

**ANALYSIS OF GREEN INVESTMENTS FOR COMBATING
CLIMATIC CHANGES THROUGH CARBON CREDIT IN
TANZANIA. A CASE STUDY OF GEPAT IN KARAGWE
DISTRICT, KAGERA REGION**

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TANZANIA. A CASE STUDY OF GEPAT IN KARAGWE
DISTRICT, KAGERA REGION**

By

Juliana Charles

**A Dissertation Submitted in Partial Fulfillment of the Requirements for the
Degree of Master of Science in Economics of Mzumbe University, Morogoro.**

2013

CERTIFICATION

We, the undersigned certify that we have read and hereby recommend for acceptance by the Mzumbe University, a dissertation that is entitled: “*ANALYSIS OF GREEN INVESTMENTS FOR COMBATING CLIMATIC CHANGES THROUGH CARBON CREDIT IN TANZANIA, A CASE STUDY OF GEPAT IN KARAGWE DISTRICT.*”

It is a partial fulfillment of the requirements for award of the degree of Master of Social Science in Economics (Project Planning and Management) of Mzumbe University.

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DEDICATION

This work is dedicated to my beloved Parents Mr. and Mrs. Charles George Tihailwa, relatives George Mganyizi Charles, Vincent Charles, Irene Charles, Catherine Charles, Dickson Ishebabi, Anania Trasier and all relatives together with my beloved friends.

LIST OF ABBREVIATIONS

CO ₂	Carbon Dioxide Gas
CBOs	Community Based Organizations
EU	European Union
FAO	Food and Agriculture Organization
GEPAT	Green for Education and Poverty Alleviation Trust
GHGs	Green House Gases
IPCC	Intergovernmental Panel on Climate Change
NGOs	Non-Governmental Organizations
OLS	Ordinary Least Square
PM	Project Manager
SHFs	Small Holder Farmers
URT	United Republic of Tanzania
UNFCCC	United Nations Framework Convectional for Climate Change

ABSTRACT

Carbon credit provision has been reported to be used as an economic incentive in mitigating climate change in the world. It has been reported by different climatic change activists that reforestation is the most important program in combating climate change in the world. This has been a concern for Project Managers (PM) and Economic Planners to address sustainable development in their plan. PMs and other social scientists cannot be involved in different natural scientific experiments, but the only way to participate in climatic change mitigation is to study economic behavioral systems directed to climatic change mitigation. Therefore, the provision of carbon credit in tree planting projects is based on the notion that trees help to mitigate climate change by sequestering carbon dioxide as they grow. This study evaluates the contribution of provision of carbon credit incentives for combating climate change through tree plantation. The study uses a case study analysis in Kituntu and Rwambaizi wards in Karagwe District. The sampling frame was 1093 smallholder farmers (SHFs) whereby a sample of 120 was chosen. The research design was mainly triangulation methods whereby qualitative and quantitative research techniques were employed. Data was collected using questionnaire and observation method. Data collected were analyzed using qualitative and quantitative methods, whereas simple statistics and linear regression model was used to test the hypotheses. The results reveal that the provision of carbon credit incentives such as seeds, seedlings and cash paid to farmers who plant trees have positive impact in increasing the rate of tree planting for combating climate change effects. In addition, the results shows that other factors which influence farmers to plant trees are the size of land owned by farmers and overall level of education which were found to be significant effect in tree planting. However, the results also reveal that there is lack of extension services and technical support regarding tree plantation to farmers in the rural areas such as Karagwe District. It is recommended that those government institutions and other environmental protection stakeholders such as Wakk Foundation and Green Choice to cooperate with private institution in offering and creating incentive oriented programs in tree planting.

The incentives motivates to motivate farmers to plant trees in their own land for the purpose of combating climate change needs to go tandem with planting timber, fruits bearing , oil seed and other beneficial trees. Commercial beneficial trees are relevant to the poor because the poor are continuously fighting poverty and therefore awareness creation on the importance and benefits of trees is equally an incentive to plant trees. The awareness creation on environmental education programs should be done frequently in the rural areas in order to reduce the rate of deforestation and increase the rate of afforestation. There is a need to conserve existing trees and add on new commercial and medicinal trees. Extension services should be established in rural areas so as the farmers will be able to get technical support from extension agents. In a way the goal of combating climate change through planting of trees in farmers' fields organized in a TRUST such as GEPAT will be achieved.

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

“Carbon Credit” is a generic term for any tradable certificate or permission allowing emitters of carbon dioxide (CO₂) and other Green House Gases (GHGs) in the atmosphere to continue emitting a certain level of it by compensating those who are affected by those gases (pollution). The compensation occurs by paying Tons of Carbon Dioxide Equivalent (tCO₂e)¹. Carbon credit is an economic incentive for mitigating the impact of climate change in the world where the countries, which hosts emitters, compensate those who do not emit it. With these strategic incentives, the world has been struggling to combat climate change to achieve sustainable economic development by limiting environmental destructions, which is the main source of climate change. The Carbon Credit System (CCS), the firms operating in the developed world voluntarily compensate for their footprint by supporting afforestation in the developing world through supporting companies or NGOs investing in afforestation and other green economic investments such as solar panels.

By 2013, carbon credit schemes and projects already seen to be efficient in combating climate change in some countries, but a little is known about the undergoing efforts in a Tanzania context. To be able to inform the communities of green economy investors on the success of carbon credit in Tanzania, the case study research was conducted in two wards of Karagwe district provide a snapshot of the success story of combating climatic change in a participatory approach among the grassroots local communities.

