POTENTIAL BENEFITS OF CARBON TRADE AS AN ECONOMIC INCENTIVES FOR EMISSION REDUCTION: A CASE OF COMMUNITY BASED FOREST MANAGEMENT IN KILWA DISTRICT, TANZANIA

BY

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ABSTRACT

This study was conducted with the overall objective of analyzing the role of carbon trading towards forest conservation to reduce emission through Sustainable Forest Management (SFM) under Community Based Forest Management (CBFM). The study was conducted in Kilwa district where REDD pilot project is being implemented by Mpingo Conservation Development Initiatives (MCDI), and where also most baseline information is available. Both socio-economic and ecological data were collected. Household questionnaires were administered to 120 households, and Participatory Rural Approach were used to collect the primary data for the study. Sample villages included those who were under REDD (40), those who were not under REDD (40) and those practicing Participatory Forest Management (PFM) only (40). The ecological data included the carbon stocks in forests managed under the three categories. Data were analyzed using both SPSS software and Microsoft Excel. A binary Logit regression analysis was used to analyses the factors/incentives influencing local participation in REDD+ activities. Participation in REDD+/CBFM and forest management activities was found to increase significantly with increase in benefits and incentives for forest management, especially the potentials for future carbon trading It was found that there is an expected net income averaging to more than TZS 410 891 27 147, and TZS 195 007 per household from the sales of carbon in Liwiti, Migeregere and Mchakama villages respectively if they sale their carbon under REDD+ activities. This can further be invested to expand CBFM for sustainable timber harvest as the goal of MCDI project. In addition more revenues, amounting to TZS 2 mill from the sales of other forest products is expected, if the community will be allowed to sale other products from the forests under REDD+ mechanisms, giving better logical incentive package for the community to participation in forest management. In general, there was increased access to livelihood assets within the community especially financial, natural, physical, and human assets,

attributed to CBFM project both at household and community levels. However, from the distribution point of view, producers (villagers) get low income from the sales of other forest products compared to other actors in the value chain of these products. Nevertheless, villagers gain more additional income from sustainable timber harvests that can be expanded as a result of the money obtained from the sales of carbon credits. It is therefore, plausible to conclude that REDD+/CBFM have positive effects on the livelihoods of the adjacent communities and it is therefore, recommended that the communities should be sensitized to participate in REDD+/CBFM activities for improved livelihoods and reduced emissions from deforestation and forest degradation.

DECLARATION

I, **Bernadetha Pantaleo Munishi,** do hereby declare to the Senate of the Sokoine University of Agriculture that the work presented here is my own original work, and has neither been submitted nor being concurrently submitted for a higher degree at any other institution.

……..... …….

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The declaration above is confirmed by;

……..... …….

Dr. R. M. J. Kadigi Date

(Main supervisor)

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LIST OF ABBRIVIATIONS, ACRONYMS AND SYMBOLS

CBFM	Community Based Forest Management
CCIAM	Climate Change Impact, Adaptation and Mitigation Programme
COP	Conference of Parties
CVM	Contingency Valuation Methods
FAO	Food and Agricultural Organization of the UN
GHG	Green House Gas
IPCC	Intergovernmental Panel on Climate Change
IRA	Institute of Resource Assessment
JFM	Joint Forest Management
Kg	Kilogram
LGFR	Local Government Forest Reserve
MCDI	Mpingo Conservation Development Initiatives
MDGs	Millennium Development Goals
MJUMITA	Mtandao wa Jumuiya ya Utunzaji wa Misitu Tanzania
MNRT	Ministry of Natural Resources and Tourism
NCMC	National Carbon Monitoring Center
NFRs	National Forest Reserve
NGO	Non-governmental Organization
NSGRP	National Strategies for Growth and Reduction of Poverty
PFM	Participatory Forest Management
PM	Profit Margin
R^2	Coefficient of determination
REDD	Reduced Emissions from Deforestation and Forest Degradation
REDDtz	Reduced Emissions from Deforestation and Forest Degradation Tanzania programme

SLA	Sustainable Livelihood Approach
SNAL	Sokoine National Agriculture Library
SUA	Sokoine University of Agriculture
TAS	Tanzanian Shillings
TaTEDO	Tanzania Traditional Energy Development and environmental
TFCG	Tanzania Forest Conservation Group
UNFCCC	United National Framework Convention on Climate Change
UN-REDD	United Nations REDD Programme
URT	United Republic of Tanzania
VCS	Verified Carbon Standards
VFR	Village Forest Reserve
VNRC	Village Natural Resource Committee
WCS	Wildlife Conservation Society
WTP	Willingness to Pay
WWF	World Wide Fund for Nature
β	Estimated Beta

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Deforestation and forest degradation is estimated to contribute about 18% of Green House Gases (GHG) emissions globally; and these estimates are comparatively higher than those in other sectors such as agriculture (Stern, 2006; REDDtz, 2009). Moreover, deforestation and forest degradation are said to account for about 20% of the total global annual atmospheric carbon emission (IPCC, 2000; Gullison *et al.*, 2007). These emissions may further increase the global temperature, contribute to changes in climate patterns, and cause harm, such low production to crucial economic sectors such as agriculture that serve as primary income sources for most poor countries.

In recognition of the global warming problem, an agreement aiming at cutting down emissions from deforestation and forest degradation was reached during the post-Kyoto protocol in Canada in 2005 (UNFCCC, 2005). The agreement was geared towards developing a REDD mechanism that will be cost effective, efficient and equitable, and that provide incentives to curb deforestation and enhance carbon stocks through sustainable forest resource management. The agreement was then signed by the signatory countries (parties) after the United Nations Framework Convention on Climate Change (UNFCCC) Conference of Parties (COP) held in Bali (Indonesia) in 2007 (UNFCCC, 2007). The agreement was meant to set grounds for the post-Kyoto Protocol mechanisms at the 15th COP to the UNFCCC in 2009 in Copenhagen. Further progress was made to include REDD+ as a climate change mitigation option (UNFCCC, 2009). Instead of just covering deforestation and forest degradation, REDD+ takes into consideration other forest management aspects such as sustainable management of forests and the enhancement of forest carbon stocks.

The concept of REDD+ is based on the premise that carbon stocks in the forests have a market value. Until recently, these stocks were considered as not having any market value. Under the REDD+ arrangement, trades of carbon stock are possible through voluntary markets as well as the compliance markets. Forests are valued not only for the goods they produce such as timber, and the land on which they stand, but also for the essential environmental services that they provide (Angelsen *et al.,* 2009).

Tanzania is one of the countries with high rates of deforestation and forest degradation in Africa. Between 1990 and 2005 an estimated 412,000 ha per annum were cleared, equivalent to about 1.1% of the total forest area (Blomley and Iddi, 2009). About 37.4% of forests including woodland have been deforested annually from 1990 to 2005 (UN-REDD, 2009). This unprecedented deforestation rate has led to considerable carbon emissions estimated at 100 million tons per year, and this poses a threat to the future of the country's forests and climate (NCMC, 2010).

A recent study in Tanzania indicates that communities can receive financial benefits in thousands of USD annually from the sale of forest carbon credits (Dominic *et al.*, 2010). Currently, there are several pilot projects being implemented in many parts of Tanzania with the aim of conserving forests while at the same time achieving livelihood goals like expanding income source. For example, the REDD+ pilot project in Nandambi village in the coastal region was estimated to raise an average net income of USD 98,795 per annum, of which USD 430 was to be distributed to each household (TFCG/MJUMITA, 2010).

1.2 Problem Statement and Justification

It is already evident that activities associated with deforestation and forests degradation will wipeout the already waning forests in most tropical countries, including Tanzania, if the current trend continues unchecked. This is happening besides the fact that both deforestation and forest degradation in Tanzania contribute large amounts of GHG emissions, which may escalate extreme weather events and further hinder the countries' efforts to eradicate poverty. This is a worrying phenomenon particularly to a country like Tanzania where majority of the people are poor and depend on agriculture and forests for their various livelihood needs. Around 412 000 ha of forests are estimated to be lost annually due to deforestation, with coastal forests being the most affected (Blomley and Iddi, 2009; Burgess *et al*., 2009; FAO, 2006). However, under REDD+ mechanisms, Tanzania stands to gain from trading of carbon stored in the forests, which are estimated to cover one-third (33.5 million ha) of the country's mainland. Engaging in carbon trading is only possible if activities associated with forest degradation and deforestation, such as unsustainable agricultural practices and forest harvests, are well addressed. Underpinning the solutions would be a motivation to local communities living adjacent to the forests to participate in conservation, which can contribute considerably to the reduction of emissions and improved livelihoods.

Despite the fact that there is a potential for carbon markets to create economic and livelihood benefits for the communities living adjacent to the forests, little is known about the effective incentives that would influence communities to conserve forests. Furthermore, there is scanty information on the quantity and value of carbon and other forest products that may be accrued from forest conservation. The livelihood impacts to the local communities, and the value chain of these products to understand the distribution aspect of benefits that will bring behavioral change among stakeholders in

areas with the conserved forests. The studies by Zahabu and Jambiya (2007) on the five villages of Gwata, Ludewa, Mgambo and Ayasanda as well as Smith and Scherr (2002) on the CDM framework of Post Kyoto protocol on the influence of carbon trade as REDD+ incentive towards forest conservation explored such influence without comprehensive analysis of the distributional aspects of the benefits that would be generated from carbon trade.

It is against this background that this study is carried out with the aim of investigating how various incentives can facilitate forest conservation to reduce emission as well as improve rural livelihood and biodiversity conservation. Specifically, this study assesses how revenues from the sales of forest carbon credits through the REDD+ mechanisms and other related benefits can effectively benefit communities from engaging forests conservation. The findings from the study will create awareness among the stakeholders on how income from the sales of REDD+ carbon credits would be beneficial and distributed among various stakeholders to positively influence their behavior towards forest conservation. This would, in turn, contribute to the efforts of mainstreaming climate change impacts into the National Strategy for Growth and Reduction of Poverty (NSGRP) in Tanzania and of the attainment of Millennium Development Goals (MDGs), as well as the contribution of these efforts to the National REDD+ strategy.

1.3 Research Objectives

1.3.1 General objective

The general objective of the study was to assess the potential of carbon trade as an economic incentive in reducing carbon emissions through Community Based Forest Management (CBFM) to curb the problem of climate change.

1.3.2 Specific objectives

The specific objectives were:

(i) To assess REDD incentives for forest conservation in the local communities

(ii) To value carbon and other forest products; and their livelihood impacts on the local communities; and

(iii) To evaluate the distribution of income/benefits among different actors in the value chain of forest products between communities with and without REDD intervention.

1.4 Research hypotheses

(i) Carbon trade has the potential of acting as an economic incentive in forest conservation among the local communities and improve their livelihoods;

(ii) The distribution of income and other benefits generated from forest products varies significantly between communities “with” REDD interventions and those “without” REDD interventions

1.5 Research question

(i) CBFM contribute to the reduction of carbon emissions and enhancement of rural livelihoods through utilization and sale of forest products?

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Conceptualization and Operationalization of Terms

This subsection defines different terms used in the study. The definitions are based on how different authors defined them and how the study used the terms.

2.1.1 Carbon credits

A permit that allows a country or organization to produce/emit a certain amount of carbon and that can be traded if the full allowance is not used. Credits are awarded to countries or groups that have reduced their green house gases below their emission quota.

2.1.2 Carbon trading

It is a trading system for countries, companies and individuals designed to offset carbon emissions from one activity with another, whereby those who cannot meet their emissions goals may purchase credits from those who surpass their goals. This study takes carbon trading to mean a market based mechanisms that allow countries which emits less amount of carbon dioxide to sell permission to those countries that emit a lot of these gases.

2.1.3 Deforestation

According to the UNFCCC Decision 11/CP.7, deforestation is defined as a direct, human-induced conversion of forested land to non-forested land (UNFCCC, 2011). This study adopts deforestation to mean the whole process of conversion of the forested land

into non-forested land. This includes the immediate human activities such as frequent cutting of trees and frequent grazing that cause deforestation.

2.1.4 Forest degradation

According to IPCC, degradation is defined as a direct, human-induced, long-term loss (persisting for X years or more) or at least Y% of forest carbon stocks and forest values since time T and not qualifying as deforestation (UNFCCC, 2005).

2.1.5 Mitigation

Means lessening the impact or degree of something undesirable and which has a negative impact on something else; for example, green house gases that have been proven to have a negative impact on the atmospheric condition. According to the current study, the concept is used to solely mean prevention of these greenhouse gas emissions from a source, for example carbon dioxide from burning fossil fuels, and deforestation.

2.1.6 Participatory Forest Management

Is a strategy to achieve sustainable forest management by encouraging the management or co-management of forest and woodland resources by the communities living closest to the resources themselves (MNRT, 2008; URT, 2010). The study looks PFM as the way in which forest-adjacent communities share the powers rather than just benefits, while assuming owner/user rights and management of the resources

2.1.7 REDD

Stand for Reduce Emission from Deforestation and forest Degradation. It is a 2012 post Kyoto-Protocol mechanism that was introduced after Clean Development Mechanism

(CDM) to avoid deforestation that was taking place in the community. REDD mechanism was proposed to compensate developing countries for nation-wide reductions in greenhouse gas emissions from deforestation and forest degradation (Aquino *et al.*, 2009).

2.1.8 REDD+

The term is more than just REDD. REDD+ was introduced in Bali Action Plan in 2007. It covers five aspect of climate change mitigation; these are; Reduce emission from Deforestation, reduce emission from Forest Degradation, conservation of carbon stocks, sustainable management of forests, and enhance forest carbon stocks in developing countries. (Mbow *et al.*, 2009; Burgess *et al.*, 2009; Aquino *et al.*, 2009).

2.2 REDD Initiatives in Africa

There is a big potential for Africa to participate in the REDD+ mechanism. About 16% of the total world forest is found in Africa (REDDtz, 2010). REDD+ funding in Africa is estimated at US$ 30 billion; covering the countries of Ghana, Liberia, Madagascar, Tanzania, Zambia and the Congo Basin (Minang *et al.*, cited in Joto Afrika, 2010). However, though National REDD readiness activities are largely distributed in Africa, the continent has lagged behind in terms of demonstration activities with large number of demonstration activities concentrated in East Asia, the Pacific, and the Amazon (Cerbu, 2009). Several REDD pilot projects are found in Africa, examples include Nambhita Community Carbon Pilot Project in Mozambique and Kasigau Corridor REDD project in Kenya, the WWF REDD pilot project in Tanzania, which is operating in large scale.

In Tanzania, REDD is being piloted in Shinyanga region by the Tanzania Traditional Energy Development and Environmental Organization (TaTEDO) with the aim of sustainably managing 2 500 ha in Ngitili to consequently reduce 108 285 tons of carbon emission (Otysina cited in Joto Africa, 2010) in 4 years. Mpingo Conservation Development Initiatives (MCDI) and Tanzania Forest Conservation Group (TFCG) in Kiswahili known as Mtandao wa Jamii wa Utunzaji Misitu Tanzania (MJUMITA) are both implementing REDD pilot projects in Kilwa and Lindi districts respectively. These projects, as spelled out earlier, are partly aiming at promoting conservation and improving the livelihood of communities living close to forest areas through forest carbon management as an option for sustainable forest management for livelihood improvement. There are still more REDD projects across the country such as the Wildlife Conservation Society (WCST) that is currently implementing the REDD+ pilot project in Mbeya and Rukwa Region (REDDtz, 2010). Other projects include the WCST REDD+ project in Pugu–Kazimzumbwi Forest Reserves and the Sokoine University of Agriculture (SUA) or World Wide Funds (WWF) REDD+ project being implemented in various parts of the country including Kilwa. Of particular interest to this study is the REDD+ pilot project being implemented by MCDI in Kilwa. The area has been of interest because of it experience in deforestation that is taking place, therefore threatening the environmental as well as the economical condition of the community. This has been so due to increase in temperature of the area causing draught on the area, and reduction of rainfall, lowering agricultural production of an area.

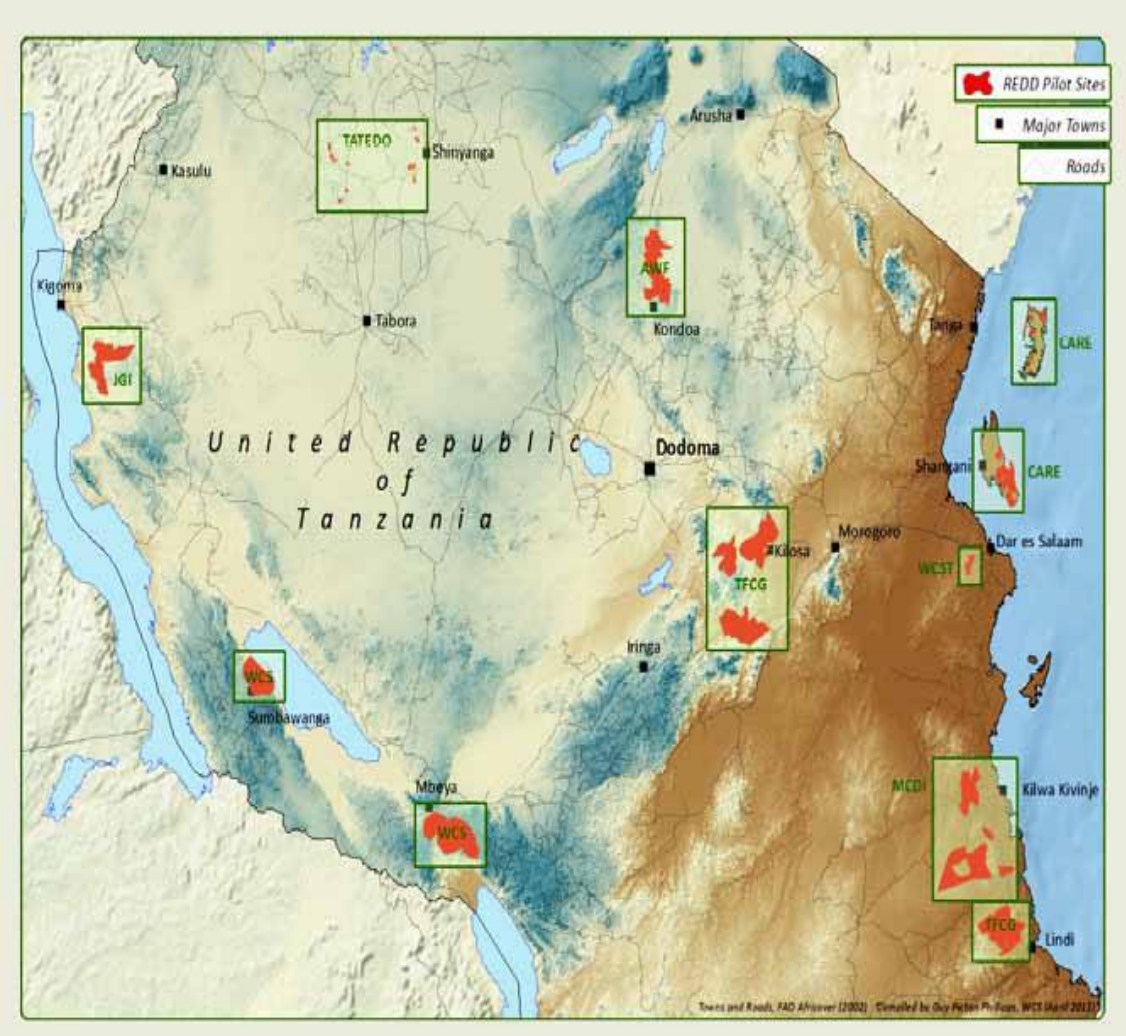

Figure 1: Map showing REDD pilot project in Tanzania.

2.3 Participatory Forest Management (PFM) in Tanzania and its significance to REDD

A study by FAO (1992) found that management of forests by forest department without a significant involvement of local people in managing them is ineffective. Tanzania has been a world leader in the development of participatory forest management approaches (Munishi, 2011). About 13% of the total forest land are under PFM in Tanzania (Munishi, 2011; URT, 2008). Therefore, PFM in Tanzania is increasingly seen as a strong foundation for developing a national REDD's strategy (TFCG, 2009; MCDI, 2010). PFM in Tanzania includes Joint Forest Management (JFM) and Community

Based Forest Management (CBFM) approaches. Under JFM, the forests adjacent to the communities together with the government (either local or central) share the responsibilities and returns among them. Management takes place mainly on reserved land such as National Forests Reserve (NFRs), and Local Government Forest Reserve (LGFRs). Under CBFM approach, villagers take a full ownership and management responsibilities for the area of forest declared by the village and the government as a Village Forest Reserved (VFR). Under the approach, villages gain full rights in the harvest of forest products and these are exempted from local government taxes (Blomley *et al.,* 2004).

Currently, about 11 to 13% of the forests land, which is equivalent to 3.6 to 4.1 million ha out of an estimated 33.5million of the forested land are managed under PFM, providing valuable opportunities for REDD implementation in over 2 320 village in Tanzania (Munishi, 2011; Otsyina *et al.,* 2008; Blomely, 2006; URT, 2001). As shown in table 1, over 863 villages covering an area of 1 777 000 ha of forest land are operating under JFM and over 1 457 villages covering an area of 2 345 500 ha are operating under CBFM model (URT, 2008) (Table1).

According to Bamboo, cited in Joto Afrika, 2010, the forest managed under PFM, especially under CBFM, was found to have a greater potential of reducing emissions; hence the conclusion that REDD should be mainstreamed under PFM framework.

Table 1: PFM adoption in Tanzania

PFM	**Area Covered (ha)**	**No of Village**
CBFM	2 345 500	1,457
JFM	1 777 000	863
Total	**4 122 500**	**2320**

Source: URT, 2008

In addition to its objective of improving forest management in Tanzania PFM focuses on improving the livelihood of the people living close to the forest by permitting them to sell as well as utilizing the forest products and generate income (IRA, 2009). According to the study done in Iringa district by African Wildlife Foundation (AWF) where the CBFM model was used, an assessment of the forest income showed an increase in financial assets. For example, the income increased from USD 540 per year per person in 2002 to USD 720 per year per person in 2005. In Shinyanga, a total monthly income of USD11.7 per person from *Ngitili* was observed, and this is far above the average consumption of USD 7.1 per month per person in rural area of Tanzania (Blomley and Iddi, 2009). Nshubemuki (2009) investigated the impact of JFM on people's livelihoods and found that each household received a sum of 310 329 TAS in 2007 from the sales of charcoal, firewood, poles, agricultural crops, and tree seedlings from forests under JFM approach.

2.4 General Land vis-à-vis Village/Community Forest land

2.4.1 General forest land

Though protected under the Forest Acts of 2002, in practice management of general land almost does not exist. This makes them consider these forests as being under open access regime as they are easily accessible for various uses. As a result, these forests are subjected to conversion to other land uses such as shifting agriculture and settlements; sometimes such forests suffer from forest burning. As Bromley (1992) argues, "everybody access is nobody's property", forests under open access regime, means there is no security of tenure or user right. Monela and Kaoneka (2000) observed that these forests account for 70% of the natural forests and woodland in Tanzania. Therefore, the control of these forests is of great importance as they provide valuable benefits to the

community. PFM is considered to be the best mechanism for controlling them in Tanzania, specifically under CBFM (Kajembe *et al*., 2003; Luoga *et al*., 2005).

2.4.2 Village/community forest land

These forests are locally managed by the community (Wily, 1998). They include forests managed by the village government, or a group of community members for various ritual activities. According to Ylhaisi (2000), these forests have high potentials for achieving sustainability as they are protected by the communities themselves, hence rendering the destruction of such forest by the community minimal. People are not allowed to enter these forests without purpose. Community approach to managing the forests is beneficial because of the lack of sufficient manpower to manage the forests from the side of the government and increasing population that aggravates the situation.

2.5 Biodiversity Conservation through Community Participation

Biodiversity conservation can be seen as the whole process of removing any actions that tend to destroy biodiversity and ecosystems. According to McNeely (1997), the forest authority should leave conservation matters to the community to achieve mutual cooperation whose objective is to enable local communities manage the diversity of their local system and ensure its sustainable productivity.

