOCAT
Grazing land GRZLAND	GRZHA	GRZOWNSHP	GRZRENTD	GRZLOCAT
Tree production TREPRD	TRPRHA	TROWNSHP	TRRENTD	TRLOCAT
Total of all the household lands =				

2) **Income (farm income sources):** Do you produce and/or sell to earn incomes from following farming products?   1=yes, 2=no

Table 8= farm income

	Produce	Sell		Produce	Sell
Maize	PRODMZ	SELLMZ	Napier fodder	PRODNFD	SELLNFD
Wheat	PRODWHT	SELLWHT	Agroforestry fruits	PRODAFR	SELLAFR
Irish potato	PRODIRP	SELLIRP	Timber	PRODTMB	SELLTMB
Sweetpotato	PRODSPT	SELLSPT	Agroforestry construction pole	PRODACP	SELLACP
Climbingbeans, peas	PRODCLB	SELLCLB	Firewood	PRODFWD	SELLFWD
Bush beans, peas	PRODBBP	SELLBBP	Charcoal	PRODCHC	SELLCHC
Banana	PRODBNN	SELLBNN	Agroforestryfodder	PRODAGF	SELLAGF
Cassava	PRODCSV	SELLCSV	Livestock for meat/animal	PRODMET	SELLMET
Rice	PRODRIC	SELLRIC	Dairy products	PRODAIR	SELLDAIR
Tea	PRODTEA	SELLTEA	livestock for manure	PRODMAN	SELLMAN

Coffee	PRODCOF	SELLCOF		Chickeneggs	PRODEGG	SELLEGG
Vegetables	PRODVGS	SELLVGS		Bean stakes	PRODBST	SELLBST

3) Marketing of timber

1) What is your role in tree marketing? MARKTROL   [__ __]

1=retail   2=   wholesale,   3=   both   4=   none   5= other...

2) Who does this activity of marketing tree? WHOACTREE   [__ __]

1= male, 2= female, 3= both 5=casual labor 6= other...

3) How long are you involved in tree trading? YRINTRETRAD   [__ __]

1= 1 year, 2=3-5years, 3=5-10 years, 4= 10-20 years; 5= over 20years

4) From where do you get the trees that you sell? SORCOFTREE   [__ __]

1=own source, 2 = DPAE, 3=farmers group , 4= commercial development project ,5= public

forest reserves, 6= neighbouring, 7=local government 98 = other specify ....

5) To whom do you sell/ buy trees ? CLIENTS   [__ __]

1 = locals carpenters, 2= wholesalers from Bujumbura, 3 = Public Establishment

4=wholesalers from other provinces, 5 = appropriate buyer/sellers,6=Government

7=foreigners, 8= locals churches instead 9= NGOs/ development agency, 8 = other

(specify)...................................

6) To which direction goes trees after being sold/bought? DIROFTREE

[__ __]

1 = In Kayanza province, 2= in bordered provinces, 3= around Muruta commune
4 = in Bujumbura other 5= in other provinces 6=neighbouring countries 7=other ....
[__ __]

7) How long do you keep trees before selling? HLKPTREE   (month/year)

8) How long do you spend before getting trees to sell if you don't sell your own? R/ HLSBGTREE   (month/year)

4) Distance to the markets (please get the distance to any market the farmer has to go to) :

1) Table 9: Distance it takes to get at the market DISCMARK

	Km LENGTH	Time (hour) HOUR
The local market DISLMARK	LENGTHL	HOURL
The nearest market DISNMARK	LENGTHN	HOURN
The farest market DISFMARK	LENGTHF	HOURF
The nearest tarmac road DISTMARK	LENGTHT	HOURT

2) How do you arrive at the market?   TRANSMARK   [__ __]

  1=walking, 2= bicycle, 3= car hiring 4= truck

Section 5: Farmer's perception, knowledge and constraints of tree

1) Please, tell us the name of 3 timber tree species (TS) of your priority? TIMBPRIOR

   TS 1---
   TS 2---
   TS 3---

2) Does theses trees grown in this region? 1=yes, 2=no   GROWTREGION

  [__ __]

3) Do you yourself plant those trees for timber use? 1=yes, 2=no   TIMBPRODUCE

  [__ __]

4) What is the main use of a tree? USOFTREE   [__ __][__ __][__ __][__ __][__ __]

Tree uses code: 1= Fruit, 2= Timber, 3=Charcoal, 4=Firewood, 5=Medicine, 6=Pole, 7=Fodder, 8=Shade, 9=Windbreak, 10=Erosion control, 11=Soil fertility, 12=Live-fence, 13=Farm tools/furniture/domestic construction materials making wood, 14= Bean stakes, 15=Cultural/Religious values, 98=other (specify)

5) What is the main use of timber for you? USOFTIMB   [__ __][__ __][__ __]

1= Furniture 2= domestic construction material 3= cultural value 3= religious value 4= national exportation material 5= family income 6= investment 7= other (specify) --------------------------------

6) Who decides to plant the tree for timber? WODPLANTRE   [__ __][__ __][__ __]

1= male/ or head of hh), 2. Female (spouse) 3= Government, 4=NGOs, 98=others (specify).....................