¹ Carbon Credit: Collins English Dictionary - Complete and unabridged 11th Edition. Retrieved October 04, 2012 from Collins Dictionary.Com.

Thus, this chapter explains background of the problem, statement of the problem, objectives, hypothesis, and significance of the study, limitation, and delimitation of the study.

1.2 Background of the Study

Implementation of the Millennium Development Goals (MDGs) number seven (MDG No 7) has a direct relationship with the Kyoto Protocol, and United Nations resolution on Clean Development Management (CDM) resolutions (Todaro and Smith 2010), Carbon credit in this study seems to be an incentives given by carbon credit buyers to motivate smallholder farmers to get involved in tree planting (Kamuzora 2008). Smallholder farmers become sellers of carbon credits as they plant trees and be rewarded by the carbon credit providers. The planted trees in turn reduce carbon dioxide in the air. Taking into considerations of the concept of tons of carbon dioxide equivalency (tCO₂e) emitted, it was expected in this study that farmers who were already preserving forest could receive the carbon credit price in terms of tons indirectly. However, this was not the case because many farmers in rural areas depends on trees for their livelihood and therefore, if they cut the trees it is not because they do not know the importance of tree planting, but because they need trees to sustain their lives. Rural areas dwellers, specifically in Karagwe district, cut trees for firewood, building houses and/or for obtaining timber or other tree logs for domestic uses. Hence, deforestation is rampant and it has caused extreme soil erosion and loss of trees of different ages and sizes because each size, and age has its own use. Young tree leaves are used for traditional medicines and firewood. Middle age tree and size are used as poles to be used in building huts.

This study was important to evaluate the economic behavioral changes, which have taken place after the introduction of new trust called Green for Education and Poverty Alleviation (GEPAT). This Trust offers incentives to care about trees and plant others in order to combat climatic changes. GEPAT started in 2008 and it has different stakeholders in all over the World but the most vividly collaborates are Wakk Foundation and Green Choice of The Netherlands. GEPAT creates awareness by offering afforestation incentives, which is expected to change cultural behavior towards

protecting and planting trees and continue depending on using tree products without depleting them. This could be done through replanting trees and protecting them Hence the carbon credit market was introduced to give incentives to the smallholder farmers (tree planters). This incentive was to provide only Tshs 100.00 per a one-year-old grown tree in the two wards of Kituntu and Rwambaizi. This incentive did not consider the people who had already grown old trees. Carbon pricing in this context was construed in terms of Tshs 100.00 per a one-year-old tree planted by a farmers being member of GEPAT.

Other incentives were to prepare a nursery and supply seedlings to the farmers, supplying fertilizer, pesticides, training, advocacy and provision of seeds. In theory carbon credit providers (i.e. GEPAT, Wakk Foundation, Green Choice and other carbon payers) are regarded as principals and the smallholder's farmers (SHFs), in this study, were regarded as agents. The agents depended on the incentives provided by the carbon credit providers (carbon buyers). However, the study assumed that the rational-strategic decision of the agent (SHFs) to plant trees was based on what would be possible within a given institutional framework. The major reason was that the activities of rational SHFs were conditioned by a set of norms, rules and regulation called institutions (North 2005) The institutions affecting tree planting in the SHFs context were formal and informal legislation and regulations (North 1982; North 1990; North 1991; North 1993; North 2005) that influence farmers to plant trees. The controversial outcome emerges when analysis the influence of property rights perceived (secured) by the farmers. Almost the farmland cultivated by the farmers is informal in nature owned under cultural construed family land received from ancestral ownership or being owned by individuals who happened to be allocated that land in the past by some perceived powers controlled the land at that time.

This study stars with the assumption that the SHFs would plant tree if there was the highest expected benefits with the lowest possible transaction costs of planting trees in the land measured in terms of opportunity costs of that land.

If the benefits of using the land for food production are higher than planting trees, a farmer will opt for not planting trees. The opposite also applies. In case carbon credit providers pays to compensate for the opportunity cost of planting trees, the farmer will plant trees and use the money paid to buy some food or other goods required for sustaining his /her livelihood. Therefore, farmer as an agent will plant more trees if the opportunity cost foregone (benefits on the land used and labor) is lower than the benefit derived from planting trees. Other factors, which could influence the SHFs to plant trees, were overall level of education and the size of land owned by her/him. Therefore, the provision of Carbon credit incentive had a positive impact in influencing farmers to be engaged in afforestation activities in order to protect environment.

For example, Jonathan (2011) reported that carbon credit provision is efficient in environmental protection through reduction of CO₂ in the atmosphere. Therefore, reduction of CO₂ in the atmosphere helped smallholder farmers to participate in environmental protection as they plant trees. The similar findings have been reported in Australia whereby carbon credit provision resulted into an increased number of tree planted and carbon sequestration by a (Lvkovk, Paul et al. 2012). A positive impact on increased revenue associated with carbon credit from afforestation activities has also been reported among the Brazilian agribusiness in Brazil (Ruzende et al. 2012).

Thus, Carbon credit provision to SHFs increases climatic resilient and acts as an alternative source of income. The cash secured from the carbon credit providers was utilized to buy food, open up new farm fields and other economic activities depending on several factors including number of trees and SHFs preferences; hence it increased farmers' household income and economic well-being.