Community participation is one of the key ingredients of empowering the community. It is then critical that community success is achieved in conservation (Reid, 2000). Community participation is defined differently by different authors.

According to Kisanga (2011), the term community participation in the context of PFM refers to institutional arrangements in which different parties that are interested in

participating in the conservation and management of the forest resource are involved in its conservation. WWF (2011) provides a broader explanation by saying that participation by local communities is an important step for identifying the values and needs of different stakeholders, especially those who are usually excluded from decision making, such as village communities. Participation is also a major factor contributing to the success of community-based natural resource management. While contributions by local stakeholders may differ from those of other stakeholders, all of such contributions are equally valid and necessary for the project success. However, in order to influence local communities to participate in the conservation programmes, incentives plays a critical roles in fostering behavioral change towards successful participation (Lalika, 2006). For example, studies by Karky (2008) and Karky and Skutsch (2010) in Napel, revealed that conserving forest for carbon management while allowing extraction of other forest products provides better incentives to the community's participation in forest conservation. This is particularly because the community earns more income from the forest. Another study by Zahabu and Jumbiya (2007) reveals that a community could receive financial benefits of more than USD 6,500 annually from the sales of their forest carbon credits through REDD activities. This would, therefore, increase their participation towards biodiversity conservation. They further argue that apart from selling carbon credits only, selling other environmental services is also possible with sound forest management. Therefore, the better incentive package to the community would be to bundle different forest services and sell them together that would bring more values and tangible incentives to the local communities.

2.6 Incentives for Forest Conservation

Many rural Tanzanians are forest dependants in terms of income generating activities and acquisition of subsistence goods and services. If conservation is to take place, there

is need for behavioral change among the stakeholders as well as of modifying economic activities that cause deforestation through specific incentives (Emerton, 1998). According to Lalika (2006) socio-economic incentives are important forces for biodiversity conservation. These incentives can take various forms. FAO (1987) and Randall (1993), identify two types of social-economic incentives, namely market or monetary incentives. Market incentive include incentives paid directly in cash or in kind, and non-market incentives, include such things as education and training, study tours and short courses. In a study on general land of Ulunguru mountain, Lalika (2006) enumerates these incentives as access to marketing and storage facilities, provision of extension services, provision of tap water and household income.

2.7 Forest Conservation and Livelihood Impacts

The livelihood of most of rural communities depends on diverse products accruing from the forest. In Tanzania, local people have various types of uses for forests, including the production of timber, poles, firewood, charcoal, medicines, withies, ropes (fibres), live fences, carvings, and performance of traditional rituals (Luoga, 2000; Abdallah and Monela, 2007). According to Augustino (2006), over 80% of Tanzanians live in rural areas, forest resources are central for their livelihood after agriculture. This is because industries and the service sector, which could save as an alternative source of income through employment, experience slow growth and are poorly developed in the rural areas (World Bank, 2000).

Despite the fact that many people in Tanzania depend on forest to sustain their livelihoods, the overall value of the forest and timbers to the national economies is consistently under-valued (ibid). Timber trees are an important tool in addressing poverty issues for the marginalized, forest-dependent communities, by contributing to

livelihood outcomes, which, in turn, assist in improving food and health security, as well as overall people's well being (Falconer, 1997).

In a study by Kessy (1998) in East Usambara, forests were found to be very important to farmers in terms of food security. The study reveals that people carried out farming activities under the forest canopy where leaf littering was deep, leading to increased soil fertility and agricultural crop production. Also, forests were found to provide agricultural inputs for agricultural implementation, such as charcoal which needed by black smiths to make these inputs. Apart from its impact on agriculture, forests also provide direct food products such as wild fruits, mushrooms, wild meat, and wild vegetables that can be consumed for nutritional purposes or sold to obtain income.

The importance of natural forests to the Tanzanian economy has been increasing in recent years. Tanzania is expected to receive thousands of US dollars from the sales of carbon credits (Dominic, 2010). In addition, the products obtained from forest management contribute to household incomes which, in turn, are used to purchase food stuffs, hence indirectly contributing to food security.

2.8 Potential of Forest Managed For Carbon under CBFM to Act as Livelihood and Economic Incentives to the Community for Conservation

As briefly mentioned before, a few studies have investigated the potential of forest managed for carbon credit as livelihood and economic incentive for forest conservation. These studies have employed various methodologies in this attempt. Similarly, this study partly relied on some of these methodologies to investigate the incentives and their motives for local communities toward forests conservation. Such approaches include, but are not limited to, the ones described below.

2.8.1 Sustainable Livelihood Approach (SLA)

Many scholars describe *livelihood* in various ways. Heninger (1998) defines livelihood as adequate flows of food, stock, and cash to meet basic needs. However, the most commonly used definition is the one provided by Chamber and Conway (1992), who define livelihood as comprising capabilities, assets and activities required for a means of living. Ellis (2000), on the other hand, defines livelihood with minor modifications to the definition provided by Chamber and Conway by taking into consideration the issue of access mediated by institution and social relation that determine the living gained by an individual. In general, SLA is useful in investigating the contribution of forests to people's livelihoods as well as in enabling an understanding of the rights and access to forest resources in a broader context (Shimizu, 2006). The approach puts special emphasis on the linkages between the context, vulnerability, rural poverty and access to forest/tree resources (Baumann, 2006; Shimizu and Trudel, 2006).

The impact of forest on the livelihood can be measured through livelihood indicators (TANGO, 2004). According to TANGO, these indicators include those used by Non Governmental Organization (NGO) and FAO, such as food security, shelter, education, health, community participation, and access to the natural resources.

A number of studies (e.g. Nigel *et al.*, 2002; Smith *et al.*, 2002; Milne *et al.*, 2003; Jindal, 2004; Miranda *et al.*, 2004; and Bass *et a.*,. 2010) have adopted the approach to investigate the impact of forests to people's livelihoods by further comparing distinct levels of assets such as natural, social, human, physical, and financial capital. Similarly, this study adopts the sustainable livelihood model by comparing the availability of these assets in the community that are under CBFM and those not in the CBFM approach over time.

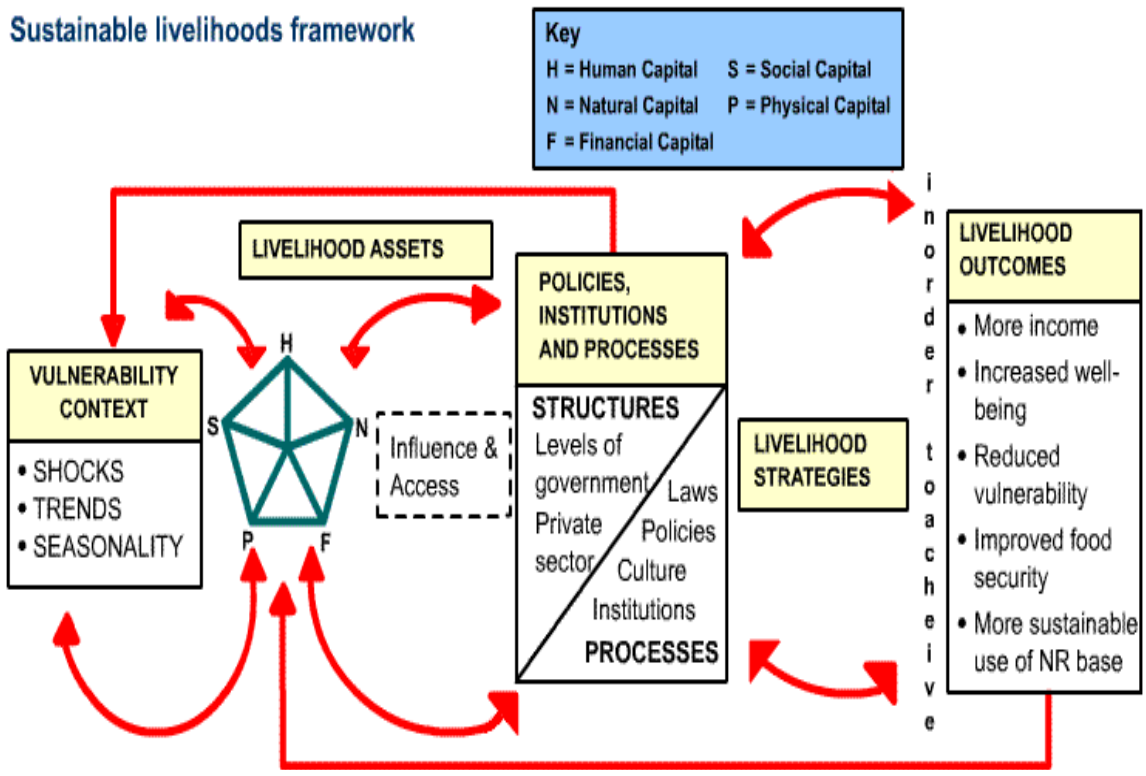

Figure 2: The Sustainable Livelihood Approach Diagram

Source: DFID (2000)

2.8.1.1 Description of the components of the SLA model

Vulnerability Context

These include external shocks, trends, and seasonality of activities that threaten sustainability of livelihoods, which include changes in the price of forest products, death of a member of a certain forest group.

Livelihood assets

These are the things on which people build their livelihood. They include *natural assets (N)* for example, land, forests; *physical assets (P)* for example transport, shelter, communications; *financial assets* (F) for example, savings, supplies of credit, pensions; *human capital* (F) for example, skills, knowledge, ability to labour and good health; and

social assets for example networks, membership of groups, access to wider institutions of the society.

Transforming Structures and Processes

These include policies and institutions both formal and informal, which regulate the way people access and use assets for example acquisition of a license to extract forest products, as a member of a forest group.

Livelihood Strategies

These denote a combination of activities that people do/undertake in order to achieve their livelihood goals; and they include productive activities, investment strategies, and reproductive choices.

Livelihood Outcome

These include improvement in the standard of living and reduced vulnerability, in this case income of the people and increased wellbeing.

2.8.2 Valuation of economic benefits of forest products

2.8.2.1 Contingent Valuation Method (CVM)

The method falls under stated preference approach, for it asks people directly to state their value rather than inferring values from actual choice as a revealed preference (Kadigi, 2006). It involves asking people directly as to how much they are willing to pay (WTP) for specific environmental good and services (Pearce and Turner, 1990). WTP shows the importance of one's preference for environmental quality, which results from the influence of several factors such as individual's income, gender, cultural preferences,

education, or age (ADB, 1995). In some cases, people are asked for the amount of compensation they are willing to accept (WTA) to give up specific environmental good and services (Kadigi, 2006). The CVM is used for assigning monetary value to non-monetized values of environment services (Randall, 1993).

The CVM has successfully been used in a number of studies to estimate the economic value of environmental resources using the WTP approach (Gunawardena, *et al.,* 1999; Barber *et al.,* 1997; Chloe *et. al*., 1995; Whittington and Saran, 1994; and Atlas *et al*., 1993).

2.8.2.2 Conventional Market Price-Based Approach

The method is used when the market price of the environmental good is known. The environmental goods are described in a physical term (quantities) and the economic values are estimated using the commercial market prices at which they are bought and sold (Dixon *et al.*, 1986; Pearce *et al*, 1994; Kadigi, 2006). However, market distortions such as those brought about by government interventions (e.g. taxes, exchange rate or interest rate) should be corrected through appropriate conversion factors (Dixon *et al.*, 1986; Pearce *et al.*, 1994). The approach is further sub divided into two categories

a) Residual Imputation Methods

The method has been widely used to find an economic value of resources such as water. This is mostly used in irrigated agriculture (Hussain *et al*., 2001; Renwick, 2001; Young 1996). The derivation of the residual value is based on the two principles: (i) Competitive Equilibrium, which requires the prices of all resources to be equated to the returns at the margins, and (ii) the Total Value of Product (TVP) to be divided into

shares so that each resource is paid according to Marginal Productivity and the TVP is completely exhausted.

b) Change in Net Income Method.

The method is derived from the Residual Imputation method. It is commonly used to assess the value of a resource when that resource is used as an intermediate good (i.e. used as an input to produce another good). Therefore, the value of the resource is derived from the change in the revenue of the associated enterprises outputs. This approach asserts from the theory of products which state that the value of an intermediate good is the net economic contribution of that good to the value of the final output.

2.8.3 Distribution of the benefits/income obtained from forest managements

The sub-section explain how benefits obtained from the forest management are distributed among different actors of forest products. The aim of the analysis is to see how much the benefits the producers of forest products who are also the villagers conserving the forest gets compared to other actors such as the processors and wholesalers. This will help make better strategies that will also benefits the producers so as to influence to conserve forests.

2.8.3.1 Value chain analysis approach

The concept of a value chain is defined differently by different authors. Kaplinsky and Morris (2001) define value chain as a range of activities required to bring a product or service through phases of production to a final consumer. Similarly, Gibbon (2001) describes value chain as a chain of activities where products pass through different

stages of the activities and at each activity the product gains some value. Mazula (2003) defines value chain as a value addition process, whereby a product is processed and adds value as it goes along the chain to the consumer.

Value chain analysis does not only enable the understanding of actors and their relationships alone, but also the distribution of benefits (Mbiha, 2008). In the analysis, the main issue is the measurement of returns (profit margin/gross margin) at every node in the chain (Mbiha, 2008). According to IIRR *et al* (2006), some individuals may grow richer than others if they are powerful in the chain. For example, processors are often powerful players that can force down the prices of the products from their suppliers while the producers are often at a disadvantage in the chain as they produce on an individual basis causing them to have little bargaining power. There are different tools for analyzing the distribution of income along the chain, some of them being gross margin and profit margin.

(i) Gross margin analysis

The margins are calculated on the basis of estimated costs and selling prices per unit of sale and the volume of the product sold (Scott, 1995). It is simply the difference between the revenue obtained and the sum of all the costs incurred in the production process with the aim of determining the return to every actor at various nodes (Kabuje 2008; Mbiha, 2008). The approach makes use of variable costs rather than fixed costs. Therefore, gross margin for the activity is the difference between the gross income and the variable costs incurred (Cosmas, 2008; Mahenga, 2008).

(ii) Profit Margin analysis

The profit margins are calculated from the total revenues less the costs associated with transportation, storage, and equipment used of a product. It was the best mechanisms for indicating who influences the value chain, as it is believed that the more the profit one gets the more influence one gets or has in the chain (cosmas, 2008; Mbiha, 2008)

2.9 Costs Associated with Implementation of Carbon-offset Project at Community Level

An understanding of the costs incurred by local communities to participate in REDD initiatives is necessary for ensuring the viability of REDD+ implementation (Long, 2001; Karky *et al.,* 2010). Lubowski (2008), Dangi and Acharya (2009), and Rasul and Karky (2007) recommend three main costs associated with the implementation of REDD projects for carbon offset, which are further divided at local and state levels. These costs include implementation costs, opportunity costs, and transaction costs. Accordingly, implementation costs include such costs as the use of additional guards to combat forests fires, registration costs by the community, designing and managing the program, informing communities about the programme, and assisting communities to participate, which are mainly incurred by the government. Karky and Skutch (2010) identify the real opportunity cost to CBFM as the loss of the use of forest products such as fuel wood, timber, fodder and grass, and a change of land use. Dangi and Acharya (2009) describe transaction costs further as brokerage, verification, certification, insurance, and recording. Rasul and Karky (2007) further include measurements and monitoring costs to transaction costs which can be reduced by training the community to conduct the activities.

2.10 Conceptual Framework

REDD mechanisms were thought to be the most significant and incentive providing forms for community participation in forest management (UFCCC, 2007), and which have an impact on people's livelihood. Through REDD, communities are able to meet their subsistence needs from the forests, plus additional revenue from carbon management that can be registered. The outcome is increased forest conservation at community level as well as increased forest enhancement thus contributing to increased potential benefits from carbon trade; improve people's livelihood and reduce carbon emission.

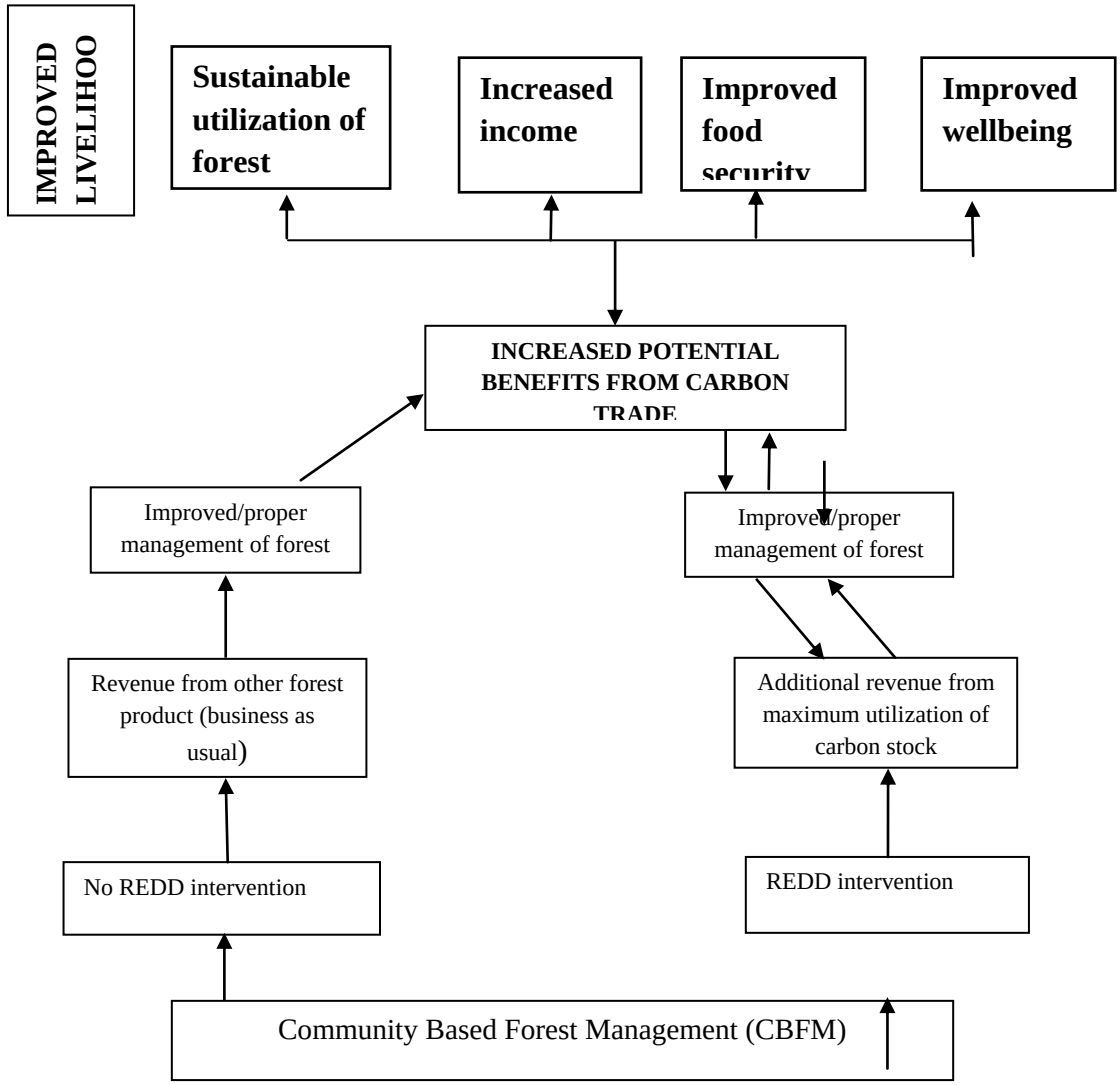

Figure 3: Conceptual framework model used in the study.

CHAPTER THREE

3.0 METHODOLOGY

The chapter describes different materials and methods used by the study to collect and analyse the data collected.

3.1 Description of the Study Area

The section describe where the study site is found, its administrative units, population statistics, its climatic characteristics (rainfall and temperature), forest nature and the economic activities that are done in the area.

3.1.1 Location

Kilwa is a district located in Lindi Region in Southern Tanzania. It lies between latitudes $8^0$20 to $9^0$56 and longitudes $38^0$36 to $39^0$50 East of Greenwich (URT, 2009). It borders Rufiji district to the North, Coast region, Lindi and Ruangwa districts to the South, Liwale district to the West and Indian Ocean to the East. The total district area is 13 347.50 square kilometers (1 334 750 ha) of which 12 125.9 square kilometers is surface land and 1 221 52 square kilometers is the ocean. It is administratively divided into 6 divisions, 20 wards and 97 registered villages. Out of the 97 villages, 3 villages were chosen for the study. These include Mchakama (REDD village), Liwiti (CBFM village), and Migeregere (Non-REDD and Non-CBFM village).

Kilwa was chosen for this study because of its involvement in Participatory Forest Management (PFM) conducted through MCDI, which is a REDD pilot project. In addition to that is the proximity to Dar es Salaam, and its experience in deforestation.

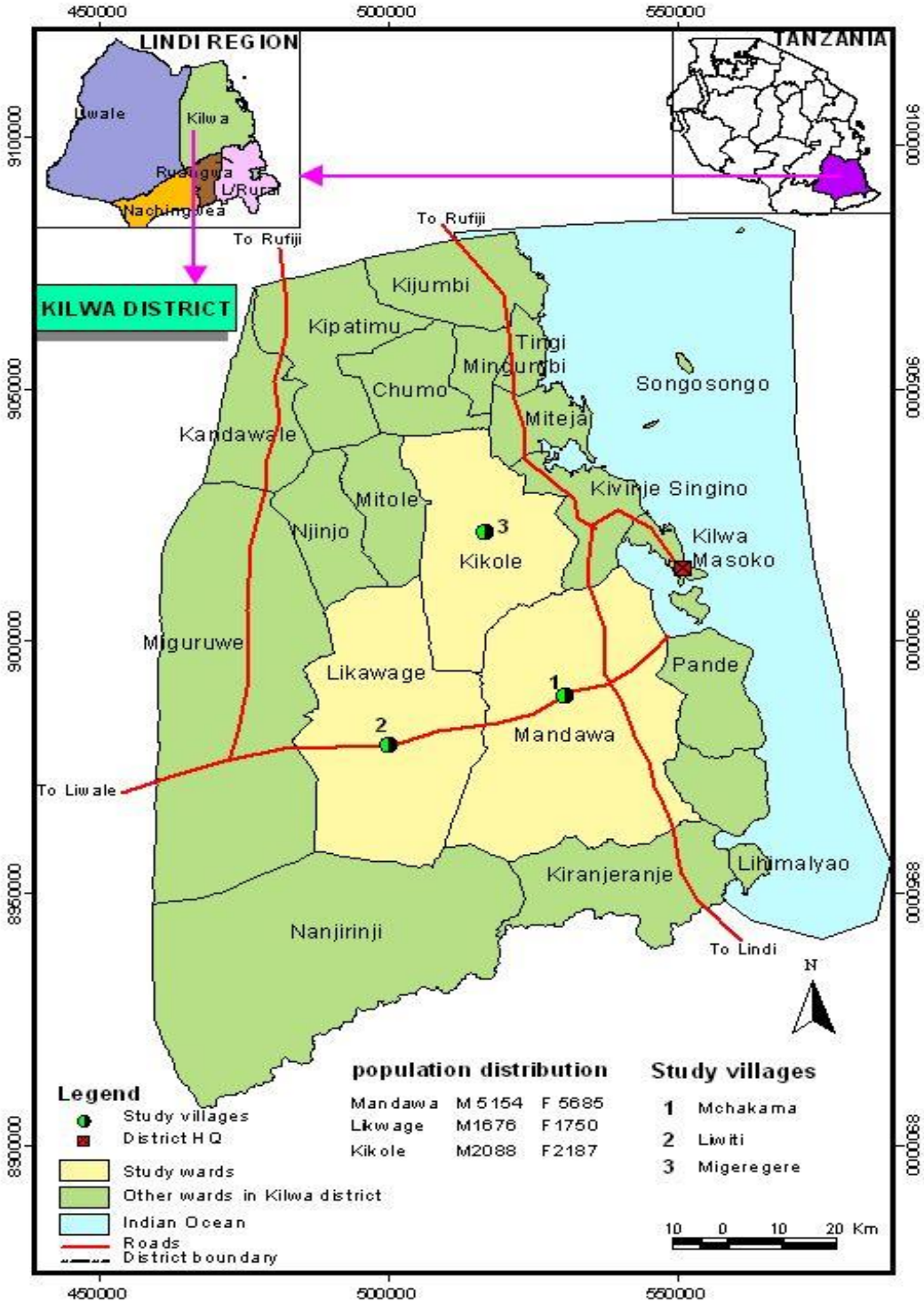

Figure 4: Map showing location of the study villages in Kilwa district, in Lindi region drawn by GIS.