7) Who does most field management of tree?   WHDOFILDM   [__ __][__ __][__ __]

1=male 2= Female3=Joint family, 4=Hired labor. 5=mutual aid/farmers group aid, 6= No management required, 98=Others (specify)

8) Do you receive any advisory services from extension on timber ? ADVISERVIC 1= yes; 2= no [__ __]

if yes, proceed to 9, if no, go to 10

9) what is the frequency of contact: FREQUENCY [__ __]

1=more than 1 per month, 2= 2times/year, 3= 4 times/year, 4=once/year, 5= every 2 – 3 years, 6= 5 years, 98= others (specify)

10) If no, why ? IFNOADVISE

R)…………………………………………………………………….................. ....

11) In your area, has there been a training on timber ?   TRAINAREA1=yes,   2=no [__ __]

If yes, precede 13, if no, go to 12

12) Have yourself received any training related to timber? TRAINED 1=yes, 2= no [__ __]

if yes, proceed 13, if no, go to 14

13) If yes, by who? BYWHO   [__ __][__ __][__ __]

1=ISABU   2=government,   2= agronomist/extensionist,   3=NGO,4=ICRAF,   98= others………………...

14) When were you trained?TRAINWHEN…………………….years ago

15) Which utilities were focused? TRAINFOCUS [__ __][__ __][__ __]

1=production,2= harvesting, 3=marketing, 4=transport, 5=processing 6= others etc.)

16) What are major constraints of tree field management do you face on farm? CONSTRAINTS

R/………………………………………………………………………………… ………………………………………………………………………………… ………………………………………………………………………………… …………………………………………………………

16) What are your wishes for the improvement of the tree sector? WISHES
R/………………………………………………………………………………… …………………………………………………………………………………

………
………
……………………………………………………

17) What should do the government of Burundi, to help you for your regular activity regarding tree production and marketing? HLPOFGVMT

R/……

………

………

……………………………………………………………………………………

Section 6 :Rules and Regulations

1.   Are there any formal rules governing the production/ marketing of timber?
FORMRULS

        1= Yes 2=No   [__ __]

2.   Are there any informal rules governing the production/ marketing of timber?
INFORMRULS 1=Yes 2= No

                                                                [__ __]

3.   Table 10: Rules and regulations

Type of rule TYPRUL 1=Formal 2=Informal	What are existing rules	Who is responsible for the formulation 1=Govt 2=Community 3=Tradition/Culture 4=Other (specify_____)	What are the punishment/penalties for violation of rules PENALTIS
	INFORULS	RESPINFOR	
	FORMRULS	RESPFORM	

Informal Rules:1.Forests are divine and should not be destroyed   2. They are our heritage they are to be   preserved   3. Belief that interference result into a curse   4. They are water catchments which need protection   5.   Preserve   for   cultural activities   6.   Other   (Specify)
…………………………………………………………………

Formal Rules: 1. Govt restriction   2. Community restriction   3.   Cutting trees requires permission/permit   4. Trees along the riverbed are govt property, no cutting   5.   Other   (specify)
……………………………………………………………….

Penalties: 1. Pay fine   2. Ex-communication   3.Jail   4. Plant a given number of trees5.Other   (Specify)
…………………………………………………..

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End of interview

Thank you for your time

End time………………..

Appendix 2 :Foods produced and sold for income.

Food variety	Production and consumption (%yes)	Sell (% yes)
Maize	90.8	2.3
Wheat	89.3	9.2
Irish potato	69.5	20.6
Sweetpotato	97.7	7.6
Climbingbeans, peas	93.1	3.8
Bush beans, peas	64.1	1.5
Banana	79.4	28.2
Cassava	59.5	6.1
Rice	0	0
Tea	74.8	67.2
Coffee	54.2	47.3
Vegetables	61.1	20.6
Napier fodder	67.2	12.2
Agroforestry fruits	87.0	29.0
Timber	64.9	35.1
Agroforestry construction pole	90.1	9.9
Firewood	82.4	8.4
Charcoal	13	6.1
Agroforestryfodder	23.4	5.3
Livestock for meat/animal	75.6	38.2
Dairy products	9.2	3.1
livestock for manure	7.4	3.8
Chickeneggs	7.6	3.8
Bean stakes	84.7	64.1

Appendix 3: Multicollinearity test

Variable	VIF	1/VIF
Membership group	1.32	0.757992
Householdsize	1.32	0.759614
Formal rules	1.29	0.776991
Market Dstce	1.2	0.832798
Age	1.18	0.846806
Landowner	1.15	0.870748
Radio	1.14	0.880683
Public employee	1.12	0.890344
Gender	1.12	0.894117
Extension	1.11	0.902547
IncomeTimber	1.09	0.915352
Occupation	1.08	0.923729
Educationlevel	1.07	0.931001
Mean VIF	1.17	

Appendix 4: Hetroscendasticity test

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of PRODUCTEUR

chi2(1)   =   20.25

Prob>chi2 =   0.0000