Therefore, this study analyzed the economic efficiency of carbon credit, which is an incentive directing farmer's behavior towards combating climate change through afforestation. Furthermore, the study assesses the influence of carbon credit as incentive to combat climate change through afforestation Tanzania.

1.3 Statement of the Problem

The rate of deforestation in rural areas of Tanzania is so high to call for concerted efforts to abate the trend (FAO, 2009). It has been estimated that Tanzania lost an average of 412,200 ha of forests per annum in the 1990s and early 2000s; this amounts to a destruction of 14.9% of its forest cover (or 37.4% including woodlands) in the period 1990-2005 alone (UN-REDD, 2009). The high rate of deforestation is attributed to the existing informal institutions guiding behavior of the rural dwellers. The rural dwellers depended on forest resources as a main source of livelihood (Monela et al., 2000). These livelihood activities include cutting trees to be used as firewood, building materials for local houses, timber, and medicines, to mention but a few. According to URT (2009), forest regulates climate change through carbon sequestration. Hence, deforestation exacerbate increased negative effects of climatic changes. This is followed by increased land degradation rate which in turn affect food security as the land fertility in rural areas depends on biomass from tree leaves and other materials. Some studies show that deforestation has worsened climate change around the world and it accounts for 17.4% of the Green House Gases emission in the World (IPCC, 2007).

According to URT (2009), deforestation has been magnified by limited human and financial incentives and the government inability to have effective sustainable forest management plans. Planting trees in farmers' fields seems to be advocated as a measure to curb reducing greenhouse gas emissions. Planting of trees in farmers' fields, have been reported to increase forest cover and regulates climate change by reducing the rate of deforestation (Foundjem-Tita et al., 2012).

In an attempt to mitigate the impact of climate change; carbon credit has been proposed through Kyoto Protocol and other green economy activists backed up by carbon credit policies. Carbon credit is a means of combating climatic change through the provision of incentives such as cash to the farmers to promote afforestation. Provision of cash, seeds, seedlings, fertilizers, pesticides and training on various aspects related to tree planting and advocacy services have positive impact in promoting tree planting (Foundjem-Tita

et al., 2012). Incentive oriented policies such as carbon credit through direct aids for afforestation, plantation maintenances, compensatory payments for farmer's loss of income have been reported to contribute in the afforestation in developed countries but there is limited empirical research of the impact and efficiency of incentive provision in tree planting in developing countries (Lawson et al., 2002). In the same direction, this study evaluate the impact of carbon credit incentive provided to tree growers who are smallholder farmers to plant more trees in their farm field for combating climate change. The carbon credit incentive packages offered to farmers are seeds, seedlings, fertilizer, pesticides, training, advocacy services, and cash. The carbon credit incentive is being provided to farmers as a motivation to encourage them to plant more trees in their farms fields. However, the decision of the farmers to plant trees may be influenced by other factors. These factors as such as education, land ownership and the institution framework (both formal and informal regulations).

1.4 Objectives of the Study

1.4.1 General Objective

The main objective of the study is to analyze the incentives of green investments given to smallholder farmers in combating climatic changes through carbon credit in Karagwe Distric, Kagera Region Tanzania.

1.4.2 Specific Objectives

The specific objectives of the study are

- i. To assess the impact of carbon credit provided to the farmers as an incentive package in combating climate change effects in Karagwe District.
- ii. To assess the impact of informal and formal institutions on incentive provided to combat climate change effects in Karagwe District.
- iii. To assess the impact of education in combating climate change effects in Karagwe District.
- iv. To determine the contribution of advocacy in combating climate change effects in Karagwe District.

- v. To assess the influence of land ownership and afforestation in combating climate change effects in Karagwe District.

1.5 Research Hypotheses

- i. H1: Carbon credit provision has positive contribution in combating climate change.
- ii. H2: Institutions do play a role in efficiency provision of incentives provided to combat climate change.
- iii. H3: Education has positive relationship in combating climate change.
- iv. H4: Advocacy increases the possibilities of farmers being engaged in combating climate change.
- v. H5: A Property right (Land ownership) is positively related with combating climate change.

1.6 Significance of the Study

- i. This study will help to understand the importance of carbon credit in combating climate change in Tanzania drawing the lesson from Karagwe where this investment is taking place.
- ii. This study will give knowledge of the importance of offering incentives to the farmers to be engaged in combating climate change.
- iii. The study is a Partial Fulfillment of the Requirements for the Degree of Masters of Science in Economics (Project Planning and Management) of Mzumbe University. The researcher is aspiring to become an expert in Clean Development Management in Tanzania, Africa and beyond.

1.7 Scope of the Study

The study was conducted in Karagwe District in two wards namely Rwambaizi and Kituntu. The two wards have been implementing carbon credit international strategies set by Kyoto Protocol to combat climate change. In these wards, GEPAT (Green for

Education andPoverty Alleviation Trust) has been working to promote climatic changes. Therefore, the two wards were suitable for this study.

1.8 Delimitation and limitation of the Study

The study confined itself to interviewing and observing specific smallholder farmers who grew trees in Karagwe district. The participants were located in different schemes and they are members of GEPAT. These participants are being provided with carbon credit incentives as motivation to plant more trees in their farms for the purpose of combating climate change, but not other members of the district. Actually, Rwambaizi and Kituntu wards members were not involved except the members of GEPAT.