3.1.2 Population

According to NBS (2012) Kilwa District has a population of 190 744. Among them 91 661 are males and 99 083 are females. Table 2 shows population distribution in the wards where the studied villages are found.

Table 2: Population profile of the studied wards in the study area

Wards	Population	Male	Female	Households
Mandawa (Mchakama)	13 192	6 404	6 788	501
Likawage (Liwiti)	3 569	1 714	1 824	622
Kikole (Migeregere)	4 294	2 082	2 212	945
Total	**21 055**	**10 200**	**10 824**	**4 032**

Source: NBS, 2012

3.1.3 Climate

Kilwa has a coastal climate that is hot and humid with the average temperature ranging from 22^0C to 30^0C. Humidity is as high, ranging between 98% and 100% especially in the rainy season. On average, the district receives 800-1400 mm of rainfall annually, and this varies with location. The north of Kilwa Masoko receives 1 000 mm to 1 400 mm per year while the southern part receives less than 800mm to 1 000 mm per year. The long rain *(masika)* starts from mid March to May and the short season *(vuli)* starts from late October all the way to December.

3.1.4 Economic Activities and Forest Resources

The economy of Kilwa District hinges on crop production, specifically maize, rice, cashew nuts, sesame, and coconuts, as well as livestock keeping specifically small stocks such as goats and poultry, and fishing. There are some industrial activities to a very limited extent. Like in most districts in Tanzania, Kilwa residents and their District Council draw a substantial amount of income and food from small holder cultivators.

Forest reserves in Kilwa district cover a total area of 207 590 ha. This is 15% of the districts total land. Out of this, 15 410 ha are mangrove forest reserves. The reserves consist primarily of miombo woodlands, which are endowed with log gable tree species.

3.2 Sampling Procedure and Sample Size

Purposive sampling was employed to select three villages in the study area. One village that is engaged in the REDD+ pilot project (Mchakama), and one village that is engaged in neither REDD+ pilot project nor PFM project (Migeregere), and one village that is in PFM project only (Liwiti). The criteria for selection were based on differential success in PFM practices, and their experience in deforestation. Random sampling was used to select households from the studied villages. A sample size of 120 households was selected to obtain socio-economic data and 40 households for identifying livelihood changes in the villages; 20 from Liwiti (CBFM village) and 20 from Migeregere (Non-CBFM village). Within the same sample, 45 households involved in the harvest of forest products for sale were selected for value chain analysis. The data capturing tools were household questionnaires (mainly semi structured) and interview guides.

3.3 Data Collection

Socio-economic data were collected using semi-structured questionnaires. Both primary and secondary data were collected. Primary data were collected in the field from households and other community members. Semi-structured interviews with key informants/stakeholders were also carried out. Given the limitation of primary data collection, the secondary data served as complementing sources. Secondary data were collected from various sources, such as natural resource offices MCDI, an organization dealing with REDD+ implementation in Kilwa district, books, and published government documents.

Primary data included household characteristics, such as age, gender, education level of the households, income from forest products, incentive of REDD+ project participation, changes in the household assets such as physical, social and human assets. The data also included the distribution of benefits villagers gets from forest conservation. Secondary data were amount of carbon generated in ton per ha, actors of carbon distribution chain and the costs incurred on REDD+ implementation.

3.4 Methods of Data Collected and Type of Data Collected by Specific Objective

3.4.1 Identification of factors/incentives for community participation in REDD+/CBFM activities

Data were collected based on whether or not the selected households are participating in REDD+/CBFM activities as well as their incentives for participating. A semi- structured questionnaire was used. The incentives mentioned included the benefits they expect to get or those which they were already benefiting from participating in REDD+/CBFM pilot activities as well as social factors such as age, gender, and education and which influence households' participation in the REDD+/CBFM activities.

3.4.2 Quantification and valuation of carbon stocks and other forest products in CBFM and their impacts on local community's livelihood

Data on the amount of carbon stored were obtained through literature review, where an average carbon density (157t ha^{-1}) for forests under CBFM in the coastal region (FBD, 2007) was obtained for using in quantifying forest carbon in the studied villages. Data on the amount of forest products were obtained from households surveys. Each household was asked to mention the quantity of each forest product utilized per month/year. The price of carbon which averaged to TAS 27 720 (USD17.5) was the prevailing market price set in the world market (Bhaskar *et al.,* 2010;

www.pointcarbon.com). The prices of other forest products were based on local markets. Households were asked to give the sales value of each forest product as how it would be sold in the market if they were to buy them or sell them in the market. The data on the cost of carbon management were collected from relevant organizations such as Mpingo Conservation Development Initiatives (MCDI).

Data on livelihood assets included changes in physical, social, capital, human, and financial assets resulting from selling forest products under CBFM/REDD+ implementation. User's access and right of ownership, and community participation were as well identified among the forest users. Both structured questionnaires and Participatory Rural Appraisal (PRA) technique, such as Focus Group Discussion (FGD), were employed in the data collection exercise

3.4.3 Assessment and comparison of the distribution of margins among actors in the chain of forest products between communities with and without REDD+ intervention

The data collected include quantities of the forest products collected and sold in the community by actors in the chain and their respective costs. Under REDD, data of all quantities of forest products and carbon stored were collected while under non-REDD scenario data on carbon were not included. Household questionnaire was used to construct the value chain of the forest products. Interview with key informants was carried out to obtain the value chain of carbon. Since most of the villages are still at the initial stages of REDD implementation, data on carbon chain and respective costs of carbon management were obtained from the baseline information given by implementing agency, in this case MCDI.

3.5 Data Analysis

3.5.1 Identification of REDD+ incentives in the community

To establish the relationship between factors/incentives for forest conservation and the decision of the household to participate in the REDD activities; logistic regression/logit model was used. According to Fannuel (2002), the model is useful for situations where one wants to predict the presence or occurrence or absence/non occurrence of a characteristic or an outcome based on the values of a set of predictor variables. Logit model was seen to be suitable for the analysis because it does not make assumption on whether independent variable is continuous or not (Peng *et al.,* 2002). The software used for the analysis was SPSS. The model used is specified as;

$$\mathbf{Y_i = 1/1+ e^{-z}} \quad \text{.....(1)}$$

Where;

$$Z = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots\ldots + \beta_n X_n \text{.....(2)}$$

$\mathbf{Y_i}$ = Probability of the i^{th} household to participate in the REDD+ activities. This was whether one participate in REDD+/CBFM activities or not, where a code of 1 was given to those participating in REDD+/CBFM activities and Code of 0 was given to those not participating in either of the activity. Therefore, in this case, the binary variables were used to depict the probability of the respondent's participation. In some cases, continuous variables were used as dummy coded depending on the type of analysis.

Dependent variable took the following dummies;

Probability of i^{th} household to participate in the REDD activities = 1

Probability of i^{th} household not to participate in the REDD activities= 0

β_0 = The model intercept (shows the probability of the household to participate given no facilitating factor for participation in the REDD activities).

Xn = Independent variable. Both binary variables which takes the value 1 and 0 (e.g. forest management incentives such as carbon payment in the future, sustainable timber harvests, and training), continuous variables (e.g., education, income from forest products, income from agriculture and categorical data (e.g. age) were used as independent variables.

βn = A Vector of the independent variable showing marginal effect (positive or negative) of a unit change in the independent variable on the dependent variable (probability/likelihood of participating in REDD+ activities).

The independent variables included in the model:

X_1 = Age of the respondent is important in social analysis. It is seen as the function of knowledge and experience as well as measure of maturity of an individual. The age also has an influence on productivity and management of resource. Age was assumed to have a positive sign of estimate beta (β)**.** That is, an increase in age, increases the potential for participation in REDD+/CBFM activities. However, it is expected that the increase in participation can vary by age group

X_2 = Education level was also thought to be important in influencing an individual into participating in the REDD+/CBFM activities. It was seen as a tool for transferring of knowledge and experience. It tends to create awareness, self reliance, stimulates self-confidence and brings positive attitude towards forest conservation. As a result, it was assumed to stimulate participation in the REDD+/CBFM activities since educated people have more access to technical information and the expected sign of β would be positive.

X_3 = Income from forest based activities is an indication of the value and wealth of the forest. It was assumed that the revenue accrued from forests increased motivation of the household to participate in the REDD+/CBFM activities. Therefore, a positive sign of estimated β was assumed.

X_4 = Income from agriculture, both livestock production and crop production. It was assumed that an individual with a high income from other sources such as agriculture would have very low probability of participating in REDD+/CBFM activities. Also the possibility of these individuals supporting REDD+/CBFM is very low as they would be worried of their agricultural land being taken up or tied to REDD+ activities. Therefore the variable was assumed to have a negative sign of an estimate β**.**

X_5 = Carbon payment in the future. It was assumed that the expected income from the sales of carbon stored in the forest that is managed by the community as the result of management and conservation activities would increase the morale of an individual to participate in REDD+/CBFM activities. A dummy value of 1 for an individual motivated by carbon payment in the future and 0 if otherwise was used. Hence the variable was assumed to have positive influence.

X_6 = Sustainable timber harvest. It was thought that if forests were conserved the community can harvest timber in a sustainable way. For that case, the community can experience sustainable benefit such as income from timber harvests. The variable was assumed to have positive influence on people's participation on REDD+/CBFM activities. A dummy value of 1 if an individual is motivated by the factor and 0 if otherwise was used.

X_7 = Training from REDD+/CBFM project. Human resource development is one of the factors that enhance livelihoods development for a society. It was assumed that a household which received training from the project would participate in REDD+/CBFM activities more effectively compared to an untrained household. Therefore, a dummy value of 1 for an individual who is thought to have benefited from the training received through REDD+/CBFM pilot project and 0 if otherwise was used.

The hypotheses tested were as follows:

Ho: $\beta = \mathbf{0}$ this shows that the regression coefficients of the independent variables are equal to zero, meaning that there is no effect of the independent variables (social and economic factors/incentives) on the dependent variable (Participation of an individual in REDD+/CBFM activities)

The goodness of fit of the model was tested by looking at Chi-square test. By using chi-square test the significance level of the model is tested at 5% probability level. The less or equal the p-value than 5% the more the goodness of the fit of the model. The magnitude of log likelihood ration test denoted by -2LL value also determines the goodness of fit of the given data set. The smaller the value of -2LL the better the goodness of the fit of the model (Norusis, 1990; Pampel, 2000). Another test is the Hosmer–Lemeshow test which looks at the value of significance of the chi-square on the test; the greater the value of significance than 50% (0.5) the more the goodness of the fit of the model (Bewick, *et al*, 2005). To test how much independent variables explain the dependent variables, the coefficient of determination (Pseudo R^2 -*Nagelkerke* R^2) was used. According to Bewick, *et al*, 2005, *Nagelkerke* R^2 is a more reliable measure of the

relationship between dependent variable and independent variables and it is the most reported measure of the R-square. It is always higher than *Cox and Snell*. Greene, (2000) and Gujarati (1995) explain further that R^2 is used to test how much the variation of dependent variables is explained by independent variable: the higher the coefficient of determination the stronger the model.

According to Menard (2005), the use Wald statistic for small samples this is often unreliable. For data that produce large estimate of coefficients, the Standard error is often inflated resulting into lower Wald statistic, and therefore the explanatory variables may be assumed to be unimportant in the model. In this case, no Wald statistic was used to determine the significance of the coefficient as a relatively small sample was used in the analysis.

3.5.2 To value carbon and other forest products

To analyze the economic values of carbon and other forest/ tree products, the conventional market price-based approach was used in which the amount of CO_2 equivalent stored per hectare/forest products was multiplied by their respective market prices. The software used for this analysis was Microsoft Excel.

The following formulae used by Adams and Cavana (2009) to value carbon was used,

$ = carbon price x tones avoided CO_2 equivalent

Same formula was applied for other forest products,

$ = prices of the products x quantity of the products

To get the net benefit the costs were deducted from the revenue obtained (a cost benefit analysis

Net income = Revenues - costs

The procedures which were used to quantify each of the forest products are discussed as follows:

(i) **Carbon**

The data were collected from literature review, where the average amount of carbon produced by the forests under CBFM approach per hectare was found. The amount was used to quantify the amount of carbon in the studied villages given the hectares of the villages. The hectares for each studied village were obtained from relevant organizations which deal with villages in forest conservation, for this case MCDI. The market price for carbon was also obtained from the literature review

(ii) **Firewood**

Each household was asked to state the amount of head loads of firewood consumed and sold per year. They were then asked to assign the value of one head load of firewood utilized/sold assuming those head loads were to be sold or bought in the market. The unit used was head loads.

(iii) **Charcoal**

Majority of respondents in the study area are involved in charcoal making for income generation as well as for domestic consumption. The respondents of this nature were also asked to value the amount of charcoal consumed and sold. The unit used to establish the quantity was a bag of 50 kg.

(iv) **Bush meat**

The respondents of this nature were asked to value the amount of meat they consumed. Those who bought from the hunter were asked to state the price of the meat and those

who hunt for themselves were asked to value the meat assuming they were buying it from the market. The unit used to value the bush meat was Kg.

(v) **Wild vegetables**

The respondents who consumed wild vegetables were asked to quantify the amount of wild vegetable consumed per month/year in terms of piles. After quantifying they were asked to state the value of each pile of wild vegetables. Different piles of different vegetables were found to have different prices but the prices were more or less the same, ranging from TAS 300 to TAS 500.

(vi) **Wild fruits**

Each household found to consume or sell wild fruits were asked to establish the quantity of the wild fruits they consumed and sold per month/per year. Then, they were asked to assign the value of each pile of wild fruits consumed or sold. The unit used to determine the value of the wild fruits consumed and sold was piles.

(vii) **Honey**

Some respondents were found to be involved in beekeeping activities. These respondents were asked to quantify the amount of honey they get per month/year from the forest and then they were asked to value this product per liter.

(viii) **Traditional medicine**

Some respondents were using traditional medicine for curing some diseases. Most of these were those who did not have money to go to hospital. Some were found to engage in the business of selling these medicines. Both types of respondents were asked to establish the amount of medicine they consume or sell per month/year and to value the quantity depending on how they sell or consume. Some valued in terms of liters, some

in terms of bottles, others in terms of packet and others in terms of spoons. All these quantification had different prices.

(ix) **Building Poles**

Poles are commonly used for housing construction. There are two types of poles, split poles (Kongowele) and round poles (Majengo). The respondents were asked to quantify the amount of these poles consumed or sold per month/year and then to value these poles by giving the price per piece.

(x) **Mushrooms**

The ecosystems of Miombo woodland provide valuable and nutritious mushrooms. The respondents who consume these mushrooms were asked to establish the amount of mushroom in terms of piles they consume or sold, thereafter assigning the value to each pile consumed or sold.

(xi) **Withies *(Fito)***

These were also used as building materials. Most of these materials are used to build chicken or livestock shelters and some are used for building residential houses. The respondents who used these products were asked to state the quantity of withies they used or sold per year. The unit used was bundles. They were then asked to value each bundle of withies they sold or used for building.

(xii) **Ropes**

Some respondents extract ropes from the forest. These respondents were asked to establish the amount of rope they extract from the forest per year, and to value the ropes in term of piles.

(xiii) **Soil**

Soil is also believed to be the product of forests. Some respondent collect forest soils for sale or for building houses. The respondents involved in the activities were asked to quantify the amount of soil they obtain from the forest and to value the product. The product was sold in terms of 10 liters bucket of soil.

(xiv) **Thatch grass**

Thatch grass is used as roofing materials for most of the houses in the study area. Very few houses had roof constructed using corrugated iron sheets. Therefore, the respondents were asked to mention the amount of thatch grass they get from the forest per month/year. And those who cut grass for sale were required to do the same. They were then asked to attach monetary value to these thatches if they were to buy them from the market and for those selling the grass were asked to mention the price they sell per bundle.

3.5.3 To analyze the impact of CBFM on the livelihoods of rural community

To analyze the livelihood impact from the utilization and sale of forest products under CBFM/REDD+ and other benefits brought about by the project, the SLA was used where by household assets and their user rights and ownership were assessed. Two villages were selected, one practicing CBFM (Liwiti) and another not practicing CBFM (Migeregere), in order to compare the livelihood of the two communities. A sample size of 40 respondents was used, 20 from each village.

The question asked was whether CBFM/REDD+ has been able to provide some livelihood benefits to the community from the forest they conserved through selling these forest products and other benefits the project provided to the community.

3.5.4 To calculate and compare the margin of actors of forest products in REDD and non-REDD scenario

In analyzing the distribution of the margins among the actors, a value chain analysis was used in both REDD+ and Non-REDD scenarios. The value chain map was established. At every point of the node, the average Gross Margin (GM) was calculated for all the products to assess the distribution of the income at each level of the actors in both scenarios (REDD+ and Non-REDD+ scenario). In REDD+ scenario, the income from carbon was included at the producer level while in Non-REDD+, the income from carbon was not included. To test whether there was any significant difference in GM between the two scenarios T-test was employed.

The following Gross margin formula for forest products was used

GM = TR – TC (TVC)

Where:

GM = Gross Margin of traders/producers

TR = Total Revenue of traders/producers (selling price of a product* Quantity sold)

TC = Total Cost of traders/producer

TVC = Total variable costs

i. To get the net value of carbon under REDD+

Net value of the carbon = Gross value of the carbon – Total cost

Where:

Gross value = Price x Quantity

Total cost = (Implementation costs + opportunity costs + management costs.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Chapter Overview

The chapter is organized into six sections. The first section mainly presents the general information of the household characteristics and the second present their income generating activities. The last four sections are presented according to the specific objectives. In effect, the third section discusses the result of the logit model which looks at different factors/incentives motivating people to participate in the REDD+/CBFM activities given that they are benefit from the project. The forth section evaluates the expected income the community is likely to get from forest activities and from carbon if they decide to conserve the forest for carbon. The fifth section discusses the impact of the project (REDD+/CBFM) on the livelihood of the local communities. And the last section evaluate the analysis of the margins at various nodes of the forest production chain to understand the distribution aspect of income among the actors in the chain under REDD and non-REDD situation.

4.2 Social Economic Characteristics of the Study Population

The section discusses the age, gender, education level and occupation of the sampled respondents and their implication on the REDD+ activities participation.

Table 3: Distribution of household's characteristics by village

Social-economic characteristics	% Distribution of household characteristics by village in Kilwa District			
	Liwiti (n = 40)	Migeregere (n = 40)	Mchakama (n = 40)	Total (n = 120)
Age				
18 to 33	50.0	40.0	35.0	41.7
34 to 49	22.5	35.0	22.5	26.7
50 and above	27.5	25.0	42.5	31.6
Gender				
Male	67.5	59.0	70.0	65.5
Female	32.5	41.0	30.0	34.5
Education level				
Primary complete	62.5	67.5	62.5	64.2
Primary incomplete	17.5	7.5	2.5	9.2
Secondary complete	2.5	0.0	0.0	0.8
Adult education	0.0	2.5	2.5	1.7
Madras at	2.5	5.0	10.5	5.8
None	15.0	17.5	22.5	18.3
Occupation				
Farmer	97.5	87.5	97.5	94.5
Employed	0.0	0.0	2.5	0.8
Self employed	0.0	7.5	0.0	2.5
Retired	2.5	2.5	0	1.7
None	0.0	0.8	0.0	0.8

4.2.1 Age

Age is an important parameter in socio-economic analysis since different age groups perform different sets of activities in most societies. The study found that people in the age between 18 and 33 accounts for about 41.7%, with Liwiti having most (50%) of the respondents in this age group followed by Migeregere (40%) and Mchakama (35%). These are active groups with capability of participating well in forest conservation activities. Middle aged people, that is 34 - 49 years old, constituted 26.7% of the sample whereby about 22.5% of them were from Liwiti, 35% were from Migeregere, and 22.5% were from Mchakama. Those above 50 years old accounted for 31.6% of the total sample; of whom 27.5% of these came from Liwiti, 25% came from Migeregere, and 42.5% came from Mchakama (Table 3). According to Nkurlu (2002), age is usually a factor in explaining the level of production and efficiency. Therefore, mature people

with more resources, experience and authority are more inclined to try new technologies initiated in their vicinity.

4.2.2 Gender

The results presented in Table 3 below show that 67.5% and 32.5% of the sample from Liwiti were males and females respectively. In Migeregere, males and females constituted 59% and 41% of the sample respectively; whereas in Mchakama gender distribution was 70% males and 30% females. In total 65.5% of all the respondents from the study areas were males and 34.5% were females. This shows that mostly males were the head of the households in the study area compared to females. The few females (34.5%) who were head of household, were those divorced or living single with a family, or are widowed.

4.2.3 Education level

Education is perceived as being among the factors that influence individual awareness of good forest practices and it informs and creates the desire among individuals to learn more and seek resources and any other information needed to improve their well-being and use of natural resources sustainably.

The results below (Table 3) show that most (64.2%) of the respondents had completed primary school, 9.2% had not complete primary school, 0.8% completed secondary education, 1.7% attended adult education, 5.8% attended Madras and 18.3% had no education at all. In general, the levels of education were low causing most of them to engage in poor Agricultural practices leading to an increase in deforestation. Non completion of schools was a result of early pregnancies and early marriages for most of girls.

4.2.4 Occupation of the respondents

The results in Table 3 show that most (94.5%) of the respondents from all villages were farmers. And only 0.8% was employed in government organization such as school. About 2.5% were self employed in different businesses such as running Kiosks and 1.7% was already retired while the rest 0.8% had no jobs.

4.3 Economic Activities that Earn an Income to the Household in the Study Area

Households earned an income from different activities including farming, livestock keeping, small business and wage labour, with farming being the leading activity involving most (96.3%) of the households. Other activities were collection of forest products involving 79.8% of the households, livestock keeping (57%), and wage labour (40.8%), and small business such as food vending and small shops (8.5%). Other activities include weaving, and tailoring. These activities were discussed as they had influence on REDD+ activities on one way or another. For example faming if it is not practiced well (shifting cultivation) may lead to negative effect on the project as people will continue to cut trees to look for land for cultivation. On the other hand over exploitation of forest products such as timber and charcoal can badly affect the goals of REDD+ project. The distribution of households by economic activities is shown in Table 4.

Table 4: Economic activities that earn income to the households in Kilwa district (n = 120)

Economic activities	Frequency	Percentage
Farming	105	96.3
Livestock keeping	69	57.0
Small business	10	8.5
Wage labour	49	40.8
Forest products	78	79.6
Others	3	2.5

Data was based on multiple response, thus percentage would not necessarily add up to hundred.

4.3.1 Farming

Farming was observed to be activity that was carried out by majority of the households though it wasn't the leading activity in terms of income generation. Most of the crops grown were for household consumption. Households grew more than one crop for security purposes. Both cash and food crops were grown in the area. The major crops grown were maize, sorghum, sesame, cashew nuts, coconuts and rice. The report shows that households were also selling some of the harvested surplus to earn income. It was estimated that on average a household obtains an income of TAS 491 426 per annum, from the sales of agricultural outputs, this was as much as necessary to meet the basic requirements for an ordinary rural household. These results are consistent with those by Winrock International (2006) which reported the sale of agricultural outputs as been among the sources of cash income for almost 62% of Tanzanians.

4.3.2 Livestock keeping

Livestock keeping was another major activity that generates income to most households. About 57% of the respondents were reported to be keeping livestock for earning income. The livestock kept were chicken, because they did not require much attention. It

was found that livestock earns an average income of TAS 75 285, for each household in the study area. However, the study found that most of the respondents from the study area do not keep large livestock like cattle, goats, and sheep because they (the respondents) concentrate much on farming and other activities such as fishing.

4.3.3 Small business

The study results show that some respondents about 8.5% in the study area are involved in small businesses such as food vending, selling small shops to earn income. There were no barriers to entry in these businesses in the study area. Anyone who wished to enter the business would do so. This finding concur with that of Mfaume and Leonard, (2004) who observed that entry into a small business in Tanzania is not a problem as one can start a business any time. It was found that a household earns an average income of TAS 33 200 per annum, from these small businesses.

4.3.4 Wage labour

About 40.8% of the respondents were found to earn an average income of TAS 43 175 (USD 28) from employment. Majority were found to fall on the casual form of employments; others were involved in forest patrolling and others obtained their income from allowances of meetings.

4.3.5 Forest products

The study also reveals that apart from depending on activities such as agriculture, livestock keeping, and wage labour, rural communities also depend on forest products. The study shows that about 79.6% of the respondents earn their income from forest based activities. These activities include charcoaling, lumbering, firewood collection, beekeeping, hunting and others such as home crafts. The expected average income from

the sales of forest products was estimated to be TAS 2 001 791 per annum, and which is 4 times the income obtained from agricultural produce. However, the respondents did not seem to have realized this. This implies that forest resources contribute to households income and livelihood support leading to poverty reduction by big margins. Therefore, forests should be given high priority in conservation aspect.

4.3.6 Other activities

Other activities reported to contribute to households' income in the study area were weaving and tailoring. The respondents engaged in these activities accounted for 2.5% of the total sample. The results show that very few are involved in these activities probably because such activities for example tailoring need special expertise or one to be trained.

4.4 Social and Economic Factors/Incentives Influencing Local Community Participation in REDD+/CBFM Activities

As Emerton (1998) observes, if conservation is to take place there is need for stakeholders to change their behaviour and diversify economic activities that cause deforestation through specific incentives, since most of the rural communities are forest dependants. From the findings, 53 respondents (66.2%) said they were participating in REDD+/CBFM activities and only 27 (33.8%) said they were not participating in such activities. Those who were participating mentioned various factors that influence their participation. Among the Social and Economic factors/incentives which were observed to have significant influence on the participation of local communities in the REDD+/CBFM activities include, age, education, income from forest products, income from agriculture, carbon payment which is to be paid in the future, sustainable timber harvest, and training. The model was found to be significant at p-value less than 1%, i.e.

(p<0.01); also as Hosmer-Lemeshow test (p=0.864) shows, the goodness of the fit is satisfactory. The Pseudo R^2 was 0.772. This implies that the model is explained by 77.2% of the odd ratios. According to Louviere *et al.* (2000), the Pseudo R square sometimes though rarely results into having high value as that of R^2 of Linear regression model; therefore the presented Pseudo R^2 is considered to have good fit.

The higher chi-square, Pseudo R square, and *p-value* of Hosmer-Lemeshow test results suggests that the model fitted to the data. In other words, the explanatory power of joint association of factors influencing participation of an individual in the REDD+/CBFM activities is higher. Therefore, from the regression equation, the null hypothesis that H_0:H_1 ≠ f (AGE, EDULVL, INCFOR, INCOAGRIC, CARBPYMT, SUSTTIMBHARVST, TRAINING) was rejected in favor of alternative hypothesis that H_0:H_1 = f (AGE, EDULVL, INCFOR, INCOAGRIC, CARBPYMT, SUSTTIMBHARVST, TRAINING) because none of these coefficient in the equation was equal to zero. Table 5 below presents the factors/incentives that influence an individual into participating in the REDD activities.

Table 5: Effect of social and Economic factors/incentives on individual participation on REDD activities

Variables	***β***	**S.E**	**df**	**Sig.**	**Expected signs of *β***
Constant	**2.197**	**0.373**	**1**	**0.000**	
AGE (18-43)	0.487	0.174	1	0.029**	+
AGE (45-69)	1.450	0.168	1	0.0025**	+
AGE (>70)	0.892	0.199	1	0.403	+
EDULEVEL	-0.448	0.705	1	0.079*	+
INCOFOR	2.196	2.188	1	0.074*	+
INCOMAGRIC	0.667	4.833	1	0.414	-
CARBPAYMENT	17.502	0.310	1	0.000**	+
SUSTTIMBHARV	10.322	5.439	1	0.000**	+
TRAINING	3.705	4.837	1	0.032**	+
	Chi-square	Df	Sig.	-2loglikelihood	Nagelkerk R square
Model	72.997	9	0.00	13.032	0.772
Hosmer-Lemeshow test (*p = 0.864*)					

Variables entered: AGE, EDUCATION LEVEL, INCOME FROM FOREST, INCOME FROM AGRICULTURE, CARBON PAYMENT, SUSTAINABLE TIMBER HARVEST, and TRAINING.

Note: - ***significant at 1% level, **significant at 5% level, *significant at 10% level, ***β*** - The estimated logit coefficient, **S.E**. -the standard error of the coefficient, **df**-degree of freedom, "**Sig.**" - the significance level of the coefficient.

4.4.1 Age

It was found that age of the household head in the study was positively correlated with participation of an individual in the REDD+/CBFM activities in both categories. This was consistent with the prior expectation which assumed that the older the age the greater the household maturity and more awareness of forest management activities. The Age group ranges of 18-45 and 45-69 years were statistically found to be significant at p-value of 5%.

4.4.2 Education

Generally theories assume that education level increases the probability of one to be knowledgeable, aware, competent and efficient in forest resources management issues. However the findings (Table 5) show that education level was significant in determining one's participation in forest related activities. The negative relationship implies that an increase in education for every one level tends to reduce the chances of a respondent to participate in REDD+/CBFM activities by 44.8%. This is attributed to the fact that most educated people tend to do away with forest related issues and instead search for white colour jobs. These are in contrast with the findings by Katani 1999; Mbwambo 2000 who argue that education has positive influence on people's participation in the forest management activities and that when the level of education increases, so is the level of awareness hence creating a positive attitude towards conservation.

4.4.3 Income from forest products under CBFM

From the table, the income from forest products under CBFM has a positive regression coefficient of 2.196. This implies that revenues obtained from the sales of forest products motivate and act as an incentive for an individual to conserve forest for REDD+ as they expect to get more benefits. Moreover, an increase in the likelihood of participation was statistically significant at p-value of 10%; therefore this implies that for an individual to participate in the REDD+ activities, the forest must deliver tangible benefits to the community.

4.4.4 Income from agriculture

The expected sign was negative. It was thought that an individual who earns an income from agriculture would not support REDD+/CBFM activities on the assumption that their land would be taken for forest conservation. Also, because they already have a

source of income from agriculture, therefore forest resource was not important to them. However, the study results show that agriculture had a positive though insignificant influence on one's participation in REDD+/CBFM activities. It was found that as agriculture income increases by one unit, participation in forest conservation increases by 66.7%. This was attributed to the fact that most households believed that good forest management brings good climatic condition necessary for agricultural production. Such good climatic conditions include rainfall given the fact that there is global climatic change which causes drought and hence low agricultural output. In addition, forests tend to increase soil fertility and moistures as the result of leaves littering hence an increase in agricultural production. These results are consistent with the results in a study by Kessy (1998) in East Usambara, who found that forests provide deep littering which support production due to an increase in fertility. Also he further said that people support forest conservation as a source of agricultural inputs such as knives, hand hoses handles, axes and panga handles, all of which, in turn, support agricultural production. Also forests act as a source of food for their livestock.

4.4.5 Carbon payment in the future

Table 5 shows a positive and significant ($p= 0.000$) relationship between carbon payment which is expected to be done in the future and household participation in REDD+/CBFM activities. The results show that the chances of one participating in REDD+/CBFM activities given the fact that they would be paid for carbon sequestered in their forest in the future increases for every unit increase in the income from carbon. The relationship was expected because forest management for carbon payment was a new issue that had been well introduced and most households had a positive thought regarding the issue. Therefore, the issue of carbon payment was found to be a big

incentive to most of the rural forest dependants to participate in REDD+/CBFM activities.

4.4.6 Sustainable timber harvesting

The incentive was expected to have positive influence on participation in REDD+/CBFM activities as timber was thought to be one of the highest value products and anyone would conserve forest so as to earn income from timber harvest. Most protected timber tree species were Mninga (*Pterocarpus angolensis),* Mvule (*Milicia excels),* Msekeseke (*Piliostigma thonningii)* and Mkongo (*Afzelia guanzensis).* Sustainable timber harvesting had a positive and significant effect on one's participation in REDD+/CBFM activities. This is because of the expected benefits that an individual can get through selling timbers in a sustainable way which is the main goal of MCDI in selling carbon. From the discussion, most of the respondents believed that it is only through participation in forest conservation that they can harvest timber sustainable.

4.4.7 Access to training

Training provided under CBFM has a positive impact on participation of an individual in the REDD+/CBFM activities. This is shown by a positive regression coefficient value of 3.705 meaning that the likelihood of participation of an individual in REDD+/CBFM activities increases by 37.05% for every unit change in the variable. This implies that people are motivated by the training which the project provides or has been provided to those engaged in the REDD+/CBFM activities. This is because they (the respondents) believe that by being trained their level of awareness, capacity and confidence on forest management would increase. These results are congruent with the findings by Mallik (2000); Rathore, (2005), who observed that training for capacity building and

competence development of villagers create immediate interest of the people into participating in the project activities.

4.5 Analysis of Household Income from the Forest Resources

4.5.1 Type of forest products collected from the study area that earns income and livelihood benefits to the community

According to the responses from the study area, about 79% of the respondents said they had collected forest products from the natural forest for the past 12 months and they were continuing to do the same. Fourteen types of forest products were mentioned to be obtained from these forests. The study reveled that at least every household obtained not less than one forest product from the natural forest. The study results reveals that firewood was the most consumed product (consumed by about 91.6% of the respondents) implying that most of the households in the study area use firewood as a source of energy for cooking and lightening as well as a source of income. The findings are similar with those in a study by Kallonga *et al.* (2003); FAO, (2001) who reported that over 90% of Tanzanians depend on firewood and other vegetation for domestic energy supplies. Similarly, URT (2000) reports that more than 50% of the household's cash income is derived from the sales of products such as firewood and charcoal.

Other products in the order of importance include round poles (majengo-local name) (29%), followed by split poles (kongowele-local name) (24%). Most of these poles were collected for immediate home consumptions such as house construction, fencing, and building construction, while others were sold to earn income. Similar findings were reported in a study by Turpie (2000) in that poles of various thicknesses are cut for house construction. Other product is Charcoal which accounted for about (9.2%) of the respondents. It was reported that most of the charcoal produced is sold to earn income

and very small amount is used for household consumption as a source of energy for cooking.

The Table below shows that about 11.7% of the respondents also obtained timber/logs from nearby forests. The study found that most of the people involved in businesses on forest products had no business licenses hence very few of them revealed their dealings on these businesses for fear of being arrested. Honey was collected by 9.1% of the respondents. It was found that beekeeping was favored in Miombo woodlands which were widely spread in the study area. As Kessy *et al*. (2007) observe, Miombo constitute a wide range of non-wood forest products including honey and beeswax. As for wild meat, about 15.8% of the respondents reported to be consuming wild meat. As for thatches, these were collected by about 30% of the respondents. Most of the thatches collected were used for roofing.

Soil was found to be collected by 9.1% of the respondents. This was use for house flooring and brick making. Other respondents reported to be selling the soil to obtain income. Wild plants such as mushroom, wild vegetables and wild fruits were collected by about 26.7% of the respondents. It was reported that most of these wild plants are available throughout the year and therefore and therefore they were a good source of food during food shortage. The results conform to those from Forestry and Beekeeping Division (1999) which reported that in severe cases of food shortage wild plants such as wild vegetables act as a complete meal for the households.

Medicinal plants were also found to be used by 7.5% of the respondents. Traditional medicines were found to cure such diseases as stomachache, malaria, anemia, and diarrhea. Some respondents reported to be selling traditional medicine to earn income.

The results imply that most of the rural people use traditional medicine as their cheap and easy way of curing diseases. Similar results are reported by Chihongo (1992) who reveals that almost 80% of the rural people rely on traditional medicine for their health care. About 8.3% of the respondents reported to be using ropes for making traditional beds.

Carbon is a product which is expected to be sold under REDD+ scheme, specifically on those villages that were piloting REDD project such as Mchakama, though the village had not yet obtained income from this product but the expected income had been calculated. The results revel further that these products had an important role on the livelihoods of the people. Table 6 summarizes the distribution of these forest products by percentage.

Table 6: Types of forest products obtained from forest in the study area (n = 120)

Type of forest products	Percentage
Wood products	
Firewood	91.6
Charcoal	9.2
Timber/logs	11.7
Split poles	24.0
Round poles	29.0
Fito	32.5
Non-timber products	
Wild meat	15.8
Thatches	30.0
Wild vegetable	26.7
Honey	9.1
Medicinal plants	7.5
Ropes	8.3
Carbon (in the future)	100

Data was based on multiple responses thus percentage would not necessarily add to one hundred

4.5.2 Income from other forest products

The contribution of natural forest products to the household income was also determined by using cash income obtained from other forest products. Each respondent was asked to mention the activities they were engaged in from the forests and the amount of cash income they obtained per annum from these products. Table 7 shows these results.

Table 7: Estimated income from other forest products

Type of forest products	Percentage (%)	Total income (TAS)	Average household cash income (TAS)
Wood products			
Firewood	91.6	5 538 500	92 308
Charcoal	9.2	5 635 000	433 461
Timber/logs	11.7	6 457 500	717 500
Split poles	24.0	1 339 000	60 863
Round poles	29.0	1 863 300	66 546
Fito	32.5	2 156 450	74 360
Non-timber products			
Wild meat	15.8	372 500	62 083
Thatches	30.0	2 278 000	75 933
Wild vegetable	26.7	1 233 500	53 630
Honey	9.1	620 000	79 000
Medicinal plants	7.5	669 500	124 000
Ropes	8.3	861 000	86 100
Soil	9.1	915 500	50 861
Total		**30 389 750**	**2 001 791**

Data was based on multiple responses thus percentages would not necessarily add to one hundreds.

Table 7 above shows the mean value of forest based economic activities undertaken by the respondents in the study area. Lumbering activities were found to have the highest value per annum. From the finding, lumbering activities had an average value of TAS 717 500 per household in the year 2011, this was because of the value addition through processing that increases the price of the timber. The activities that followed was charcoal making with an average value of TAS 433 461, medicinal plants had an

average value of TAS 124 000, firewood had an average value of TAS 92 308, rope had an average value of TAS 86 100, honey TAS 79 000, thatches TAS 75 933, fito TAS 74 360, round pole TAS 66 546, wild meat TAS 62 083, split pole TAS 60 863, wild vegetable collection TAS 53 630 and soil TAS 50 861The total average value from forest resources was found to be TAS 2 001 791.

The results imply that reasonable amount of cash income would be accrued from undertaking different forest based activities if the forests are properly managed. Similar results were reported by Munishi *et al.* (1997) who revealed that more than 66.4% of the households in seven administrative regions of Tanzania derive more than 15% of their income from forest based activities

Although majority of the respondents in the study area do not use charcoal for cooking, the product ranked the second in providing higher income to most of the respondents. This is attributed to its high demand in the nearby towns such as Kilwa Masoko, Kilwa Kivinje, Nangurukuru and Dar es Salaam city. It was observed that most of the charcoal was traded in these towns. The findings is supported by Turpie (2000) observations that most of the charcoal produced in the rural areas is not for local consumption but it is exported to the major towns.

Timber harvesting was the leading activity that provides higher income to the households because this product is both demanded in the villages and in towns for building purpose, furniture making and boat construction. The last use is especially for those who are involved in fishing activities in the Indian Ocean around Kilwa Kivinje. It was observed that a single piece of timber is worth TAS 5 000 to TAS 6 000. Very few respondents who were being involved in this business owned licenses; thus they were

doing this business illegally leading to loss of both revenue and forest resources. The findings are supported by those of the World Bank (2002), which estimates that USD 15 billion of taxes is lost each year through illegal activities on forest resources.

Wild vegetables obtained from leaves of wild plants, trees, shrubs, and herbs were found to be a good source of food especially during drought seasons as well as a source of income in the study area. Wild vegetables consumed had a market value of TAS 53 630 per year for each household. This implies that money is obtained indirectly by the households through the consumption of these vegetables during this period.

It was also revealed that most of the houses are made up of poles and thatches. In addition, it was observed that poles of different size were used to make handles for different equipment such as hoes and axes. In this case, a significant amount of poles were consumed for various uses. The total average market value for poles both split and round wood was TAS 60 863 and TAS 66 546 respectively (Table 7).

Honey was also found to be collected from natural forest and has an average market value of TAS 79 000 per annum per household. This implies that much of the honey collected is sold to earn income. The findings are comparable to those of Chihongo (1992) who reported that honey in Tanzania is widely used in manufacturing of honey beer which is potential business for earning income at community and even household level.

Other income generating activities found to result from forest resources were collection of fito, thatches, ropes, soil, medicinal plants, and wild meat. The results reveal that even those products which are not commonly traded could generate a valuable income.

Therefore, the conclusion is that every forest product can generate a cash income provided that it is demanded by the society.

4.5.3 Estimated quantity and value of carbon from the three sites in Kilwa District

The findings from literature reveal that on average Tanzanian coastal forests under CBFM produce 157tons of carbon per hectare (FBD, 2007). Given the amount of carbon per ha, carbon dioxide equivalent and deforestation rate, and the average carbon dioxide emitted in the area per hectares of the forest reserve in each study site was as follows: Mchakama village which is a REDD pilot project has an area of 2 235 hectares, which translates to about 4 608 tons of avoided carbon dioxide stocks. While Liwiti village, a PFM village with an area of 6 229 hectare was found to have 10 944 tons of avoided carbon dioxide, and Migeregere village which is non-REDD and non-PFM village with an area of 1 009 hectare was found to have 1 728 tons of avoided carbon dioxide.

According to the current market price of carbon which is estimated to range between USD 15 to USD 20 per ton of carbon dioxide (Bhaskar *et al.,* 2010; www.pointcarbon.com) an average price of USD 17.5 which is equivalent to TAS 27 720 per ton of avoided carbon was used to value the amount of carbon in each village forest reserve. From the data Mchakama is estimated to have carbon value of TAS 127 733 760 from the sales of their carbon credits at the given current price under REDD+ mechanism. Liwiti is expected to obtain an income of TAS 303 367 680 from the sales of their carbon credits if they decided to be in the REDD+ project as they are already in CBFM Approach. Similarly, Migeregere village community is expected to earn TAS 47 900 160 from the sales of their carbon if they also decided to be involved in the REDD+ project.

Table 8: Potential of Carbon Storage in the Kilwa district Forest Reserves

	1	2	3	4	5	6	7	8	9
Village	Average Carbon per ha (t ha^{-1})	CO_2 equivalent factor	Total CO_2 equivalent (t/ha) (1*2)	Total Forest area (ha)	Deforestation rate (%)	Avoided deforestation (ha) (5*4)	Total tones of CO_2 avoided (4*7)	Price $TASt^{-1}$	Co_2 value over whole forest (TAS) (7*8)
Mchakama	157	3.66667	576	2235	0.3	8	4608	27 720	127 733 760
Liwiti	157	3.66667	576	6229	0.3	19	10944	27 720	303 367 680
Migeregere	157	3.66667	576	1009	0.3	3	1728	27 720	47 900 160
Total									479 001 600

4.5.4 Estimated costs and net returns from carbon trading, a cost-benefit analysis

The cost of the community in claiming for carbon credits under REDD program in the studied villages were quantified and the expected net income was computed through cost benefit analysis model as used by Karky, (2008); Karky and Skutsch (2010) in Nepal . Two scenarios were developed to understand the different ways the forest could be utilized for internal carbon credit generation project.

Scenario 1 represents a case in which a community manages forests for carbon plus other normal activities undertaken in CBFM, in other words the community continues to meet their subsistence needs by harvesting other forest products and in addition receive carbon revenue (no opportunity cost is incurred) (Bhaskar *et al*, 2010). Scenario 2 represents a case in which community manages forests for carbon only, no harvest of other products from the forest is allowed (opportunity cost is incurred) (*ibid).*

Three types of costs were identified from the literature survey. According to TFCG/Mjumita the cost components in managing a forest for carbon include management/implementation costs; transaction costs, and opportunity costs (TFCG/MJUMITA, 2011) (Table 9).

4.5.4.1 Management costs

The communities included in the study were found to already manage their forests under Community Based Forest Management (CBFM), one of the components of PFM. However, additional costs were to be incurred if they were to register as a project under REDD program. These costs included monitoring and village natural resources operational costs. Other costs under these categories were service charges from

respective organization (MCDI in this case); these include remote sensing charges, facilitation and marketing costs. These costs were fixed irrespective of the size of the forests.

4.5.4.2 Opportunity cost

The study found that the community reserve forests were established typically far from village centers, and are not prioritized for agriculture (WCST, 2011). Therefore, the real opportunity costs for conserving forest for the purpose of carbon storage under REDD program were not the value of agriculture but the potential reduction on the amount of forest products such as firewood, timber, fodder and charcoal which are important resource in the subsistence livelihoods. The study observed that the communities were not completely banned from the extraction of these forest products under PFM instead they were allowed to use limited quantities under permission; though they were allowed to freely collect the products from the general lands. However, it is likely that with the introduction of formal system of carbon registration under the national REDD+ program, the rules on such harvests would be tightened. Therefore, the opportunity cost for carbon management under the studied CBFM forest would be the value of the costs for different forgone products and activities that would be forbidden by the existing regulations under REDD+ mechanisms. The opportunity costs under such situation is estimated to be TAS 1 909 483 (income from the sale of other forest product and services foregone) for the whole forest. In this case, the income from firewood is excluded as much of the firewood is collected from deadwood (Malimbwi *et al.*, 2005), thus firewood collection would probably be allowed even under a strict carbon management regime and therefore there would be no opportunity costs in this regard.

4.5.4.3 Transaction costs

This includes the cost of making an economic exchange (Ellis, 1996). These costs were not dependent on the forest size. According to the findings, transaction costs included registration costs, verification charges by a third party (independent verifier), certification cost, and brokerage costs. The total transaction cost was therefore estimated to be TAS 13 799 808 which is equivalent to USD 8 712. Table 8 below shows the value of the costs and the net income that the community is expected to get if they would decide to manage their forests for carbon credits and emissions mitigation.