In this study, the researcher encountered limitation that could not be avoided. The interviews were conducted in two languages conversant to all participants that were Kiswahili and Kihaya. The interview questions were translated into the participant languages to make sense to them. The process posed some challenges in delivering the right message and understanding of the concepts. To do away with the language barrier, the researcher employed an enumerator, M/s Herieth who not only that she played the role of enumerator, but also acted as a translator.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview

This chapter discusses the concept of Climate Change and Carbon Credit, conceptual framework, theoretical and empirical literature review of the economic efficiency of carbon credit in combating climate change specifically in afforestation. The concept of climate change from various literatures show the effects of climate change which in turn lead to the emergence of carbon credit as a tool to combat climate change in the World. This is done through application of renewable energy and afforestation / reforestation activities and other new technologies that will not allow environmental destruction. The conceptual framework applied shows the Carbon Credit incentive package provided to smallholder farmers in order to plant more trees for combating climate change. The framework also shows other factors that may enhance tree plantation, for combating climate change, whereas in the theoretical literature various theories relevant to the study are discussed. Finally, the empirical literature review shows empirical evidence of the economic efficiency of Carbon Credit provision in combating climate change.

2.2 The Concept of Climate Change and Carbon Credit

Climate change is a long-term alteration in global weather patterns, especially increases in temperature and storm activity. Climate change is mainly caused by increasing concentration of greenhouse gases in the atmosphere, which stem primarily from both natural and human economic activities (IPCC, 2007). It is argued that, economic growth is the key driver of the greenhouse gases emission in the atmosphere particularly CO₂ emission because as the economy expands, demand for energy and energy-intensive goods increases, pushing up greenhouse gases emission (Sathaye, 2007).

The impact of climate change caused by increasing of concentration of greenhouse gases in the atmosphere is one of the greatest social economic and environmental challenge the world had never experienced before (UNEP, 2009; EU, 2009; IPCC, 2007; UNFCCC, 2006). It is reported that, climate change have serious devastating impact in developing countries mainly because of higher dependency on natural resources and limited

capacity of developing countries in adopting to a changing climate (UNEP, 2005; EU, 2009; IPCC, 2001; FAO, 2005). The serious impact of climate change in poor countries is associated with various factors such as poverty, food insecurity, poor livelihood, environmental destruction and unsustainable economy (FAO, 2005; IPCC, 2001).

Therefore, due to the increased concerns with climate change and impact on humanity has led to an increased interest in reducing atmospheric greenhouse gases as the only way to mitigate climate change. Mitigation of climate change involves actions that are designed to limit the amount of long-term climate change (Fisher, 2007). Mitigation may be achieved through the reduction of greenhouse gas (GHG) emissions or through the enhancement of carbon sink that absorb GHGs, for example forests. Forests play an important role for mitigation and adaptation to climate change through carbon sequestration (URT, 2003; 2009). Recognizing the importance of carbon sequestration in combating global climate change sink activities such as afforestation and reforestation projects have been discussed in the Kyoto Protocol as a means of meeting the GHG emission reduction (IPCC, 2007).

Current development, advocate for economically sensitive methods for reducing CO₂ emissions. Carbon credit trading has proposed as an option (Zhang and Folmer, 1995; Ellerman et al., 1998; Petty and Ball, 2001). Carbon credits are certified tradable schemes that provide a way to combat climate change through the reduction of GHGs in the atmosphere. The concept of carbon credit became effective in 2005 because of increased awareness of the need to reduce emissions of greenhouse gases to combat global warming as part of the 1997 initiative of the Kyoto protocol (UNFCCC, 2011). The Kyoto Protocol has established policies and mechanisms to reduce GHG emission, including phasing out subsidy in energy-intensive technologies, encouraging adoption of alternative environment-friendly technologies and taxing emission.

Carbon credits as one of the mechanism used to combat climate change make up a trading system that creates financial incentives to reduce greenhouse gas emissions in the atmosphere (Petty and Ball, 2001).

Carbon credits are earned by increasing removal of CO₂ from the air and storing it in plant material. Farmers create carbon credits by planting trees on their land, converting cropland to grassland, and/ or reducing tillage operations. Therefore, to encourage afforestation activities among smallholder farmers carbon credit are provided as incentives to increase afforestation activities at the local level for regulating climate change.

2.3 Theoretical Literature Review

Efforts to combat climate change will depend much on the roles of Institutions like the Government, Non-Governmental Organizations (NGO's), Community based organizations (CBO's) and other local Institutions. This is because in any development processes, Institutions play greater role (North, 1990; 2005). Institutions shape the direction of the acquisition of knowledge and skills. The direction offered by the Institutions will be the decisive factor for the long-run development of the society (North, 1990). The guidance offered by the Institutions in any society helps the society to adopt new knowledge and providing clear information. Institutions especially local institutions play greater role to shape the effects of climate hazards in three important ways: they influence how households are affected by climate impacts; they shape the ability of households to respond to climate impacts and pursue different adaptation practices and they facilitate the flow of external interventions in the context of adaptation. However, to be able to achieve all these expected benefits systematic guidance of the communities coupled with incentives provision is essential.

Therefore, carbon credit provision as an incentive to farmers through afforestation to adopt in a changing climate context is likely to be influenced by the institutions through shaping the behavior of smallholder farmers in protecting their environment. In theory, carbon credit providers are regarded as principals and smallholder farmers are agents who depend on the provided incentives. In an agency relationship, the principal wants the agent to act in the principal's interest. However, the agent is expected to have his own interest and consequently, he may not act in the principal's best interests.

Then, the principal's problem is consequently to design an incentive contract that induces the agent to undertake actions that will maximize the principal's welfare. The rationale behind provision of carbon credit incentives to smallholder farmers to be engaged in afforestation activities is that, smallholder's farmers living at the subsistence economy level do not have the capital required to implement conservation measures through afforestation activities and they cannot afford to devote time in tree planting activities which will bring no immediate revenue. On the other hand, they also cannot afford to set aside part of their land and take it out of production without financial support during the transitional period until plantations of trees.

One of the most commonly cited constraints is that of the relatively long production period of most tree species. Poor farmers can seldom divert resources from producing needed food and income to a tree product, which will start producing returns at best a few years into the future. For the poor, the need to give priority to meeting present rather than future needs is evident. Therefore, even at the individual farmer level it is important that tree growing produce tangible short-term economic benefits. In that case, the incentive provides to farmers are tools to remove the constraints to development, which prevent farmers' participation in afforestation activities such as lack of awareness of the benefits of tree planting in the environment, poor financial capability of investing in afforestation, lack of interest in long-term investments and land tenure instability. In that context, provision of carbon credit incentives to smallholder's farmers has positive impact in increasing afforestation activities in regulating climate change.

2.4 Empirical Literature Review

Studying clean and green investments is quite new. A few number of researches have been conducted in this thematic area. Therefore there appears to be a lack of empirical studies which either examines the theory of emissions reductions underlying the creation of carbon credit or the economic efficiency of carbon credit provision as strong incentives to farmers to undertake afforestation activities so as to combat climate change.

Therefore, this part discusses few empirical evidence of carbon credit initiative in combating/mitigating climate change. Again, it discusses the empirical evidence of various factors that influence farmers to undertake afforestation activities.

2.4.1 Factors that influence farmers to undertake afforestation activities

Several studies has indicates that factors such as age of the farmer, overall level education of the farmer, size of the farm owned by the farmer, income of the farmer and provision of incentives and technical assistance influence farmers to undertake afforestation activities in their land. For example;

Nagubadi et al. (1996) suggested that older age and larger land area would enhance the probability of participating in afforestation. Stevens et al. (1999) proposed that older age would reduce the probability of participating in afforestation, but higher income would raise it; Megalos (2000) and Lorenzo and Beard (1996) proposed that the people who have larger land area and are not farmers would have higher probability to participate in afforestation.

2.4.2 The contribution of carbon credit provision in afforestation for combating climate change

Carbon credit which are provided to tree growers farmers are found to be efficiency in other area, that is they increase income of farmers For example, Jonathan (2011) in his study has found out that, many farmers who are engaged in planting carbon trees has improved the environmental conditions on their farms for their crops and livestock. Among the changes reported by farmers were protection from sun and wind, reduced soil erosion and improved fertility. Farmers were found to use the carbon credit in ways that can increase household income. Some farmers used the credit to hire labor, especially for cash crops such as tea, coffee, and sugar cane. Others bought animals and topped up savings to buy plots of land, which can increase the amount and diversity of food available to households. A positive impact on increased revenue associated with carbon credit from afforestation activities has also been reported among the Brazilian agribusiness in Brazil (Ruzende et al., 2012).

Similar findings have been reported in Australia whereby carbon credit provision resulted into an increased number of tree planted and carbon sequestration by about 25% (Lvkovk et al., 2012).

Therefore, Carbon forestry can be a useful activity to help offset greenhouse gas emissions and restore landscapes but it should be viewed as a long-term project. For carbon credit to be most efficiency in tree plantation projects, landowners should be given incentives and other financial assistance to cover the cost of converting their land into planting trees instead of using to plant food crops and other possible economic activities. In addition, the local community needs education about the importance of planting trees in their land, capacity building and good policies towards afforestation will increase people participation in tree plantation projects. This is supported by Palm et al. (2004) who note that efforts to mitigate the greenhouse gas effects of slash-and-burn systems, either through reduction in rates of deforestation or establishment of tree-based systems, may require granting incentives to land-users and building their capacity. Since slash and burn is the only option for poor farmers, they would need some sort of sensitization, financial incentives for keeping trees as well as government and other institutional support to avoid deforestation.

2.5 The Conceptual Framework

Conceptually the economic efficiency of carbon credit particularly in tree plantation project in combating/mitigating climatic change is expressed in figure 2.1.