Table 9: Estimated costs and net benefits in the three study sites for managing forest for carbon under CBFM

	Scenario 1 (no opportunity cost incurred)			Scenario 2 (opportunity cost incurred)		
Costs/benefits	**Mchakama (HH= 501)**	**Liwiti (HH=622)**	**Migeregere (HH=945)**	**Mchakama (HH= 501)**	**Liwiti (HH=622)**	**Migeregere (HH=945)**
Gross Revenue	**127 733 760**	**303 367 680**	**47 900 160**	**127 733 760**	**303 367 680**	**47 900 160**
Costs						
Management costs						
Self monitoring	1 691 712	1 691 712	1 691 712	1 691 712	1 691 712	1 691 712
VNRCs operation	2 502 720	2 502 720	2 502 720	2 502 720	2 502 720	2 502 720
Facilitation and marketing	1 085 040	1 085 040	1 085 040	1 085 040	1 085 040	1 085 040
Remote sensing	316 800	316 800	316 800	316 800	316 800	316 800
Total	**5 596 272**	**5 596 272**	**5 596 272**	**5 596 272**	**5 596 272**	**5 596 272**
Opportunity costs						
Estimated opportunity costs Across the whole community	-	-	-	1 909 483	1 909 483	1 909 483
Total	**-**	**-**	**-**	**1 909 483**	**1 909 483**	**1 909 483**
Transaction costs						
Registry and certification	1 354 320	1 354 320	1 354 320	1 354 320	1 354 320	1 354 320
Brokerage fee	11 938 608	11 938 608	11 938 608	11 938 608	11 938 608	11 938 608
Verification charges	506 880	506 880	506 880	506 880	506 880	506 880
Total	**13 799 808**	**13 799 808**	**13 799 808**	**13 799 808**	**13 799 808**	**13 799 808**
Total annual costs	**19 396 080**	**19 396 080**	**19 396 080**	**21 305 563**	**21 305 563**	**21 305 563**
Net Profit margin	**108 337 680**	**283 971 600**	**28 504 080**	**106 428 197**	**282 062 117**	**26 594 597**
Average net profit	**216 675**	**456 546**	**30 163**	**212 856**	**453 476**	**28 142**
10% village contribution	**21 668**	**45 655**	**3 016**	**21 285**	**45 347**	**2 814**
Individual dividend	**195 007**	**410 891**	**27 147**	**191 571**	**408 129**	**25 328**

From the result above (Table 9), the net profit under scenario 2, Liwiti gained the most (TAS 282 062 117 and also at household level (TAS 408 129) compared to Migeregere which gained TAS 26 594 597,) and Mchakama which gained TAS 106 428 197, The trend is the same at household level where a household receives TAS 25 328 at Migeregere and TAS 191 571 at Mchakama. This suggests that the cost of managing forests under scenario 2 with opportunity cost incurred is not financially viable as households get more income from selling other forest products (TAS 2 001 791) compared to selling carbon only (TAS 408 129) for Liwiti, TAS 25 328 for Migeregere and TAS 191 571 for Mchakama. The variation in the values is largely dependent on the variation in the size of the forests and the number of households. This suggests that the economies of scale play an important role in carbon trading. The larger the forest area, the lesser the unit cost.

It is obvious that for a community to participate fully in carbon trading activities, the net returns per households must be greater than that of the business as usual and carbon alone Under scenario 1 no opportunity cost is incurred, communities get income from utilization of other forest products, and from the carbon managed in their forest. Under this scenario, Liwiti gets a net income of TAS 283 971 600 and at household level TAS 410 891 which is higher than the amount received at Migeregere village (TAS 28 504 080) whereby each household would receive TAS 27 147 and.Mchakama village (TAS 108 733 760) where each villager receives an average income of TAS 195 007 from managing carbon only; plus additional income of TAS 2 001 791from selling other forest products, making up a total income of TAS 2 412 682 for households in Liwiti village, TAS 2 028 938 for households in Migeregere village, and TAS 2 196 798 for households in Mchakama village from managing and conserving their forest under REDD+ mechanism.

The analysis shows clearly that strict conservation policy for the sake of maximizing carbon stock in the areas which communities live for the increased carbon stock but are denied access to subsistence products would be fundamentally unenforceable because of community highly dependence on forest products for various uses. In addition to that individuals get more income from conserving forest for both carbon and other products.

One of the reasons for variation in the costs and benefits across the communities is economies of scale. Migeregere village with only 1009 Ha of reserve forest and Mchakama with 2235 Ha of forest reserve are at a disadvantageous position compared to villages such as Liwiti (6229ha) because some costs such as management/implementation costs are fixed regardless of the forest size. Therefore, allowing extraction of forest products together with carbon would give the two villages (Migeregere and Mchakama) better incentives by giving them more income, compared to conserving the forests only for carbon.

4.6 Analysis of the Impact of CBFM Model on the Livelihood of Rural Communities

Most of the rural communities in Tanzania depend on forests for their livelihoods. Forests play a vital role in improving rural livelihood by providing fuel woods, construction material, animal feeds hence providing an agro based economy (Kanel *et al.,* 2004). Therefore, the main objective of PFM apart from its objective of improving forest management has been to improve the livelihoods of the people living close to the forests, through permitting them to sell forest products to generate income (IRA, 2009). This section mainly discusses the impact that CBFM brings to forest dependent communities in terms of assets that may be associated with utilization of forest products. Key indicators were used for assessing project impact for each asset. The main aim of

the analysis was to see whether CBFM model has been able to bring positive impacts on the rural communities who depend on these forests.

4.6.1 Natural assets

The natural assets referred to in these sections include forests, their products, and land. The key indicators used to asses these assets are changes in forests conditions, resource flows and resource right, access, and ownership.

(i) Forest condition overtime

From interviews administered to different households there were changes in the forest condition over time both under CBFM villages and non-CBFM villages. About 85% of the respondents from CBFM villages reported that forest condition has improved while 10% said there were no changes and 5% said the forest was degraded (Table 10). According to the VNRCs, there was increase in bird species such as 'Kokoro or Kanga pori' and Kikululu, and which is an indicator of improvement in the forest condition. In contrast to non-CBFM village where 75% reported on the degradation of the forest e 15% said there were no changes, and 10% said the forest condition has improved. The improvement in the condition of the forest under CBFM was due to the protection of the forest from unnecessary fire, illegal logging, awareness on the value of the forest and use of penalties to offenders. For example it was put on the village forest bylaws that anyone who would be caught collecting forest products without permission from the village forest authority would be fined between AS 50,000 and 100,000 depending on the offense. The degradation of forest in non-CBFM village was found to be as a result of shifting cultivation, over logging, and unsustainable timber harvesting (specifically selective harvesting). In Migeregere (non-CBFM) for example, uncontrolled cutting of trees for charcoal making, was observed to be high but nothing was done by the village

government to control the cutting as being witnessed by an old man (65) that '*he was part of it'*. Key indicator that showed the forest in this village was been degraded was the disappearance of timber species such as Mvule (*Milicia excels),* Mninga (*Pterocarpus angolensis),* Msekeseke *(Piliostigma thonningii),*and Mkongo *(Afzelia guanzensis).*

Table 10: Forest condition under CBFM and Non-CBFM Villages

Forest condition	**CBFM village (n=20)**	**CBFM village (n=20)**
	Percentage	**Percentage**
Degraded	5	75
Improved	85	10
No changes	10	15

Source: own survey, 2012

(ii) Forest and forest products availability

Villagers were given an opportunity to identify forests that surrounded their communities and their importance in their daily life. The respondents from CBFM villages (Liwiti) were found to be more aware of the importance of forest to their lives than the respondents form Non CBFM villages (Migeregere). Respondents from CBFM villages mentioned direct benefits they get from their forest; and these benefits include the provision of products such as timber, firewood, charcoal, building poles, honey, mianzi, and fito (figure 5). Charcoal was the most harvested product (48.9%), followed by timber (15.6%), this is probably because charcoal was among the highly marketable products. Other products in the order of importance included building poles (11.1%), fuel wood (8.9%), mianzi (6.7%), honey (4.4%), and thatches (4.4%). These products were considered important as they are used to meet daily consumption needs while the other products such as timber, firewood, charcoal and honey were sold to obtain income

at household level for various household needs/demand. The respondent from Non CBFM village said the use of the forest was unsustainable and threatens the forest condition as well as the livelihood of these communities. The forest resource were depleting with time. Illegal activities such as logging and charcoal making are common in these forests.

Other indirect benefits observed from CBFM villages were such things as services for the protection of water catchment areas, like the one observed at Matandu River. Additional benefits included an increase in soil fertility and moisture, and soil erosion control.

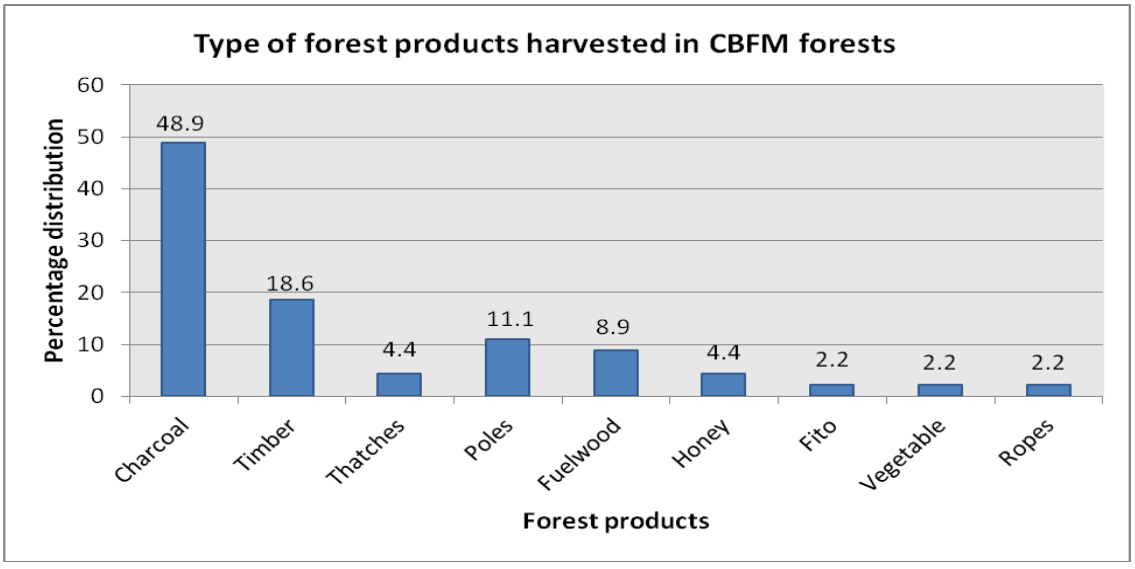

Figure 5: Type of forest products harvested in CBFM Forest.

(iii) Forest ownership, access and right

According to FAO (2005), allowing communities to manage their own forests was more successful in improving the condition of the forest than it was when they (forests) were managed by the government. The Local Government Act (1982) gives authority to local

communities to formulate and develop bylaws to be used for managing village forests and catchment areas. In the villages under CBFM, communities were given authority to control, own and manage the forest; and the VNRCs were formed to act as top authority in managing forest on behalf of the villages.

Given the situation, villagers under CBFM are free to access forests and collect forest products, undertaking controls on their forests such as punishing offenders (MNRT, 2008). Under the studied villages, people were free to move to the Reserved Village forests to collect forest products under the permission of VNRCs. This gave them better incentives to participate in forest conservation. Majority (75%) of the communities in the CBMF villages attested to the fact that they were allowed to access forest products in the forest, with a small proportion (20%) denying that they have such access, while very few (5%) did not know of such opportunities. Unlike in the non-CBFM, village communities had no right to access to their forest and lacked the powers over the income collected from the harvests of timber and other forest products. This leads to lack of incentives for them to conserve the forest thus leading to illegal harvesting of forests in order to sustain their living. The above findings are in agreement with what other authors observed (Blomley and Iddi, 2009), (FAO 2005) who argue that 'forest areas managed with the inclusion of rural communities are likely to have good condition than those which are under exclusive state management or open access regime.

Table 11: Accessibility of forest in CBFM village (Liwiti)

Access to forest (n=20)	Percentage
Allowed to access	85.0
Not allowed	10.0
Do not know	5.0

(iv) Land access, right and ownership

According to the Village Land Act of 1999, village governments have the responsibilities and authority of managing land and issuing certificates of customary title/right of occupancy to their people. Majority of the respondents were found to own land, while some rented. The respondents from CBFM village were asked if the introduction of CBFM project had any negative impact on access to land or reduction of the size of land; none of them complained (0%), instead they said that such management approaches had a positive impact (95%), such as an increase in soil fertility which boosted the production of such crops as sorghum, sesame, and maize, which in turn increased income flow at a household level. Others said they were able to increase the size of their land whenever they wanted. And only 5% said they did not know. The findings reveal further that an average size of land owned by the households were 6.1 acres, which is bigger enough to provide a household with food security (Table 12). This is unlike the villages which had no CBFM where most of the respondents complained of an increase of incidences of drought causing loss of soil fertility and moisture, leading to an increase in shifting cultivation which in turn reduces the land available for agriculture.

Table 12: Land access and ownership

Access to land (n=20)	Percentage
Allowed to access	95.0
Not allowed	00.0
Do not know	5.0

4.6.2 Human asset

Variables such as education and skills, employment creation, health care, and food security were assessed to see the impact of CBFM project on these assets.

4.6.2.1 Education

Education status for both villages was found to be low, with majority (65%) having attained primary school level, and only 10% attained secondary education. On the other hand, about 20% of the respondents did not complete primary school and 5% did not attain primary school at all. Low education levels were attributed to such factors as early pregnancies, and long walking distances to and from schools. However, though CBFM was not found to have so much impact on education sector possibly because it was a new project with less than 10 years, it was expected to have a bigger impact for the coming generation. This was witnessed in Liwiti- a CBFM village where the condition of their primary school was well maintained compared to other villages such as Migeregere where the condition of their school maintenance was poor. Also from the discussion carried out with village leaders in CBFM; more plans had been made to improve education services unlike the case in non-CBFM villages. For example in Liwiti, they had a plan to increase the number of classrooms after they had received money from timber stock which they were expecting to sell soon.

4.6.2.2 Employment opportunity

CBFM project was found to have a greater impact on job creation in the villages for both males and females. Many people were employed to do forest related jobs as well as the provision of social services in and outside their villages. Some villagers were employed as causal workers in the forest related activities such as fire breaking, timber harvesting, transporting of logs from the harvesting sites and guiding researchers and tourists around the village. This was reported by leaders in Liwiti village. This enabled most of them to pay school fees for their children hence increasing the number of children attending school.

4.6.2.3 Awareness creation on forest related issue

According to the interview carried out with village leaders in CBFM, it was reported that there had been an increase in the awareness of forest related activities by the people. The villages received a number of training from different organizations such as MCDI, District forest officers on good governance, forest monitoring and ways of conserving their forests. The training ranged from village level to those that only included VNRC or village leaders. Some members were sent to attend workshops outside the region; for example in 2002, some members were sent to attend a workshop in Muheza district in Tanga, coastal region and Kibaha district.

In Migeregere a non-CBFM village, the level of awareness on forest activities was very low. From the discussion with the VNRCs, members were found not even to know their roles. In 2011, Migeregere community received training from Mpingo on forest conservation issues once but it caused a border conflict with the nearby villages that were not under CBFM. as a result, most of the villagers remained poor as it was claimed by one of the villagers.

Box 1: A villager complaint on community attitude toward forest conservation in Migeregere village a Non-CBFM village

'we have to change our attitude towards forest conservation now; our poverty will never end, we have to invest in our own forest, we have to learn from what our neighbours have done with their forests ...everyone is participating in the forest management and they have became the guardians ... their environment is green, and the benefits are shared among all, look at us ... let us together conserve and invest on our own forest so that we all benefit and make future generation proud of us...(FGD, 2011)

There was also an assessment to see whether or not people were aware of the practice of forest governance and institutions (forest laws and by-laws that govern them). On the question about governance and institutions arrangement 75% of the respondents from CBFM village (Liwiti) got the questions right and only 25% got it wrong. This shows that the level of awareness among the people in the village on governance of forest is high. In contrast in Migeregere village, a non CBFM village, only a few (45%) respondents had some knowledge of governance and institution of their forests, while 65% were not aware of the forest laws and by laws of their villages (Table 13).

Table 73: Awareness of forest governance and institution

	CBFM village (n=20)		Non-CBFM village (n=20)	
Awareness of forest bylaws	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Aware	15	75	9	45
Not aware	5	25	11	65

4.6.3 Financial asset

Financial assets include sources of income both at household and community levels as well as savings that provide people with different livelihood options. Sources such as marketing of timber and Non-timber forest products, agricultural goods, and employment that form part of financial assets are discussed.

4.6.3.1 Income from small business

Majority (90%) of the respondents both at CBFM and non-CBFM villages mention agricultural production as their major source of income. The major crop grown was sesame which was sold at TAS 1 000 to TAS 1 500, which is equivalent to USD 0.64 to USD 1 per kg respectively. Other crops in their order of importance include sorghum, rice and cashew nuts. The average income from agricultural production for both villages was estimated to be TAS 300 000 to TAS 350 000 in 2007 which is equivalent to USD 191 to USD 223 respectively; and these figures were reported to rise especially in CBFM village due to agricultural expansion.

Other sources of income identified in the villages include sales of Non Timber Forest Products (NTFPs), daily wage labour, public wage labour, and small businesses. By selling NTFPs such as grasses at TAS 500 per bundle, fuel-wood at TAS 300 to TAS 500 per bundle and Kongowele at TAS 200 per piece, members were able to get income for meeting subsistence needs and improve their livelihood. Similar results were reported in a study by Nshubemuki (2009) who investigates the impact of CBFM on the livelihood of people and found that each household received a sum of TAS 310 329 in 2007 from selling charcoal, firewood, poles, agricultural crops and tree seedlings which provided them with money for meeting households needs hence improve their

livelihood. The study found that on average a household received an income of TAS 2 001 791 in 2011 from the sales of these products.

In the CBFM, members were allowed to go to general land to collect forest products. In non-CBFM villages in Migeregere, members collected forest products illegally which tend to destroy forest more. Most of the villagers especially women were found to engage in charcoal making business and firewood selling as an income generating source. Women in Migerergere admitted that they did not have permission to cut down trees for charcoal making and they were having charcoal kilns around the village. According to them, charcoal was sold at TAS 2 500 to TAS 3 000 per bag. The money helped them to buy household needs, such as salt, food stuffs and the like. They admitted though that the business was not sustainable as they might be caught by VNRC anytime. They also complained about unavailability of trees for charcoal, in that the tree species are disappearing and that they don't know how they would sustain their livelihood after the trees have disappeared completely.

4.6.3.2 Income from Employment

It was reported by VNRC members, village leaders and by key informants during interview that CBFM has increased the incomes of most of the households. People were employed at different levels and were paid according to the positions. For example in the year 2009/10, forest guards, patrollers and tourist guards were paid TAS 3 000 to TAS 5 000 per day, researchers guards were paid TAS 5 000 per day, and those employed permanently by village government in social services like in health centers were paid TAS 30 000 per month.

It was claimed by most of the households that the income obtained was used for subsistence needs and invested in other assets such as physical assets such as land, houses, furniture and the like. Others said they invented in human assets such as education, and paying for health insurance.

4.6.3.3 Saving/ loan access and social group

Most women who were interviewed reported to have been members of Vicoba, a local micro credits. Other said social network helped them to secure income for most of their businesses. They said the money they get from Vicoba and social networks helped them to pay for school fees for their children and invest in small businesses. Others said they used the money to buy agricultural inputs to invest in agricultural production. as for the households interviewed in both villages, almost 30% were found to have bank accounts and have access to loan in the nearby towns such as Kilwa Masoko and Kivinje. Social relation among villagers was also cited as an important asset which majority relied upon to get support in time of hardship such as drought periods, death of a family member and the time for preparing farms.

The study findings show that there are greater potential for securing financial assets in CBFM villages both at household and community levels. Further expectation was seen in CBFM villages that they would receive more financial benefits from certified timber in the future, and further opportunities were envisaged from the sales of carbon credits if at all villagers decide to be in the REDD project. Different from non CBFM villages where the situation was different. In these villages only the few who had an access to illegal activities were the one benefiting while the poor remained poor and obtain unsustainable benefits from destroyed forests. These finding are similar to the finding

from other researchers such as Adhikari, (2000, 2001) who found that on average the richer obtain the benefits from forest three times over than what the poor obtain.

4.6.4 Physical assets

4.6.4.1 Physical assets ownership within the community

From the discussion with village leaders in CBFM villages it was reported that the project has improved their infrastructure. For example, they reported to have built two classes and improved the condition of their schools. The leaders reported further that they had already collected 100 logs in 2011 and that they were only waiting for the customer to buy the logs. From the discussion they (village leaders) said that they had a plan of adding two more classrooms and build a health center from the money they expect to get from the sales of logs. In addition, the village received four bicycles from Mpingo group to be used by forest guard for forest surveying. Also the village used timber products from their reserved forest to make desks and other furniture for their primary school.

In non CBFM village, the physical assets obtained were not the result of forest activities; instead they were the result of money received from selling part of its land to Bioshape Company in Migeregere. The money obtained from the sale of land was TAS 107 284 000, which was used to build village government office, meeting rooms, five teachers' houses, and to purchase a power tiller which at the time of my field it was not working, and nothing was invested in the forest.

Corruption was also cited as a major problem within the village of Migeregere. From the discussion, the respondents complained against their leaders who spent part of the

money earned for personal matters. The following was a complaint from different groups in the village;

Box 2: Community complaints on the misuse of money received from the sale of land to Biosphere Company in Migeregere village

'*They failed to provide a detailed report on how the money received was used. The houses claimed to be built with a lots of money have cracks on walls and floor. The power tiller which was said to be bought by 79 million shillings is not working now. They use the power tiller to rent to the nearby village for their own interest. They cheated on us*.'(FGD, 2011)

4.6.4.2 Physical assets owned by households

From the interview carried in CBFM village, almost 80% of the respondents were found to own houses and only few (20%) were in rented houses.. Majority (77.5%) were also found to own farms of not less than 5 acres, 75% owned radio which helped them to get more information on forest related issues. Other assets owned by households were bicycles (60%), poultry (57.5%), furniture (47.5%), mobile phones (7.5%), livestock specifically goats (7.5%), generators (5%), flour milling machines (2.5%), television sets (2.5%) which was used for business purpose, and small shops (2.5%). This was different from those in Non-CBFM village, where only few possessed some of these physical assets. Table 14 summarizes the percentage distribution of the physical assets owned by the households.

Table 84: Distribution of household physical assets in the CBFM and Non-CBFM village

Physical assets	% Distribution of household physical assets (n= 40)	
	Non-CBFM (%) (n=20)	CBFM (%) (n=20)
House	50.0	80.0
Farm	47.5	77.5
Bicycle	45.0	60.0
Radio	10.5	75.0
Television	0.0	2.5
Mobile phone	2.5	7.5
Generator	0.0	5.0
Livestock (goats)	2.5	7.5
Poultry	25.5	57.5
Flour milling machines	0.0	2.5
Small shop	2.5	2.5
Furniture	20.0	47.5

Data was based on multiple responses, thus percentage would not necessarily add up to hundred.

4.6.5 Social assets

4.6.5.1 Functioning of the local institution

During the interview carried out with village government leaders, it was reported that since the introduction of CBFM, VNRC participation has increased to a great extent. This was due to an increase in the awareness of most members on the roles and responsibilities of the committee which explained to these members about forest related issues during the workshop conducted by Mpingo group . Members reported to have been actively involved in monitoring and patrolling forest resources. In addition, members participated in formulating village forest bylaws and made sure that people observe them and those who fail to abide by these bylaws get punished. Village leaders reported that VNRC members hold meeting every month and the report is submitted to village government office and a summary of a report is presented to the villagers.

Unlike in non CBFM village where VNRC members were not aware of their responsibilities and where it is reported that meeting were not held regularly and when they did the attendance was always poor. For example in Migeregere, only one meeting was held in January, 2011 and the report for the meeting was not available at the village office.

4.6.5.2 Community participation in forest management

The study found that there was an increased participation of local communities in forest management activities in CBFM unlike it used to be before. Local communities were involved in decision making. The study found further that during this time, more women were than it used to be before are involved in decision making on forest issues something which was once thought to be the domain of males only. The leaders also confirmed that during the meeting, all issue related to forest was openly discussed and everyone was free to talk, participate in decision making, asking questions and raise doubt where he/she believes something is not clear. The meeting is held four times per year, and all the meetings involved the local communities. However within non CBFM village, the situation was different. Majority of the members interviewed said they did not attend village meetings due to lack of information about such meetings, and other claimed that they were busy with farming activities, while others cited lack of accountability among leaders in the village as a reason of staying away from such meetings.

In general, the study found that more households were participating in forest management activities under CBFM villages than is the case with non-CBFM villages. Statistics shows that majority (85%) of household interviewed in CBFM village were

involved in forest management activities unlike in non-CBFM villages where less than 50% participated in forest management activities. Table 15 below shows the statistic of households' participation in different forest activities in CBFM and non-CBFM villages.