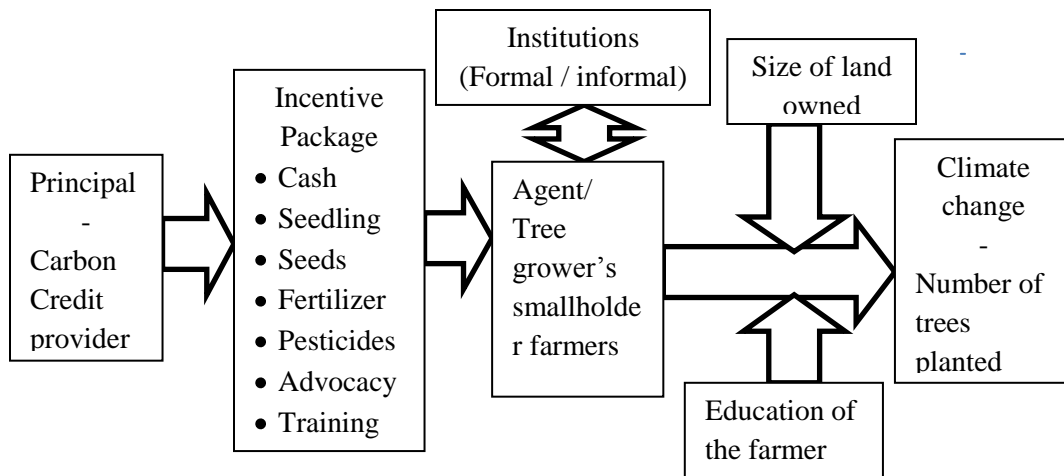


Figure 2.1: Conceptual Framework

The conceptual model applied evaluate the impact of carbon credit incentives provided to tree growers (who are the smallholder farmers) in afforestation for combating climate change.

The study conceptualizes that there is an incentive provision and receiving relationship between the agent and the principal. The principal expects the agent (SHF) to plant trees in his/her own land. In the case of tree planting in Karagwe district, the principal will generally be the government based on the laws of Tanzania (URT (n) 1999; URT (o) 1999) or it could be a privately owned land or can be owned by the NGOs. However, the majority own the land informally. The principal provides incentives such as cash, seeds, seedling, fertilizer, pesticides, training, and advocacy services to influence the agent to plant trees. However, the decision of the agent to plant trees in his/her plot may be influenced by factors such as his overall education level and the amount of land owned, this means, these factors can determine the number of trees that the agent may plant. The typical principal agent model assumes the principal maximizes some objective function subject to the agent's utility constraint (Hart & Holmstrom, 1987). This means the agent will plant more trees if the opportunity cost of foregone benefit of the land used is lower than the benefit derived from planting trees. On the other hand the conceptual framework depict that, the rational agent(tree grower) do not operate in a vacuum, meaning that, their activities are conditioned by set of norms, rules and regulations defined as Institutions (North, 1990). Therefore the outcome of the agent to plant trees in a given piece of land is not only influenced by the highest expected utility but also by what is possible in a given institutional environment comprises of government policies and conducive legal framework (both formal and informal). This means that, depending on the way the policies and regulations are drafted, they may provide any combination of incentives, disincentives sanctions, or information to promote a particular type of behavior (North, 1990; Doward & Omamo, 2009).

In the context of this study, these institutions may be both formal and informal legislation and regulations that influence the agents (farmers) to plant trees through their control on farmers' perceived (secured) property rights to land and tree products. In the absence of clear property rights about access to land and tree products, the agent will not take advantage of planting trees. In addition, in the absence of an adequate policy framework, transaction risks and costs will be high (Bienabe et al., 2004) and may further reduce farmers' motivation to plant trees in their land.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This section presents a systematic analysis of the research techniques employed in conducting this study. It present the study location; discusses the type of data that was collected, the methodology of collection, research design, sampling technique, data collection technique, and data analysis technique.

3.2 Research Design

3.2.1 Triangulation

Triangulation is the use of two or more independent sources of data or data collection methods to corroborate research findings within a study (Bryman, 2006; Nachmias and Nachmias, 1996). In a study both qualitative and quantitative research methods of data collection techniques were employed.

Qualitative research method is a research method that aims to gather an in-depth understanding of the phenomena, human behaviors and the reasons that govern such behavior. The qualitative method investigates the why and how of the decision making not just what, where, when. Hence, smaller but focused samples are more often needed than large samples. Qualitative research, as a method of data collection and analysis used field research methods, primary case studies and participant observation within natural setting in an attempt to understand behavior and institution by getting to know the person involved and their values, rituals, symbols, beliefs and emotions (Nachmias and Nachmias, 1996). In this study, the researcher used observation method together with focus in-depth interview method to gain a clear understanding of the participant in their natural setting. Observation helped the researcher to see the reality of what have happened to the farmers after receiving carbon credit incentives. The main question was to see if they had planted the trees for combating climate change so as to come up with reliable data.

Face to face in-depth interview help the researcher to understand the emotions, beliefs, knowledge and attitudes of the participant, again it gives the researcher the additional information that indicate the way forward of enabling the farmers to plant more trees for combating climate change.

Quantitative research methods refer to the systematic empirical investigation of social phenomena in which numerical data are used to obtain information about a certain phenomenon. This research method is used to describe variables, to examine relationship among variables and to determine cause and effect interactions between variables via statistical, mathematical or computation techniques. In this study, quantitative methods were used to analyze other numerical data that are collected from the field by a researcher, mathematical computation are used to describe some numerical data which are presented in form of tables in chapter four. The combination of qualitative and quantitative approaches allows statistically reliable information obtained from numerical measurements to be backed up by and enriched by information about the research participants explanations.

Apart from qualitative and quantitative approaches, the researcher also use inductive approach. Inductive approach is a research approach involving development of a theory as a result of the observation of empirical data. In this approach the researcher starts to collect data and then explore them to see which themes or issues to follow up and concentrate on (Glaser and Strauss, 1967; Strauss and Corbin, 2008; Yin, 2003). When the researcher commence data collection with this type of approach s/he will need to analyze the data as s/he collect them and develop a conceptual framework that will guide the subsequent work. In this study the researcher starts from data collection, then after develops a theory according to the data collected which were collected through observation, in-depth interview and survey. This approach helps the researcher to have a good fit to develop between the social reality of the research participant and the theory that emerged i.e. the researcher grounded the theory based on that reality. In the context of this study after collecting the data from the field the researcher come up with the theory of incentive that is based on principal-agent relationship.