Table 15: Participation of local communities by forest activities

Forest activities	CBFM Village (n = 20)		Non CBFM village (n = 20)	
	Frequency	Percentage	Frequency	Percentage
Approving village bylaws	17	85	9	45
Mapping village forest	10	50	5	25
Maintenance of forest roads	12	60	3	15
Clearing firebreaks and control	18	90	9	45
Forest monitoring and patrol	19	95	4	20
Timber harvest and logs transp.	12	60	8	40

Data were based on multiple responses, thus the percentage would not necessarily add up to hundred.

4.7 Analysis of Distribution of Income among Different Actors in the Value Chain of the Forest Products and Carbon

This section is mainly concerned with the analysis of the distribution of income among different actors in the processes of selling forest products including carbon, from the point where it is produced up to where it is consumed. The analysis was done on the three sampled villages, one which practice REDD (Mchakama), one which is non-REDD, but practices PFM (Liwiti), and the other that practices neither REDD nor PFM (Migeregere).The section is divided into three sub-sections. The first sub-section describes the social economic characteristics of the actors in the chain. The second sub-section presents the margins and their distribution at different levels of the chain. And the last sub-section describes the constraints that the actors in the chain face in the process of marketing the products.

4.7.1 Characteristics of the value chain actors

This section describes the characteristics of the actors at each stage in the chain as presented in the following sections.

4.7.1.2 Forest products production

The category of producers refers to those people who are involved in the process of extracting forest products for sell from the forests. Most of them are villagers and who extract forest products from village owned forests. These actors sell their products either directly to the final consumers or to marketing agents such as wholesalers, retailers or processors, either in large or small quantities.

4.7.1.3 Social economic characteristics of the producers

The section describes social economic characterists of the producer such as age, gender, education and occupation of the producers and their influence on the production process of the forest products

Table 96: Social economic characteristics of producers

Social-economic characteristics	% Distribution of producers characteristics by village in Kilwa District			
	Migeregere (n = 16)	Liwiti (n = 19)	Mchakama (n = 10)	Total (n = 45)
Age				
Below 30 years old	56.2	50.4	30.0	50.7
30 to 44 years old	43.8	42.3	50.0	42.6
45 to 64 years old	0.0	7.3	20.0	6.7
Above 65 years old	0.0	0.0	0.0	0.0
Gender				
Males	62.5	100.0	60.0	77.8
Female	37.5	0.0	40.0	22.2
Education level				
Primary completed	25.0	31.6	10.0	24.4
Primary incomplete	43.8	36.8	70.0	46.7
Secondary complete	0.0	10.5	10.0	6.7
Secondary incomplete	6.2	5.3	10.0	6.7
Graduate	0.0	0.0	0.0	0.0
No education	25.0	15.8	0.0	15.6
Primary completed	25.0	31.6	10.0	24.4
Occupation				
Main/primary occupation				
Farming	36.8	81.2	90.0	75.6
Forest product harvesting	63.2	18.8	10.0	24.4
Farming	60.2	12.5	10.0	15.6
Forest product harvesting	24.0	81.2	90.0	75.6
Wage employment	15.8	6.2	0.0	8.9

(i) Age distribution

According to Sigh *et al*. (2003); and Hoppe (2002), age can play an important role in influencing one's experience or decision making, which as a result can influence one's productivity and how one performs. Table 16 shows that a large proportion of producers belongs to the age group of below 30 years old, in all the villages. This age group consists of highly productive people who can be involved in production activities such as forest product harvesting, which could improve their livelihood.

(ii) Gender distribution

Table 16 above indicates that 77.2% of the sampled producers of forest products were males, with Liwiti having majority of the sampled producers who are male (100%) participating in forest harvest. This implies that the work of going to the forest searching for forest products is such a risky business that very few women are involved in forest products extraction. Most forests are far from the villages hence poses difficulties for women in walking such distances. As a result, most of the forest works are left to the men while women remain at home doing less risky jobs; such as farming, cooking or selling the products at home after their men have harvested them. Such jobs do not require them to walk long distances.

(iii) Education level

The level of education is relevant in understanding good practices in forest products harvest, and which ensure its sustainability. Good knowledge on how to manage and use their forest in a better way needs to be imparted to the community so as to improve the forests productivity. According to the study findings, about 24.4% of the producers attained primary school were few compared to those who didn't complete. The percentage of those who completed secondary education and who did not complete secondary education was the same (6.7%) and none of the producers was reported to have attained post secondary education. Those with no education were 15.6%. In general, the results show that most of the sampled producers at least attained primary education.

(iv) Occupation of the household

Table 16 shows that majority of the respondents cited farming to be the primary or main occupation. Only few of the households in the district reported farming to be their

secondary occupation. Most (75.6%) households, which is equivalent to those who reported farming as their main occupation, cited forest production business as their secondary occupation. The reason is that they only do the business as alternative occupation when agricultural production period is over, or when they are waiting for the next farming season. Others said that they do the business during dry season when production has stopped or when they need quick money while farming still continues. Also the introduction of conservation projects such as REDD and PFM have reduced their dependency on these forest products. For example, in Mchakama where REDD project is implemented, a slightly higher proportion (90.0%) of the sampled producers cited forest harvest as their secondary occupation. Also in Liwiti village 81.2% of the respondents cited forest harvest to be their secondary occupation, as a result of PFM project, which reduces dependency on unnecessary extraction. Therefore, people extract forest products only when they are in need of quick money and in a limited amount as per permission from village government. This is unlike the situation in Migeregere village where none of conservation projects is present, leading to high rate of extraction. The study findings also show that about 63.2% of the sampled producers in the village depend on forest product extraction as their main occupation with farming being an alternative occupation (60.2%).

4.7.1.4 Source of start-up capital for production

In order for people to utilize available opportunities that emerge in the production process or marketing of products, capital is essential. There are various sources of capital, According to Schrader *et al.*, (2005), capital can be from own savings or credits. The findings as presented in Table 17 show that own savings was the major source of capital reported by 62.2% of the sampled producers. Only 37.8% reported family or

friends as their source and none of them reported formal credits and income from pension as their source of capital. The reason was to do with difficult collateral requirements from the banks or microfinances such as SACCOS which gives out loans. Other reason though minor was that most of the businesses are unregistered so it is hard for the banks/microfinances to provide them with loans.

Table 107: Source of start-up capital for producers

	% Distribution by village			
Source of capital	**Migeregere (n= 16)**	**Liwiti (n=19)**	**Mchakama (n=10)**	**Total (all villages) (n=45)**
Own savings	62.5	63.2	60.0	62.2
Family or friends	37.5	36.8	40.0	37.8
Formal credits	0.0	0.0	0.0	0.0
Pension income	0.0	0.0	0.0	0.0

4.6.1.5 Type of products harvested and forest harvested

Table 18 shows that most of the products harvested for sale was charcoal (48.9%), with greater quantities being extracted from Liwiti (57.9%) and Migeregere (56.2%). The second product is timber (15.6%) with greater quantities (25.0%) coming from Migeregere, then poles (11.1%). Charcoal was found to be the major product harvested because it does not require much technology in terms of equipment used in charcoal making; therefore, a lot of people were involved. .This is unlike timber which requires sophisticated equipment, which is too expensive for most of the producers. Another reason was that the demand for charcoal was high as it was demanded within and outside the village. This is unlike timber which is to be harvested only when a customer's places an order to the producer, but yet it is ranked number two because of its high demand. In general, these two products were highly extracted because of their market expansion, such that much of them were exported to the nearby towns. Other

products in order of their importance were firewood (8.9%), Mainzi (6.7%), thatches (4.4%) and honey (4.4%). These products were ranked low because most of them had no or small market as anyone can go to the forest (general land) nearby and collect the products, unlike charcoal and timber which needed much time and energy to produce.

Most (77.8%) of these products were extracted from general land where any one was free to enter and collected the products; these include bushes that surrounded their houses. And only 22.2% came from the village forest land. The small percentage which comes from the village forest land was a result of the implementation of REDD pilot projects especially in the villages of Mchakama and Liwiti (PFM project) village which prohibit people from extracting forest products without permits. Only 20% and 12.5% of the respondents were reported to extract the products from Mchakama and Liwiti forests respectively.

Table 18: Type of products harvested and forest harvested

	% Distribution by villages			
Means of transportation	**Migeregere (n=16)**	**Liwiti (n=19)**	**Mchakama (n=10)**	**Total (all villages) (n=45)**
Types of products harvested				
Charcoal	56.2	57.9	20.0	48.9
Timber	25.0	15.8	0.0	15.6
Thatches	0.0	0.0	20.0	4.4
Poles	12.5	5.3	20.0	11.1
Firewood	6.2	10.5	10.0	8.9
Honey	0	10.5	0	4.4
Mainz	0	0	30.0	6.7
Forest where extracted				
Village forest	31.6	12.5	20.0	22.2
General land	68.4	87.5	80.0	77.8

4.7.1.6 Means of transporting forest products

Table 19 shows that most (71.1%) of the producers use bicycles to transport their products from the production point to the selling point or their homes. Walking accounts for 15.6% of the forms of transportation While 13.3% said they did not transport the products. In most cases where the products were not transported they were collected within short distances such as neighborhoods by consumers from the producers.. And for the wholesalers who had their own transportation they collected the products from the producers at the production site as is the case with charcoal and timber. The predominance of bicycle and foot as the means of transportations indicated lack of access to other means of transportation; as a result wholesalers are forced to transport small quantities of products hence lowering profits through selling small quantities. This is unlike the case if wholesalers were using better means of transportation such as cars where they could be able to transport large quantities of products. Also they fail to expand their market because they cannot travel long distances; therefore they sell everything within the village. This makes them uncompetitive because they trade the products only within small radius and hence have slow growth in the supply of the products.

Table 119: Means of transporting forest products

Means of transportation	% Distribution by village			
	Migeregere n=16	Liwiti n=19	Mchakama n=10	Total (all villages) n=45
On foot	0.0	10.5	50.0	15.6
Bicycle	81.2	73.7	50.0	71.1
Did not transport	18.8	18.8	0.0	13.3

4.7.1.7 Price determination

About 64.4% of the respondents said the prices were determined by the producers themselves; and only few (35.6%) said that the prices were a result of negotiation. This only happened when a buyer buys a product at large quantities and in some cases when the products are high in supply.

Table 20: Price determination

	% distribution in the village	
Price determinants	**Yes**	**No**
Producers	64.4	35.6
Negotiation	35.6	64.4
Total	100.0	100.0

4.7.1.8 Time used in the production process per year

The average time spent by most of the producers in the production process was found to be78 days per year, with the maximum time being 270 days per year and minimum time being 6 days per year. During this time, most of the production processes such as agricultural production tend to cease. The maximum time was found to be spent in the timber production process. This implies that lumbering takes much time than other products and most people dedicate much of their time in lumbering than in other products because timber gives much income due to its high price per unit compared to any other product such as poles which only take 6 days per year of the producers' time.

4.7.1.9 Constraints faced by the producers

Identifications of constraints were inevitable so as to ensure producers are equipped with better strategies in improving productivity in a sustainable way. Table 21 indicates the major constraints that most producers face in their production process; and these include low profits (17%) and unreliable market (14.6%). The problem of low selling

prices was evident in Liwiti villages (22.3%) unlike in any other villages. Other constraints faced in order of importance were accidents in the working places (12.2%) such as being struck by falling trees, kiln fires, attacks by wild animal such as elephants (12.2%), bad debtors (7.3%), scarcity of valuable timber trees (7.3%), threats from VNRC (4.9%), poor working equipment (4.8%), health problem such as cough as the results of dusts from charcoal (4.8%), high transportation costs (2.4%), lack of capital (2.4%) and poor harvesting skills (2.4%).

Table 21: Constraints faced by producers in Kilwa district

Means of transportation	% Distribution by village			
	Migeregere n=16	Liwiti n=19	Mchakama n=10	Total (all villages) N=45
Low selling prices	15.4	22.3	10.0	17.0
High transportation costs	7.7	0.0	0.0	2.4
Unreliable market	15.4	11.1	20.0	14.6
Accidents in the working places	15.4	5.6	20.0	12.2
Health problem	7.7	5.6	0.0	4.8
Trees scarcity	7.7	5.6	10.0	7.3
Bad debtors	7.7	5.6	10.0	7.3
Threats from VNRC	0.0	11.1	0.0	4.9
Poor working equipments	0.0	11.2	0.0	4.8
Attack from wild animals	0.0	16.7	20.0	12.2
Poor harvesting skills	0.0	5.6	0.0	2.4
Lack of capital	0.0	0.0	10.0	2.4

4.7.2.1 Forest product processing

By processing we mean changing or transforming a product from its raw form to another form of high value. Processors are all those people who in one way or another are involved in the process of transforming that product to its high value. They include actors like saw millers who transform logs into timbers, carpenters who use timber to produce furniture and other products that use timber or people who make mates using

wild-palm leaves in Kiswahili known as kindu. In most cases, these actors are likely to get higher margin because the nature of the products they produce fetch higher value as well as income multipliers through derived jobs.

4.7.2.2 Characteristics of sampled forest products processors

Table 22: Social Economic Characteristics of sampled forest products processors

	% Distribution of processor characteristics by village			
Social-economic characteristics	**Temeke (n = 8)**	**Ilala (n = 5)**	**Kilwa (n =27)**	**Total (n =40)**
Below 30 years old	43.8	46.3	30.0	45.6
30 to 50 years old	56.2	47.4	50.0	46.7
Above 50 years old	0.0	6.3	20.0	8.7
Below 30 years old	43.8	46.3	30.0	45.6
Gender				
Male	100	100.0	85.2	90.0
Female	0.0	0.0	14.8	10.0
Main occupation				
Yes	100	100.0	70.4	80.0
No	0.0	0.0	29.6	20.0

(i) Age distribution

According to the sample most processors were found to belong to the age group of 30 to 50 years old in all the districts. Very few respondents were found to belong to the age group of 50 and above, with Ilala having only 6.3% of this age group and Kilwa district having 20% while Temeke was having none of this age group.

(ii) Gender distribution

At this level there were also more males (90%) than females with Temeke and Ilala Districts constitute 100% of males each. These results imply that, more male are involved in the processing activities compared to females. This is because of the nature

of the job that is, the jobs such as carpentry and saw milling involve much energy which cannot be expended by females. The few (10%) females who were found to be involved in processing activities were found to engage themselves in light activities such as sawing mates. These females were found in Kilwa district (14.8%) where raw materials (Kindu) for sawing mates are found.

(iii) Occupation distribution

About 80% out of 100% of the sampled processor found in the two districts said processing is their primary occupation (Table 22). And only 20% of the sampled processors cited processing as their secondary occupation, with Kilwa district consisting most (29.6%) of these people because most of them are involved in agricultural production. Another reason is scarcity of timber products due to restrictions from conservation Projects such as REDD and PFM within the villages. This leads to an increase in the prices of timber, which most village processors cannot afford. Unlike processors in Temeke and Ilala who only depend on processing as their main occupation.

4.7.2.3 Source of start-up capital for processing units

Like producers, majority (59.3%) of the processors within the villages (Kilwa district) cited own saving as the source of their start-up capital. Unlike the sampled processors in towns such as Ilala (100%) and Temeke (100%) districts who cited financial services, both formal and informal as their source of capital. The dependency on own savings among processors within the villages is associated with inability to access financial support from credit institutions. Other important sources of capital cited by the respondents include family or friends which account for about 15% of processors in both the villages and in towns.

Table 23: Source of start- up capital for processing units

Source of capital	% Distribution by district			
	Temeke (n= 8)	Ilala (n=5)	Kilwa (n=27)	Total (all districts) (n=40)
Own savings	0.0	0.0	59.3	40
Friend or family	0.0	0.0	22.2	15
Formal credits	100.0	100.0	18.5	45

4.7.2.4 Scale of processing unit

Table 24 shows that, most (67.5%) of the processing units are small in scale in such a way that the technology used is very low to influence production. Most (100%) of these processing units were those found within the villages in Kilwa district and most of them use hand based tools which tend to lower production of goods and spending of much time in the production process. unlike the processing units found in the towns of Temeke (87.3%) and Ilala (100%) district whose scale of units were medium and large (12.5%) due to use of improved technology such as electrical machines, and advanced equipment. Most (30%) of the processing units found in towns were of medium scale And only one, accounting for 2.5% of the processing unit found in two districts specifically Temeke District operated at a large scale.

Table 24: Scale of processing unit

Scale of processing	% Distribution by district			
	Temeke (n= 8)	Ilala (n=5)	Kilwa (n=27)	Total (all districts) (n=40)
Small (simple technology)	0.0	0.0	100.0	67.5
Medium (intermediate technology)	87.3	100.0	0.0	30.0
Large scale (advanced technology)	12.5	0.0	0.0	2.5

4.7.2.5 Types of processed products

Table 25 below shows four kinds of products which are processed from forest resources in the study area. The results show that most of the processed products were furniture (57.5%), followed by charcoal (25%) which was done through packing, and timber (7.5%) in Kilwa district specifically at Nangurukuru; then followed by mats (7.5%) which were mostly made by women and lastly Kuti (2.5%) for house roofing. Timber processing units (saw milling units) were found to operate at Nangurukuru town at the main junction to Kilwa Masoko, Kilwa Kivinje and other villages within Kilwa district where the business were reported to be more developed. And none of the timber processing units were found within the villages. The reason that this enterprise is located at Nangurukuru is because of the access to the means of transportation such as roads, as well as availability of power.

Table 25: Type of processed products in the study area

	% Distribution by district			
Type of processed products	**Temeke (n= 8)**	**Ilala (n=5)**	**Kilwa (n=27)**	**Total (all districts) (n=40)**
Furniture	75.5	60.0	51.9	57.5
Charcoal	25.5	40.0	22.2	25.0
Timber	0.0	0.0	11.1	7.5
Mates	0.0	0.0	11.1	7.5
Kuti	0.0	0.0	3.7	2.5

4.7.2.6 Means of transporting processed products

Most (20%) of the processors in the study area who were found to transport their products to the marketing centers used public transport, with a large proportion coming from Kilwa district (29.6%). And only few (2.5%) used bicycles to transport their products. Large proportions (77.5%) of the processors within the two districts were

found not to transport their products. Most of them said their customers come and collect the products from their processing units. The reason for using bicycle as a means of transportation or not transporting the product at all is insufficient capital to enable them to hire a car for transportation. As a result they fail to expand their market leading to getting low profits.

Table 26: Mode of transporting processed products

Means of transportation	% Distribution by district			
	Temeke (n= 8)	Ilala (n=5)	Kilwa (n=27)	Total (all districts) (n=40)
Public transport	0.0	0.0	29.6	20.0
Bicycle	0.0	0.0	3.7	2.5
Did not transport	100.0	100.0	66.7	77.5

4.7.3 Marketing of forest products within the villages and outside the villages

4.7.3.1 Marketing agents of forest products

These are players who connect producers to the final consumers. They include such players as wholesalers who tend to buy forest products in bulk from forest harvesters and sell either directly to the final consumers, processors, or retailers in bulky. Another group is retailers who buy either from producers or wholesalers in bulky, and sell the products either to other retailers, processors or directly to the final consumers in small quantities. Most of these actors sell such products as charcoal in small plastic bags or in small buckets of 10 liters.

4.7.3.2 Characteristics of sampled forest products marketing agents

Table 27: Social-economic characteristics of sampled marketing agents

	% Distribution of marketing agent characteristics by district		
Social-economic characteristics	**Temeke**	**Ilala**	**Kilwa**
Age			
Wholesaler (n =7)			
Below 30 years old	0.0	0.0	42.9
30 to 50 years old	0.0	0.0	57.1
Above 50 years old	0.0	0.0	0.0
Average age			
Retailers (n =45)			
Below 30 years old	20.0	0.0	45.5
30 to 50 years old	60.0	0.0	54.5
Above 50 years old	20.0	100.0	0.0
Gender			
Wholesalers (n=7)			
Male	0.0	0.0	71.4
Female	0.0	0.0	28.6
Retailers (n=45)			
Male	80.0	100.0	18.2
Female	20.0	0.0	81.8
Education level			
Wholesalers (n=7)			
Primary education	0.0	0.0	42.9
Secondary education	0.0	0.0	57.1
Post secondary education	0.0	0.0	0.0
Retailers (n=45)			
Primary education	75.0	33.3	63.6
Secondary education	25.0	66.7	36.4
Post secondary education 42650	0.0	0.0	0.0
Occupation			
Wholesalers (*main occupation*) (n=7)			
Farming	0.0	0.0	57.1
Other business	0.0	0.0	42.9
Secondary occupation			
Forest product business	0.0	0.0	100.0
Retailers (*main occupation*) (n=45)			
Wage employment	15.0	66.7	0.0
Forest product business	85.0	33.3	36.4
Farming	0.0	0.0	22.7
Other business	0.0	0.0	40.9
Secondary occupation			
Forest products business	20.0	66.7	63.6
Farming	40.0	0.0	36.4
Other business	40.0	33.3	0.0

(i) Age distribution

Table 27 shows age distribution of the marketing agents. From the table most of the marketing agents in Kilwa district belong to the age of 30 to 50 years old; with wholesalers accounts for 57.1% and retailers 54.5% within this age group in the district.

Also most of the retailers (60%) in Temeke district were found to belong to this age group. In Ilala district, most of the retailers (100%) were found to belong to the age group of above 50 years old and none of the wholesalers were found to be above the age of 50 years in either of the district.

(ii) Gender distribution

Table 27 shows that most (71.4%) of the sampled wholesalers in Kilwa District were males while most (81.8%)of the retailers were females. unlike the forest producers and processors, females dominated forest product market within the district. This is because most of the retailers of forest products sell the products at home and the process does not require much energy and time; so it is possible for women to do the business at home and at the same time get involved in other domestic activities, while males are the harvesters of these forest products. In Temeke and Ilala districts, males constitute a large percentage of retailers; 80% and 100% respectively, this is because in town males are responsible for finding money for the their families while females would stay at home doing other domestic activities such as cooking, and look after kids.

(iii) Education level

From Table 27 wholesalers in Kilwa district had most (57.1%) of the sampled agents with secondary education, while retailers (63.6%) had primary education. Ilala district had most of retailers (66.7%) with secondary education and Temeke District had 75% of the retailers with primary education. Neither wholesalers nor retailers were found to have post secondary education in either of the districts.

(iv) Occupation distribution

Marketing of forest product was found to be a secondary occupation for most of the marketing agents in Kilwa district. Within the district, 100% of the wholesalers and

63.6% of the retailers cited forest product marketing as their secondary occupation. Most (57.1%) wholesalers said farming was their primary occupation, while retailers (40.9%) said other business such as kiosk, restaurant, selling genge were their main occupations in the district. unlike retailers in Temeke district where forest product business was found to be their primary occupation (85%) followed by wage employment (66.7%), forest products business was found to be a secondary occupation for only 20% of these retailers. A special case was found in Ilala district where wage employment and forest products were found to carry the same weight (66.7%) for retailers.

4.7.3.3 Types of forest products mostly sold by marketing agents

The most commonly forest product sold by the marketing agents is charcoal, which was sold by 57.1% of the wholesalers and 71.1% of the retailers; this is, followed by timber with 42.9% of wholesalers and 22.2% of retailers. The reason for these products to be highly sold is because of their high demand both in the villages and in towns. Firewood was found to be traded by few (6.7%) retailers and at small quantities and none of the wholesalers was found to trade firewood within the villages. The reason was that these products do not have a big market as most of the people would just go to the forest and collect firewood on their own. Products such as firewood, poles, and grasses were mostly sold within the villages by retailers because they are not highly used in town; therefore most of these products did not require marketing agents as they were sold from producers directly to the consumers within the village.