In that sense, the theory developed suggest the subsequent appropriate action to be taken because it is specifically derived from the events and circumstances of the setting in which the research was conducted (Glaser and Strauss, 1967; Strauss and Corbin, 2008).

The cross sectional study design was done to assess the effectiveness of carbon credit provision in tree plantation in Tanzania. This study is part of the larger project implemented at Karagwe District by GEPAT (Green for Education and Poverty Alleviation Trust) and thus the researcher was benefited from the already collected baseline information to facilitate collection of baseline indicators to complement to the cross sectional data that was collected.

3.3 Sample Size and Sampling Technique

This study used sampling frame because the researcher use the list of individuals who are tree grower's deal with tree plantation in the area of the study (Nachmias and Nachmias, 1996). Therefore to avoid research bias the researcher randomly selected 120 tree growers from four schemes whereby in each scheme 30 tree growers were visited and interviewed.

3.4 Data Type and Collection Methods

This study used primary data collected from the field through observation and survey techniques. Direct observation was made by visiting the farmers in their farms in which they plant trees as a result of being given the carbon credit incentives.

3.5 Area of the Study

Karagwe is one of the six districts of Kagera Region of Tanzania. Karagwe district is characterized by Mountain ranges which are separated by swampy valley bottoms and wet lands. The altitude ranges between 1500-1800 meters above sea level. The district has a tropical highland climate. The annual average temperature is 260C. Rainfall distribution is bi-modal with peak rains from September to December and from March to May. This type of climate makes the district very potential in most of agriculture activities. Karagwe district is administratively divided into 28 wards. This study was conducted in two wards namely Kituntu and Rwambaizi.

The majority of people in Kituntu and Rwambaizi are farmers as the main economic activity in the area is Agriculture, the main cash crops grown in these areas are banana and coffee. Banana and beans are the staple foods in the area which are also traditional foods. Karagwe district was well forested with indigenous trees until the early twentieth Century. The forest cover disappeared recently in most of the areas especially in Kituntu and Rwambaizi because of the increasing rate of cutting trees for burning charcoal and heavy dependency of rural people in collecting firewood for sale, this lead to deforestation in Karagwe district. The researcher chose to conduct her research in two wards (Kituntu and Rwambaizi) because these two wards host a carbon credit tree plantation project conducted by GEPAT (Green for Education and Poverty Alleviation Trust). Therefore the place was suitable for this study as the targeted farmers who grow trees are available in this place.

3.6 Data Analysis Techniques

Both qualitative and quantitative data were analyzed, the data that were collected from primary source using structured questionnaire were summarized and coded by using SPSS version 16 before entered to software STATA 9. SPSS (Statistical Package for the Social Sciences) is a computer application that provides statistical analysis of data. It allows for the in-depth data access and preparation, analytical reporting, graphics and modeling (Nachmias and Nachmias, 1996). STATA is a general purpose statistical software package created in 1985 by Stata Corp. the name STATA is a combination of the word Statistic and Data. STATA is used for data management, statistical analysis and presentation of results.

The researcher decided to use SPSS and STATA for data analysis because the researcher is fully aware and capable of using them in analyzing data, again they are suitable for the type of data that the researcher have collected in the field. In addition SPSS and STATA are among the most widely used program for statistical analysis in social science around the World.

3.6.1 Econometric Model

Multiple linear regression model was used whereby, Ordinary Least Square (OLS) method was used to estimate the model. The dependent variable is afforestation which is indicated by number of trees planted. The independent variables are the carbon credit incentive package indicated by cash paid for the number of trees planted, number of seeds and seedling, and other factor i.e. amount of land owned by the farmer.

Therefore the regression model is seen as follows;

$$N_{\text{trees}} = f (C, S, S_{\text{ng}}, Lo)$$

Whereby

N_{trees} = Number of trees planted

C = Cash paid

S = Number of seeds

S_{ng} = Number of seedling

Lo = amount of land owned

3.7 Discussion of the variables and the way they were measured in the analysis

3.7.1 Carbon credit efficiency in afforestation (number of trees planted) N_{trees}

The study analyzes the efficiency of carbon credit in afforestation in terms of number of trees planted by tree growers. The symbol for number of trees planted will be N_{trees} on the equation

3.7.2 Education of the farmer (Ed)

The farmer education is looked if he/she has any education background, that is if he attain a primary or secondary education, or high level of education (college). This was analyzed descriptively.

3.7.3 Amount of land owned by the farmer (Lo):

The study analyzed the correlation between the amount of land owned and the number of trees planted. If tree grower who own farms, this was measured in terms of the farm size they own.

3.7.4 Incentives (In)

The study analyzed if provision of incentives in terms of price paid per tree, seeds, and seedling motivate tree growers to plant more trees. The incentive package that was focused was price per tree, seeds, seedlings, fertilizer, pesticides, advocacy (technical support).

3.7.5 Institution setup (Ins)

The study looked about what kinds of institution exist in the study area, if it is formal or informal what causes it has in incentive provision to tree growers in tree plantation. This was analyzed descriptively.