Table 28: Type of products mostly sold by marketing agents

Type of products sold	Frequency	Percentage	Cumulative frequency
Wholesalers (n=7)			
Charcoal	4	57.1	57.1
Timbers	3	42.9	100
Retailers (n=45)			
Firewood	32	6.7	6.7
Charcoal	10	71.1	77.8
Timber	3	22.2	100

4.7.3.4 Source of initial capital for marketing agents

Most of the sampled marketing agents in Kilwa district used own savings as startup capital, with retailers having higher proportion of 63.6% and wholesalers of 42.9%. Unlike retailers in Temeke district (75%) and Ilala district (100%) who were mostly found to secure loans from financial institutions such as Finca and SACCOS, family and friends (31.8%) were found to be alternative source of income for most of retailers in Kilwa district, with credit institution (4.5%) being the least source of capital in the district. The reason for this is that most of these agents within the villages do not have access to the financial institutions. This might be attributed to the reason that most of the agents found in the villages do not have registered business which makes it difficult for them to obtain loans from financial institution. Wholesalers who were able to secure loans from credit institutions (28.9%) from Kilwa district were those in Nangurukuru town.

Table 29: Source of initial capital for marketing agents

	% Distribution by district		
Source of capital	**Temeke district**	**Illala district**	**Kilwa district**
Wholesalers (n=7)			
Own savings	0.0	0.0	42.9
Family and friends	0.0	0.0	28.6
Credits institution	0.0	0.0	28.6
Retailers (n=45)			
Own savings	20.0	0	63.6
Family and friends	5.0	0	31.8
Credit institution	75.0	100	4.5

4.7.3.5 Source of forest products marketed by sampled marketing agents

It was found that marketing agents had two sources of obtaining forest products as shown in Table 30. From the table about 85.7% of the sampled wholesalers and 86.7% of the sampled retailers obtained their products from villagers who are forest harvesters from the study area. And only a few (14.3%) of the wholesalers and (13.3%) of the retailers obtained their products from such sources as town vendors who also obtained these products from villages. This implies that forest destruction take place in the village therefore if conservation measures are to take place, they should start at village level.

Table 30: Source of forest products marketed by sample marketing agents

Source of forest products	**Frequency**	**Percentage**	**Cumulative frequency**
Wholesalers (n=7)			
Vendors	1	14.3	14.3
Producers	6	85.7	100
Retailers (n=45)			
Vendors	6	13.3	13.3
Producers	39	86.7	100

4.7.3.6 Mode of transportation of forest products among the marketing agents

Assessment of the mode of transportation among traders is essential in order to determine how marketing agents are linked to other value chain actors in the distribution process. According to the findings the most used mode of transportation by marketing agents was public transport with 57.1% of the wholesalers from Kilwa and 95% and 100% of retailers from Temeke and Ilala district respectively using this mode. Other modes of transportation in order of importance as identified in the study area are bicycles which accounts for (14.3%) of wholesalers and (9.1%) of retailers in Kilwa district and none in other districts. The use of cart (18.9%) was most commonly used by the retailers because these agents were selling their products in small quantities. And about 28.6% of wholesalers and 72.7% of retailers from Kilwa district said they did not transport their products; and only 5% of the retailers from Temeke district said they also did not transport their products. Most of them were selling the products at home because of higher transportation costs.

Table 31: Mode of transportation of forest product among the marketing agents

	% Distribution by districts		
Source of forest products	**Temeke district**	**Ilala district**	**Kilwa district**
Wholesalers (n=7)			
Bicycle	0.0	0.0	14.3
Public transport	0.0	0.0	57.1
Did not transport	0.0	0.0	28.6
Retailers (n=45)			
Bicycle	0.0	0.0	9.1
Public transport	95.0	100.0	0.0
Carts	0.0	0.0	18.2
Did not transport	5.0	0.0	72.7

4.7.4 Forest products marketing channels

Five marketing channels were identified in the study area. The channels varied from one village to another depending on the location of the villages. Those villages located near to the roads and towns such as Migeregere had a long chain compared to those which are far from the roads or towns. Villages in the former category, unlike those in the latter, were able to transport their goods to other areas such as Nangurukuru, Kilwa masoko, Kilwa kivinje and Dar es Salaam city. The most transported products were charcoal, and timber. Products such as firewood, grasses, poles, and fito were rarely transported because very few users in towns used these products; therefore, they had shorter channel. Most of these products were sold within the villages. The identified marketing chains were as follows:

a) Forest products harvesters who sell raw products such as timber to processors, who then sell processed products such as furniture to the final consumers
b) Forest products harvesters who sell forest products such as timber, charcoal, grasses, firewood, and the like directly to the final consumers.
c) Forest products harvesters who sell forest products such as charcoal and timber to the marketing agents (wholesalers, retailers) who then sell such products to the final consumers.
d) Forest products harvesters who sell forest products to processors (saw millers), who then sell the products to the marketing agents such as wholesalers and retailers, who again sell the products to the final consumers
e) Forest products harvesters who sell raw forest products such as timber to processors, who then sell processed timbers to other processors (carpenters) who then sell processed products such as furniture to the final consumers

Channel (b) which involved direct sale to consumers is the shortest; this is mostly applicable to products such as firewood, poles, grasses, fito which are mostly sold within the villages as they are not transported because of their low demand in towns.

While channel (e) is the longest with which the products pass through several intermediaries.

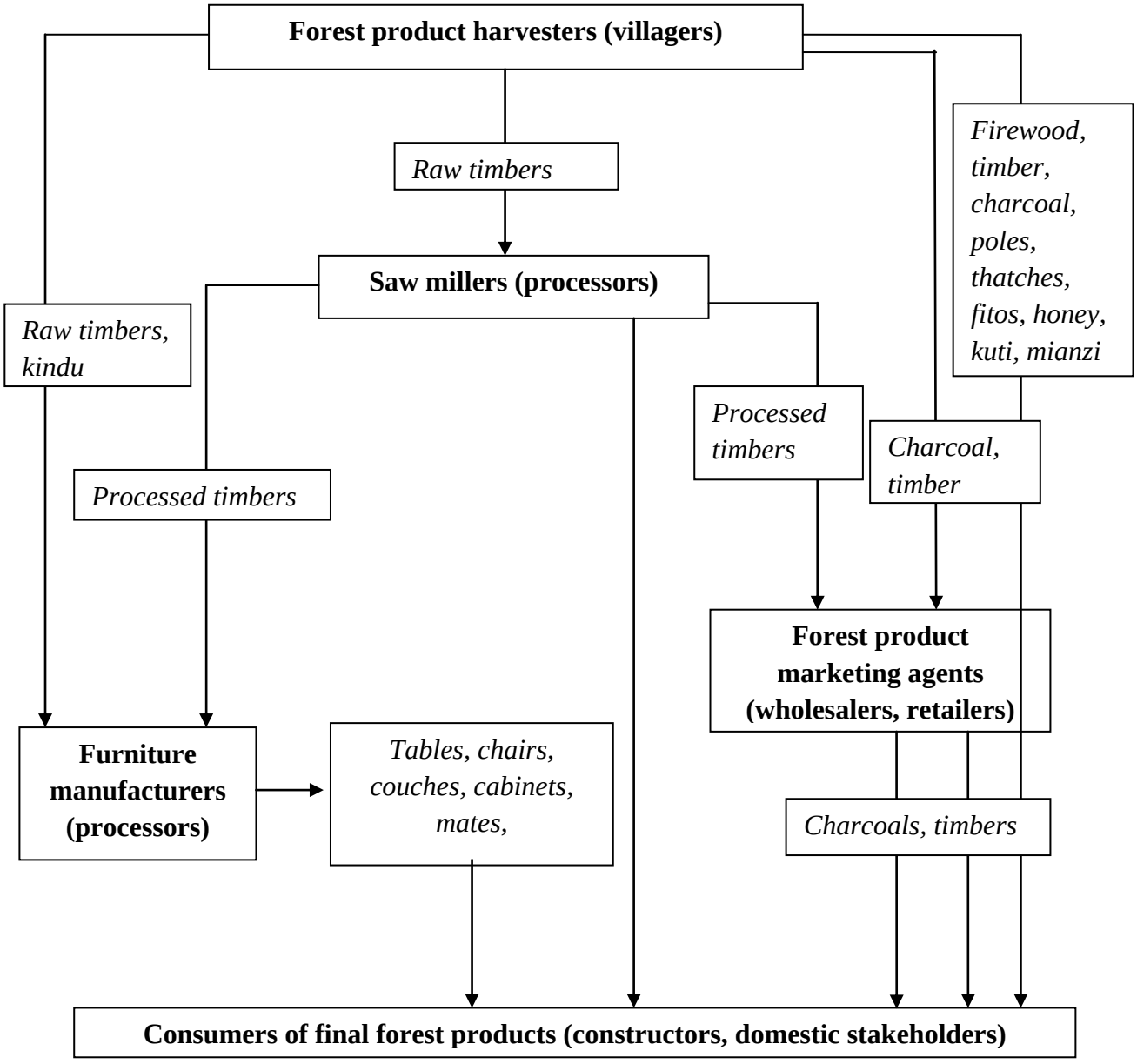

Figure 6: Forest products marketing channels in Kilwa and Dar es Salaam city.

4.7.5 Seasonality of products sales

According to the law of demand and supply, an increase in the product supply lowers the price of the product and vice versa. Table 32 presents this same picture. Most (89.7%) of the villagers said the prices were low during dry season with the reason that, most people are involved in forest product extraction compared to the wet season hence an increase in the supply of the products. This is because during this season agricultural production does not take place so much, as it is not sweet able time to produce due to drought. This force many people to engage in forest product business such as charcoal making, firewood extraction, and thatches selling as their alternative source of income. Another reason for high supply in dry season is the fact that this is the best period because most of the products such as firewood, or thatches become dry; also it is the best period for charcoal making as the business is not suitable during wet seasons. Very few respondents (10.3%) said the prices are high during dry season.

Table 32: Seasonality of product sales

	% Distribution by seasons	
Seasonality of product sales	**Dry season**	**Wet season**
Low prices	89.7	10.3
High prices	10.3	89.1

4.7.6 Price and profit margin analysis among actors

4.7.6.1 Forest products prices at various nodes along the value chain

Forest products which take relative longer chain in the marketing process were selected to identify changes in the prices along the nodes of their chain. This was done to identify the change in the value of the products as they move from one actor to the other. The products selected were timber and charcoal. The reason for choosing these products was

the fact that the products are the most transported, and some can be processed like timber hence gets a longer chain. Therefore, it is easy to identify the changes in their values as they move from one point to the other. Products like firewood, poles, fito, thatches, and soil, were not included. Such products are only sold within the villages and directly to the final consumer as they are not transported from one village to another neither to towns due to their low demand.

Table 33 shows that the prices vary between value chain actors. Three products; charcoal, and timber or logs which take relative longer chain hence involves many actors as processors, wholesalers and retailer were selected to assess changes in the prices between actors. Products such as fito, poles, thatches, honey, and bamboo involved only two actors, producers and final consumers therefore they were not useful to show price variation among actors. Selling prices were higher at the processing level followed by marketing level (wholesale and retail level) then at the production level. The reason for having higher prices at the processing and marketing levels was o that value is added to the products gradually as the products move from one stage to another, resulting either packaging or processing. Transportation cost is another factor that causes changes in the prices of the products among actors. Higher prices at the processor's node are partly due to the costs associated with value addition through processing.

Table 33: Forest products price variation at different nodes along the chain

Price variation	Production		Processing		Marketing agents			
					Wholesale		Retail	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Charcoal (50kgs bag)	1 500	2 500	-	-	3000	5000	5500	6000
Timber (Piece)	4 000	5 000	30 000	35 000	38 000	40 000	45 000	48 000

4.7.6.2 Gross margins realized by value chain actors of the forest products in Non-REDD situation/scenario

Gross margin at different nodes of the chain was calculated to identify the distribution of margins among the value chain actors of all forest products. At this point, all forest products including those which fetch shorter chain were included in the analysis. The reason for including all of them is that they also contribute to the profits of the producers. Table 21 present the profit margins obtained by producers, processors, and traders (marketing agents) of all forest products under non-REDD scenario. According to the results, processors realized the highest average margin of TAS 19 590 797 per year, followed by marketing agents in which the retailers were getting TAS 8 092 943 and wholesalers TAS 9 428 738 per year, and lastly producers who were getting TAS 741 274 per year in this scenario (non-REDD). Higher profits among processors result from value addition to the product, as well as the number of different products produced using the same type of raw material such as timber. Despite the additional costs, the products fetch high prices due to value addition. The costs incurred by the actors include transportation cost, the cost of moving a product from one place to a point of selling or production. Other costs are taxes charges for each product obtained, working equipment such as axes, panga, knives, and different kinds of machines used at the processor's level, the cost of buying a product such as charcoal, timber for the case of processors and marketing agents, and raw materials cost such as nails, and polish for the processors.

Table 34: Annual gross margins obtained by value chain actors of forest products in non- REDD situation

Revenue/Actors	Producers	Processors	Marketing agent	
			Retailers	*Wholesalers*
Total revenue	**852 758**	**22 561 685**	**98 160 648**	**24 960 000**
Average cost				
• Transportation	83 655	86 300	-	326 000
• Tax	10 264	322 200	13 072 484	350 833
• Working equipment	17 565	729 118	-	-
• Buying cost	-	1 584 050	76 995 222	11 919 429
• Raw material	-	249 221	-	-
Total average costs	**111 484**	**2 970 888**	**90 067 706**	**15 531 262**
Gross margin	**741 274**	**19 590 797**	**8 092 943**	**9 428 738**

This part calculate the margin obtained by all actors of forest products in a non-REDD scenario. In this scenario income from forest products excluding carbon is used to calculate the margin of the actors with the objective of knowing what is the producer of these forest products who has a role of conserving the forest gets.

The high level of profit for marketing agents was contributed by the fact that wholesalers sell their products in large quantities and incur low average transportation costs hence they benefit from economies of size. Also value addition through packaging and processing of charcoal and timber respectively enable them to fetch higher prices.

For retailers, those who sell charcoal, high margins are the result of absence of transportation costs since they get charcoal from wholesaler through home delivery and sell the product at their home. In Dar es Salaam region, retailers get higher profit margins on the processed timber business because the products are sold at higher price

while it bears little cost in investment. The low profit obtained by producers unlike other actors is a result of selling forest product at their raw state or do minimum value addition.

Table 35: Gross margin obtained by producers of forest products without carbon within the studied villages (in TAS)

Revenue (Producers)	**Mchakama**	**Liwiti**	**Migeregere**
Total revenue	**736 607**	**648 867**	**682 800**
Average cost			
• Transportation	160 567	95 333	39 001
• Tax	64 360	39 467	21 171
• Working equipment	23 400	9 007	40 482
• Raw materials	-	-	-
• Other costs	-	-	-
Total average costs	**248 327**	**143 807**	**100 654**
Gross margin	**488 280**	**505 060**	**582 146**

The section illustrates the gross margin obtained by producers from each village under a situation where carbon is not included in the margin. In this case producers only get income from selling all other forest products found in the community such as charcoal, timber, thatches (grasses), firewood, soil etc.

Producers at Migeregere village were obtaining higher gross margins compared to producers in other villages such as Mchakama (a REDD village) and Liwiti (a PFM village). High profit in Migeregere was a result of poor restrictions and management of the forests by the village in conserving the forest. The village didn't have any forest

conservation project; therefore, people were accessing the forest any time they wanted. For the case of Mchakama, producers were getting very low income as the result of REDD pilot project implemented within the village that restrict villagers from extracting forest products anytime they wanted. The same is true with gross margins at Liwiti village where the PFM project allows people to collect forest products at minimum frequency.

4.7.6.3 Distribution of carbon funds at the community level in the study area

According to mjumita REDD fund model was developed in 2011, and REDD payments are made directly to the communities. Villages commit themselves to forest management activities by reducing deforestation and take responsibilities of addressing sources of deforestation such as shifting agriculture. Emission reductions are calculated and sold to voluntary markets, and the payment is on performance based depending on the reduction level relative to historical baseline. Therefore, MJUMITA channels payment from voluntary market directly to the communities through village assembly and they choose their payment system of which they codify them in the village by laws which govern the distribution of REDD funds centered on individual dividends. The project implementers believe such payment create the most direct incentive to the community in reducing deforestation and are mostly likely to succeed reaching the goal of reducing deforestation and promoting rural development.

4.7.6.4 Actors in the REDD funding at the community level in the study area

4.7.6.5 Direct actors

a) Local communities/project implementers

These are the project owners; and they are the legal owners of the carbon credits achieved from emission reduction, through reducing their deforestation activities. Local

communities make commitment to themselves to reduce deforestation and undertake community based forest management, village land use planning, improved agriculture and taking steps to address deforestation drivers such as shifting agriculture. In addition, they pass by laws to govern the distribution of REDD funds centered on direct payments of dividends to all community members.

b) Village assembly

These are selected villagers within the community whose roles are to decide on individual dividends to be used for forest management activities as per specific development activities. They pay the verification and marketing costs to MJUMITA and receive REDD funds from them depending on their reduction on behalf of the whole communities. They then channel the funds received to each registered villager based on the agreed model of payment set by the villages in their village by-laws.

c) MJUMITA/TFCG/MCDI

MJUMITA is an NGO which connects the community with buyers of their carbon credits. They play the role of service provider linking the communities with REDD finances. They are specifically responsible for providing all the necessary support in developing project design documents that meet Verified Carbon Standards (VCS), implementation and facilitate the process of credit creation, marketing/selling of carbon credits on behalf of the local communities. Furthermore, they are responsible for remote sensing and compiling monitored data and arranging third party verification by independent and accredited verifier for verification and certification of the emission reduction achieved by the communities. Apart from that they pay registry fees to VCS registry, and receive Verified Emission Reduction documents (VER) from them of which they then channel the VER to the final buyers. Their compensation is limited to the costs of services they provided.

4.7.6.6 Indirect actors

a) VCS verifier

These are independent verifiers whose role is to verify the compiled data from MJUMITA on carbon monitored from the community responsible for emission reduction. They then submit Verified Emission Reduction document (VER) to the VCS registries for registration.

b) Verified Carbon Standard (VCS) registry

The main role of these actors is to register the emission reduction (offset project) done by the communities. After independent verifier have verified community emission reduction they submit the verified/certified emission reduction to them for registration, then VCS registry channels these reports to MJUMITA after paying registration fees.

c) Buyers/ REDD financiers

These are final consumers of the certified emission reduction paper. They include individuals or organizations who are responsible for emission and who have failed to meet their emission goals. Most of these are individuals or organizations from developed countries.

d) Environmental committee

Specifically these are responsible for enforcing laws on the environmental conservation issues and report on deforestation to the village assembly meetings and receive their payments from them. They channel the payments to the forest monitors who are registered villagers under the REDD scheme selected within the villages for monitoring activities in the village forests.

e) Village government

These are the final players in the whole process of REDD funding. They are responsible for planning village development projects from the money they received from every registered village as per agreed contributions within the village. These development projects include school building, health centers building, and communication network development for the benefits of the whole communities.

Other participants in order of importance include micro finance institution such as the banks whose role is to channel loans received from MJUMITA to the registered villagers, who in turns use the money to purchase agricultural inputs from agricultural service institutions for agricultural production. They also channel loans to the private agricultural service institutions to facilitate them.

4.7.6.7 Distribution channel of REDD funds at community level in the study area

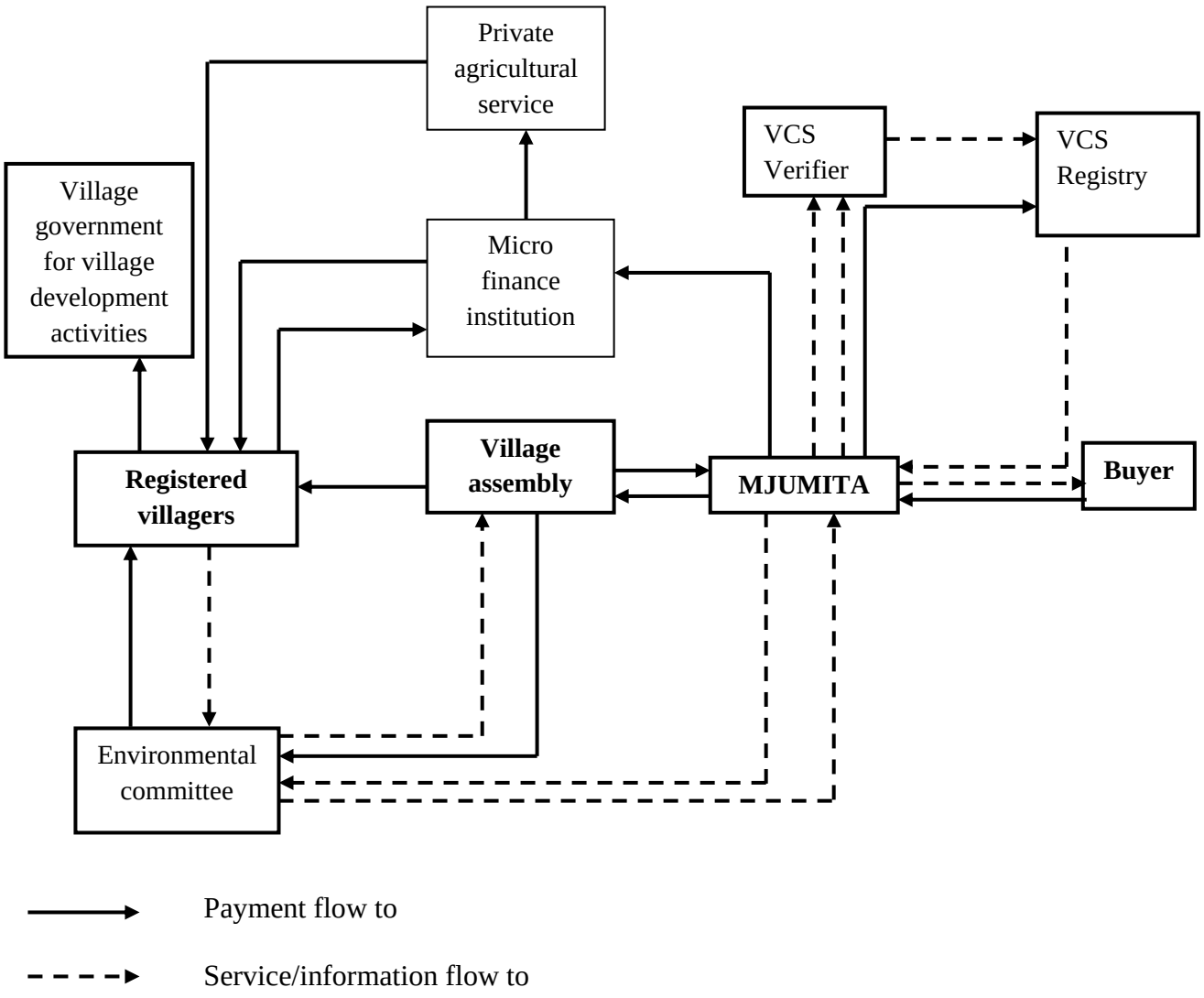

Figure 7: Distribution channel of carbon payment within the community

Description of above diagram:

a) Village assembly pays MJUMITA for verification and marketing costs
b) MJUMITA provides remote sensing and compiled data received from environmental committee to VCS verifiers for verification and pays them for the verifications
c) VCS verifiers provide Verifies Emission Reduction (VER) to VCS registry to register and certify the community concerned for REDD funds after their monitored data have been verified and certified.
d) VCS registry provides certified emission reduction document to MJUMITA who then market the Verified Emission Reductions on behalf of the community concerned. After receiving the money from the buyers they then flow the funds to the village through village committee, based on their performance. And they put another fund in the banks where any member of the community and private agricultural service institutions can be free to borrow and invest in agriculture for agricultural development.
e) Village assembly then decides on the amount to be distributed to each registered villager. After villagers received the funds they then contribute to the village government as per the agreed amount for development projects within the village and use other money for their home needs.
f) The village government then plan on the village development projects according to community priorities. These developments projects could be school building or construction of health centers.
g) Private agricultural service providers, provide agricultural inputs to the villagers who demand agricultural inputs for agricultural development.

h) Village assembly also pays environmental committee for their enforcement on environmental conservation, and who in turn pays villagers who are responsible for enforcing environmental conservation.

4.7.6.8 Gross margin realized by the community under REDD situation

This part evaluate the gross margin obtained in REDD situation where producers (community) sells both carbon and other forest products. This is illustrated in Mchakama village where producers (community) of the forest products obtain income from other forest products as well as from carbon. The margin is compared to other villages such as Liwiti and Migeregere who are not in REDD but sell only other forest products.

From the results (Table 36), Mchakama which was under REDD mechanism was observed to obtain higher profit margin of TAS 683 287 per household than household in non-REDD situation whose average income was TAS 505 060 for Liwiti and TAS 582 146 for Migeregere community. These amounts are however less than the incomes obtained by other actors such as processors and marketing agents.

The higher profit margin at Mchakama community was found to be contributed by additional income the community is expected to obtain from carbon managed in their forests. It can therefore be concluded that communities manage their forests under REDD mechanisms are expected to receive higher income than the income of those under non-REDD situation. This is supported by t-value of 0.0032 at $p<0.05$ which implies that gross margin in REDD scenario was statistically higher than in non-REDD scenario (see for Mchakama village). This will give the best incentives for them to

manage their forest properly as the income that they will be receiving annually is higher than that obtained from normal management of the forests.

Table 36: Gross margin realized by the actors in carbon distribution chain

Revenue/costs	Mchakama	Liwiti	Migeregere
Revenue (value of verified emission reduction)	127 733 760	-	-
Annual costs of CBFM			
• VNRCs operation	2 502 720	-	-
• Self monitoring	1 691 712	-	-
MJUMITA service charges			
• Facilitation and marketing	1 085 040	-	-
• Remote sensing	316 800	-	-
• Third party verification charges	506 880	-	-
• Registry and certification	1 354 320	-	-
• Brokerage fee	11 938 602	-	-
Total costs from carbon management	**19 396 074**	**-**	**-**
Net income from carbon selling	**108 337 680**	**-**	**-**
Per capital income from carbon	**216 675**	**-**	**-**
10% village contribution	**21 668**	**-**	**-**
Individual dividend	**195 007**		
Per capita income from other forest products	**488 280**	**505 060**	**582 146**
Total per capita income from forest resource	**683 287**	**505 060**	**582 146**

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

5.1.1 Value and benefits of Forest resources and their livelihood impact

Natural resources, especially forests, contribute substantially to the income level of the local communities through various forest products, including carbon obtained from the forest. Given the fact that agriculture is the leading activity in terms of the number of people involved, for most rural communities' forests diversify income earning opportunities to rural people.

From the results, income from natural resources such as forests was found to be the leading source of income at household level even though a few people partake in forestry activities as opposed to farming. Although the costs and benefits in participating in REDD+ activities vary between communities as the result of differences in their forest size, this is well stipulate that REDD+ does not always produce a win-win situation. For example in a situation where community was banned from collecting forest products but are extracting carbon, the average income per year generated from carbon only was low (TAS 408 129 in Liwiti village, TAS 25 328 in Migeregere village and TAS 191 571 in Mchakama village) compared to income obtained from business as usual (TAS 2 001 791) where community extract forest products only. This calls for national REDD+ strategies to address this problem through designing of equitable benefit sharing mechanisms that would ensure that local participation becomes financially attractive.

5.1.2 Livelihood analysis

The forests within the villages contribute 76% of the household's improved livelihoods and CBFM contributes much to an increase in the household assets apart from monetary gains as well as a multitude of direct and indirect benefits from the forests they manage.

This shows that the perception of communities towards CBFM was positive and communities' participation in CBFM activities was highly influenced by the benefits obtained. Generally, CBFM showed positive effects towards improving livelihoods of the adjacent communities.

5.1.3 Effect of socio-economic factors/incentives on household participation in REDD+/CBFM activities

The results of logit regression analysis indicated that socio-economic factors/incentives such as age, education, income from forest products, income from agriculture, carbon payment in the future, sustainable timber harvest and training were positively correlated with individual participation in REDD+/CBFM activities (R^2 = 0.772). From the regression equation, null hypothesis was rejected at 5% level of significance that carbon trade is not a significant economic incentive for household participation in forest conservation. Therefore, it was concluded that carbon trade though was a new alternative source of livelihood to rural forest managers acts as a potential economic incentive for emission reduction in coastal forests, because the coefficient in the equation was not equal to zero.

5.1.4 Distribution aspect of the benefits from forest resources

Value chain analysis shows that producers of forest products receive the lowest profit margin compared to other actors in the chain. This may act as a disincentive to forest

conservation. Though the income is still low at the producer level, REDD+ mechanism improves the financial gain at the producer level hence improving the potential to act as an incentive to forest conservation.

Generally, forest resources have a great potential in sustaining household livelihoods through provision of a multitude of different forest products, thus contributing to poverty reduction especially under the REDD mechanism.

5.2 Recommendations

Decisions on forest conservation issues under REDD+/CBFM should take into account the socio-economic factors or incentives that influence community participation for better impact of REDD+ programs.

Communities should be allowed to extract forest products in a sustainable way under REDD+ program in order to realize more diverse benefits and reduce/minimize the opportunity costs that the community is likely to face for managing their forests under REDD+

A fair and equitable benefit sharing mechanisms among stakeholders is necessary if adequate local community participation in REDD programs is to be achieved.

There is a need to enhance a wider community participation in forest management for carbon emission mitigation through a wider awareness creation and formal community training on the concepts and practices of carbon assessment and management to improve this knowledge among the local communities.

REDD+ mechanism in general was found to be potential in helping reducing climate change impact if well strategies are put in place that are beneficial, and effective to give better incentives to the community. Therefore further studies on the impact of carbon trade to reduce emission are needed to overcome the problem of climate change which has already started to bring negative effect on the country as well as on worldwide.

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APPENDICES

Appendix 1: Household Questionnaire

Village_____ Ward_____ Division _____

District _____ Region _____

Date: _____Questionnaire No. _____

SECTION A: DEMOGRAPHIC INFORMATION

1. Were you born here (in this village)?
   _____(01) Yes
   _____(02) No

2. If not, when did you move to this village? _____

3. Reasons for moving to this village?
   1. Followed spouse
   2. Followed parents
   3. Seek land
   4. Villagization policy of 1970s
   5. For business purposes
   6. Other (please specify) ……..

4. How many people are there in your household (i.e. persons that live here with you and share this house/room)?
   _____Number of Household members

5. How many members engage in income generation in your household?

6. What is the main livelihood activity that your household relies on (select only one)?
   1. Farmer
   2. Livestock keeper
   3. Business
   4. Wage laborer
   5. Other

7. What other activities earn an income for your household?
   1. Farmer
   2. Livestock keeper
   3. Business
   4. Wage laborer
   5. Others

8. Please help us fill this table about your household

No	*7[a]* *Ñame* **(Start with respondent: not important,** skip if the respondent does not insist that you record their names)	**7B Male (1) Female (2)**	**7C** **Relationship with head of household** Head of household….....01 Spouse. .....02 Son.....……...03 Daughter….....04 Brother ..……..05 Sister ..……. .....06 Father….. ……07 Mother .....……08 Other family .....09 Housemate (not family)…10 Other (not family)…….11	*7D* **Age**	**7E** **Education** None.....01 Attending Primary.....02 Primary complete.....03 Primary incomplete.....04 Attending secondary.....05 Secondary complete.....06 Secondary incomplete.....07 College,Vocational.....08 University complete.....09 University incomplete.....10 Postgraduate.....11 Other.....12	**7F Occupational status (select only one)** Farmer.....01 Fisherfolk.....02 Employed by; Government.....03 By private company.....04 NGOs.....05 Self employed.....06 Retired.....07 Unemployed.....08 Casual worker.....09 Livestock keeper.....10 Students.....11 Other.....12
1						
2						
3						
4						
5						
6						

SECTION B: HOUSEHOLD INCOME ASSESSMENT (COMPREHENSIVE)
In this section we would like to ask you some questions about your household's sources of income. The purpose is that we would like to understand how important agriculture, forest resources and other income sources are to your household.

9. INCOME FROM AGRICULTURE (skip if did not indicate farming in questions 5 and 6) What are the quantities, uses and values of crops that household has harvested during the past 12 months? *Note: List first the main crops that are harvested in largest quantities at specific times of the year. Then probe for small quantities of crops that are continuously harvested for subsistence uses.*

Crops	Total production (2+3)	Unit (for production) 1	Own use (incl. gifts) 2	Sold (incl. barter) 3	Price per unit 4	Total value ((2+3)*4)
11A: Maize						
11B: Sesame						
11C: Rice						
11D: Cashewnut						
11E: Coconut						
13F: Vegetables						
Other						

10. **INCOME FROM LIVESTOCK KEEPING** (skip if did not indicate livestock keeping in questions 7 and 8) What is the number of ADULT animals your household has now, and how many have you sold, bought, slaughtered or lost during the past 12 months? *Note: Only include larger valuable animals; smaller animals are included in table xx.*

Livestock	Present number 1	Sold (incl. barter), live or slaughtered 2	Slaughtered for own use (or gift given) 3	Number (12 months ago) 7	Price per adult animal 8	Change in stock value (for a calendar year)
13A: Cattle						
13B: Goats						
13C: Sheep						
13C: Pigs						
Others						

11. Which smaller animals does the household keep and what was their perceived importance and estimated value to the household economy during the past 12 months?

Livestock	Present number 1	Sold (incl. barter), live or slaughtered 2	Slaughtered for own use (or gift given) 3	Number (12 months ago) 7	Price per adult animal 8	Change in stock value (for a calendar year)
15A: Ducks						
15B: Chicken						
15C: Guinea pigs						
Rabbit						
Pigeon						
Guinea fowl						
Other, specify:						

12. **WAGE INCOME:** Has any member of the household had paid work over the past 12 months?

Wage item	**Total wage income actually received annually**
18A: Casual labour	
18B: Attending meetings (allowances)	
18C: Forest patrols	
Fire break slash and burning (fire line and early burning)	
Monitoring (carbon, biodiversity)	
Research	
Remittances	
Gains for accompanying	

13. Income from own/other business (not forest or agriculture). Are you involved in any types of business, and if so, what are the gross income and costs related to that business over the 12 months?

Type of business	Gross income (sales)	Costs (prof. Kulindwa)	Net income
19A: Food venders			
19B: Small shops			
Middle men			

14. **FOREST RELATED INCOMES:** What are the quantities and values of the economically most important *raw-material* forest products the members of your household collected for both own use and sale over the past 12 months?

Forest product	Collected by whom?*	Collected where? **	Quantity collected	Proportion Sold	Unit	Price per unit	Gross value
20A: Firewood							
20B: Poles (majengo)							
20C: Fito							
20D: Charcoal							
20E: Timber/logs							
20F: Honey							
Wild-meat (including birds)							
Grass for thatching							
Soils							
Plant foods (fruits, tubers, vegetables, mushrooms)							
Medicinal plants							
Medicinal animals (e.g)							

** Codes: 1=only/mainly by wife and adult female household members; 2=both adult males and adult females participate about equally; 3=only/mainly by the husband and adult male household members; 4=only/mainly by girls (<15 years); 5=only/mainly by boys (<15 years); 6=only/mainly by children (<15 years), and boys and girls participate about equally; 7=all members of household participate equally; 8=none of the above alternatives.*

***Codes: 1= own farm, 2= village forest, 3 = village reserved forest, 4 = outside this village*

15. Have you experienced any changes in the quality or quantity of the important forest products your household obtains from nearby forests? Yes/No

16. If, yes, please explain the change

17. What do you think caused the change?
(drought, population growth, forest restrictions, REDD project, PFM/CBFM project implementation, natural)

SECTION C: FOREST GOVERNANCE AND INSITUTIONS AT THE LOCAL LEVEL

In this section we would like to ask you questions that would help us understand whether and how CBFM/PFM has improved governance and institutions for forest governance in your village. We are using a standard knowledge, attitude and practice assessment.

18 COMPREHENSIVE UNDERSTANDING ON FOREST GOVERNANCE AND INSTITUTIONS

- PRACTICE OF FOREST GOVERNANCE AND INSTITUTIONS

Do you attend village meetings?
Do you attend forest related village meetings?
Do you attend various forest related activities?

ATTITUDES/AWARENESS TOWARDS FOREST GOVERNANCE AND INSTITUTIONS
Opinions about forest bylaws
Opinions about VNRC and its functionality
Opinions about village leadership (council) and its functionality
Opinions about MPINGO and other actors
Opinions about the role of the government in local forest management (district and ministerial level)
Opinions about whether local people themselves can sustainably manage the forest
Opinions about drivers of deforestation and forest degradation

19. Are you participating in forest conservation activities carried under REDD+/CBFM?

20. If yes in 19, what kind of activities are you involved in among the following? (tick on appropriate box).

01. Planting trees [ ]
02. Educating people [ ]
03. Participating in village forests protection [ ]
04. Others (Specify) [ ]

21. If no, are there any reasons made you not to participate?

……

22. Who else participate in forest related activities in your household…….....

23. From the 22 above, mention them and their roles

Name	Roles
01)	
02)	
03)	

24. What are the factors/incentives/benefits that motivates you to participate/ your household members in REDD+/CBFM activities?

Incentives	YES/NO
Climate related benefits (rain)	
Carbon payment (in the future)	
Non-Timber Forest Products (NTFPs)	
Timber for subsistence	
Environmental service (e.g. water)	
Sustainable forest harvest	
Income from tourists	
Ritual	
Trainings (e.g. carbon monitoring)	
Employment opportunity	

25. What incentive do you think will likely be more effective in inducing people to participate in REDD activities?

i)……ii)……
iii)…… v)……

26. What do you think on the use of incentives to facilitate people to participate in REDD activities?

……
……
……

27. What are the risks involves in managing forest for REDD+ activities

……, ……., ……., ……., ……., …….

28. What can you say about REDD+, in helping mitigate the problems brought by climate change?

……
……

THANK YOU FOR YOUR COOPERATION

Appendix 2: Effects of CBFM/REDD on Livelihoods at the Household Level

(In this section we would like to ask you some questions about your own perception and attitude on the implementation of CBFM/REDD including determining livelihood outcomes associated with restrictions and incentive structures. The purpose is that we would like to understand whether the livelihood outcomes associated with restriction and incentive structure have changed or are likely to change and your perception of the future situation as REDD arrangement commences.

The aim is to capture the effect/s of forest institutions in accessing and utilizing various forest products at the household level focusing on the following livelihood aspects. Also looking at people perceptions of change in the quality and quantity of various livelihood aspects that might be affected (positively or negatively) by the different institutional arrangements for forest management.)

Energy resources (fuel-wood and charcoal)

1. What is the main source of energy for cooking at your household? (firewood, charcoal, gas, kerosene, grid electricity, solar panels, generators, other sources)

2. What was the source of energy for cooking at your household 15 years ago? (firewood, charcoal, gas, kerosene, grid electricity, solar panels, generators, other sources)

3. What is the main source of energy for lighting at your household? (firewood, gas, kerosene, grid electricity, solar panels, generators, other sources)

4. What was the source of energy for lighting at your household 15 years ago? (firewood, gas, kerosene, grid electricity, solar panels, generators, other sources)

5. Have there been any changes in the amount of firewood and/or charcoal consumed at your household during the past 15 years? Yes/No

6. If yes, please explain the changes? (increased, decreased, remained the same)

7. What do you think caused the changes? (forest restrictions, natural scarcity, household size change, drought, floods, other reasons

Land for farming (whether the household's farm has changed in size and location and what caused the change)

8. Have there been any changes in the size of land you cultivate anytime during the last 15 years? Yes/No

9. If yes, how did it change? Increased or decreased

10. What reasons made you change the size of your farm? (to increase production, to avoid weeds, drought, household size change, declining fertility, improved transportation, better prices, market availability, other)

11. Have there been any changes in the location of your farm anytime during the last 15 years?

12. If, yes, what caused the change in the location? (weeds, insects, drought, loss of soil fertility, etc)

13. How does the size of land available for farming for your household compare now and 15 years ago? More land now/ less land now/ no changes

14. What caused the change?
    (land set aside for PFM/REDD/CBFM, population growth, land taken by biofuel investors, other factors)

15. If you wanted to increase or relocate your farm elsewhere, is there enough land for doing that? (inside your village, outside your village, outside your region)

16. Land for livestock keeping (whether there is less/more land for grazing now that there is a CBFM/REDD forest area)

17. **Water resources** (whether CBFM/REDD absence/presence in a village has had any effect on the quality and quantity of water resources available for various uses at the household level)

Land for other uses (human settlement etc)

18. Access to and utilization of the forested land for recreational, spiritual etc

19. Benefits enjoyed at the household level (agricultural support, social services improvements etc e.g. if a health center built using CBFM/REDD related revenues benefits the household or if they do not see any change)

Other forest products to capture whether the amount and quality consumed at the household have changed any time during the past 15 years and what caused the changes if any.

20. Medicinal
21. Building materials (poles, fito, thatching grass, soils)
22. Timber

Appendix 3: Value/Distribution Chain Analysis of other Forest Products and Carbon

Forest products production/Harvesting (Producers)

(i) Village:……
(ii) Name:…….
(iii) Age:……..
(iv) Sex:……
(v) Education level:……
(vi) Main Occupation:……....
(vii) Alternative occupation:……

What kind of products do you harvest/produce from the forest?

……
……
…….

From which forest do you harvest you products? (Village forest or General land)

……
……

Do you have any plan to expand in the future? .....

Types of activities involved in production/harvesting of forest products?

Activity	Time used for the activity
Cutting forest products (e.g. trees, withies, poles, bamboo, grass, etc)	
Preparation of product (e.g. cutting trees, splitting poles-majengo etc)	
Processing/production	
Others	

Do you sell your as final product or as intermediate products

(i) Final product [ ]
(ii) Intermediate product [ ]

To whom do you sell your products?

……
……

Sale for the past 12 months (quantity and value of the products)

Product 1:

To whom do you sell	Quantity sold	Price per unit

Product 2:

To whom do you sell	Quantity sold	Price per unit

Product 3:

To whom do you sell	Quantity sold	Price per unit

- Costs involved in production/processing for the past 12 months?

Types of costs	Amount (Tshs)
Working equipment/facilities	
Time uses	
Transport	
Taxes	
Others	

What are the kind of equipments used

……....., ……..,

……., ……..

What are your sources of income (put a tick where appropriate)

a) Own saving ( )
b) Family or friends ( )
c) Formal credits ( )
d) Pension income ( )

What mode of transportation do you use to transport you product from the forest to marketing area/home? (tick where appropriate)

a) On foot ( )
b) By bicycle ( )
c) Public transport ( )
d) Own car ( )
e) Did not transport ( )

Who determine price for the product?

a) Seller ( )
b) Buyer ( )
c) Negotiation ( )

What are the benefits have you obtained from the business?

(i) ……
(ii) ……

Constraints/bottlenecks

(i) ……
(ii) …….
(iii)……

From the above constraints, what are your suggestions?

…….....
……..
……
…….

THANK YOU

PROCESSOR

(i) Village:…….
(ii) Age:…….
(iii) Sex:…….
(iv) Education level:……..
(v) Main occupation:……
(vi) Alternative occupation:……..

What is the scale of your processing units? (Small, medium, large)?
……

What is the type of Ownership?
……

Do you sell your product as
(i) Final products [ ]
(ii) Intermediate products [ ]

What are types of Products you process, volumes sold, price you sell and to whom do you sell for the past 12 months?

Product 1:

To whom do you sell	Volume sold	Price per unit

Product 2:

To whom do you sell	Volume sold	Price per unit

Product 3:

To whom do you sell	Volume sold	Price per unit

Product 4:

To whom do you sell	Volume sold	Price per unit

Product 5:

To whom do you sell	Volume sold	Price per unit

Product 6:

To whom do you sell	Volume sold	Price per unit

Product 7:

To whom do you sell	Volume sold	Price per unit

Product 8:

To whom do you sell	Volume sold	Price per unit

What are costs that you incur in processing the products in past 12 months?

Type of cost	Amount (Tsh)
Equipment costs	
Time used	
Transportation	
Taxes	
Raw materials	
Accommodation and food	

Do you have any plan to expand in the future? …….

What are you source of income

a) Own saving ( )
b) Family or friends ( )
c) Formal credits/informal credits institutions ( )
d) Pension income ( )

Means of transport (tic where appropriate)

a) On foot ( )
b) Public transport ( )
c) Bicycle ( )
d) Own car ( )
e) Did not transport ( )

What are the Constraining factors you face?

……
……

From the above constrains what are you suggestion?

THANK YOU

Traders-wholesalers, small traders, vendors, retailers

(i) Village:……..
(ii) Kind of trader: Wholeseller/retailer/vendor (tick appropriate)
(iii) Age:……..
(iv) Sex:……..
(v) Education level:……..
(vi) Main occupation:…….
(vii) Alternative occupation:……..

What kind of products do you acquire from the villagers to trade?

……,……..,……,

From whom do you acquire your products?

……

What are the volume and type of the products you trade for the past 12 months?

Product 1:

To whom do you sell	Volume of the product	Price per unit volume

Product 2:

To whom do you sell	Volume of the product	Price per unit volume

Product 3:

To whom do you sell	Volume of the product	Price per unit volume

What are the costs involves in trading the products for the past 12 months?

Type of costs	Amount (tsh)
Transportation	
Time use	
Accommodation and food	
Taxes	
Cost of buying a product	

Do you sell your product as final product or as intermediate product?

(i) Final product [ ]

(ii) Intermediate product [ ]

To whom do you sell your products?

....., ……

Source of start-up capital (tick appropriate)

a) Own saving ( )
b) Family or friends ( )
c) Formal/informal institutions ( )
d) Pension income ( )

Mode of transportation (tick appropriate)

a) On foot ( )
b) Bicycle ( )
c) Public transport ( )
d) Own car ( )
e) Did not transport ( )

Constraints/bottlenecks

……, ……, ……, ……

THANK YOU

CHECKLIST (Key informant under REDD community)

To asses carbon distribution chain actors, costs they incur in marketing carbon and benefits they get

What is the activities/process involves in the carbon marketing/trading process?

…… ……
…… ……
…… ……

Who are the key players in this process of carbon marketing/trading?

What are their roles in the process?

What are the types of the costs involved in carbon marketing/trading and their quantities?

Transaction costs

…….. ……
…….. ……
…….. ……....

What are the fixed costs involves in the management of forests for carbon if any an their quantities?

……., ……., ……., …….

How is the government involved in the process of selling carbon?

Does the government charge tax in the process of selling carbon?

If yes, how much does it charge per unit tone sold?

How is the benefit obtained from carbon trade distributed to the final beneficiaries' at individual level?

Quantification of costs for carbon management

Cost over and above the normal forest management costs

S/N	Type of Costs	Value of cost (US$/year)
1.	Management costs/implementation costs • Paying guards • Paying VC	
2.	Transaction costs • Carbon stock assessment/measurement • Verification • Certification • Insurance • Brokerage • Monitoring • Recording	
3.	What has been Opportunity cost of implementing REDD (if the community is banned from the use of other forest products)	
Total annual costs		

THANK YOU

Variables in the Binary Logistic Regression model

Variables	Description	Types	Values
Dependent Variable			
Participation CBFM/REDD+		Dummy	0=No, 1=Yes
Explanatory Variables			
AGE	Age of household head	Continuous	Number of years
EDLV	Education level	Categorical	Number of years
INCOMFOR	Income from forest activities	continuous	Tshs
INCOMAGRIC	Income from agriculture	Continuous	Tshs
CARBPAYMNT	Carbon payment in the future	Dummy	0=No, 1= Yes
SUSTTIMHARV	Sustainable timber harvest	Dummy	0=No, 1=Yes
TRAINING	Access to training	Dummy	0=No,1= Yes