3.8 Validity and Reliability of the Study

3.8.1 Validity of the Study

Validity is concerned with the extent to which data collection techniques or methods accurately measure what they were intended to measure or the extent which research findings are really about what they profess to be about. It is concerned with the question “Am I measuring what I intend to measure? (Nachmias and Nachmias, 1996; Saunders et al., 2009). There are three kinds of validity which are content validity, empirical validity and construct validity.

Content validity refers to the extent to which the relevance of an instrument or measuring device, (in the context of this study, it is questionnaires constructed to be used in the personal interview or face to face interview), to the characteristics of variable it meant to measure provides adequate coverage of the investigative questions that is assessed by face validity (the researcher’s subjective assessment of the instrument’s

appropriateness) and sampling validity (the degree to which the statements, questions or indicators constituting the instrument adequately represent the qualities measured (Nachmias and Nachmias, 1996; Cooper and Schindler, 2008). In this study content validity was measured through questionnaires that were constructed to be used in personal interview or face to face interview where by 120 focused respondents were interviewed by the use of the questionnaire. In addition the researcher used direct observation method to see the reality i.e. the efficiency of the incentive given to these farmers in tree plantation for combating climate change. In this way the researcher was able to get true data that shows the effectiveness of the incentive given to farmers for afforestation in order to combat climate change.

Empirical Validity is concerned with the relationship between a measuring instrument and the measuring outcomes. If a measuring instrument is valid, there should be a strong relation between the results produced by applying the instruments and the real relationships existing among the variables measures, often this is undertaken using statistical analysis such as correlation (Nachmias and Nachmias, 1996; Cooper and Schindler, 2008). In this study empirical validity is measured through correlation analysis and multiple linear regression analysis which both shows the same results, the results of correlation analysis are shown in the appendix while those of multiple regression analysis are shown in Table 4.9. Both results shows that there is a strong positive relationships between the amount of seeds given as incentive to farmers, the amount of land owned by the farmer and the cash paid to the farmers to the number of trees planted by farmers, all these variables are found to be significant at 1% level of significance where by the p- values are 0.000,0.001 and 0.000 respectively, while one variable (seedlings) was found to have positive relationships but not significance even at 5% level of significance this is because there was lack of enough seedling to be distributed to farmers again most of the farmers are not educated.

Construct validity is concerned with relating a measuring instrument to a general theoretical framework in order to determine whether the instrument is tied to the concepts and theoretical assumptions they are employing (Nachmias and Nachmias,

1996). In this study the researcher has found that the results are conformed with the general theoretical framework, that is farmers increase the rate of tree planting after they were given incentives as the theory of Principal- Agent depict that, when the principal offer incentives to the agent, so as the agent can act on the principal interest, in this study the principals are carbon credit providers while the agents are farmers who receive incentives from the principals. Thus the measuring instrument according to this study which is the questionnaires is related to the general theoretical framework because it achieves to come up with the results that are agreed with the theoretical framework.

Therefore, this study is valid because the sources of data are coming from a valid source (content validity) and the variables are positively correlated (empirical validity) and they are related with the general theoretical framework (construct validity).

3.8.2 Reliability of the Study

Reliability refers to the extent to which the data collection techniques or analysis procedures will yield consistent findings. It can be assessed by posing the following three questions; will the measures yield the same results on other occasions? Will similar observations be reached by other occasions? Is there transparency in how sense was made from the data? (Easterby – Smith et al., 2008).

This study is reliable since the data collection techniques and the analysis procedures yield to the consistent finding. This is because the results are consistency with past research done by other researchers and if the same data collection techniques will be used in other occasions will yield the same results with similar observation.

CHAPTER FOUR

RESEARCH FINDING AND DISCUSSION

4.1 Introduction

This chapter deals with presentation, analysis, and interpretation of data that were collected from the field using survey data collection methods. This study deals with evaluation of economic efficiency of carbon credit as incentives to combat climate change in afforestation project at Karagwe District. The subject of this study were tree growers who are members of (GEPAT) located in different schemes and receive carbon credit incentives as motivation for them to plant more trees in their farms. In this chapter, analyzed data and research findings have been interpreted in relation to the objectives of the study and with respect to the hypothesis developed to guide the study. In analyzing the data collected, the researcher used both qualitative and quantitative techniques.

4.2 Presentation of the Findings

This study applied exploratory, descriptive and explanatory as explained by (Yin, 2005). Exploratory have been used in literature review and conceptualization of the model. Descriptive and explanatory methods were applied after data collection (see Chapter 4) (Yin 1989).

4.2.1 Descriptive and Explanatory Analysis

This part deals with the descriptive and explanatory analysis of the data that have been collected from the field. Descriptive analysis is concerned with the description of data, it simply describe what is or what the data shows. Descriptive analysis can often be made clearer by using descriptive statistics, descriptive statistics provides simple summaries about the sample and the observation that has been made in the field, the measures used to describe the data set are the measures of central tendencies (mean, median, mode, frequencies, and percentages) and measures of variability and dispersion like standard deviation or variances. Descriptive analysis also shows the relationship between variables that is done through regression analysis, basically descriptive analysis focused in answering the basic Questions; Who, what, when, where, while the “why” question

falls outside of the scope of descriptive analysis, this is where “Explanatory analysis” come in to answer the questions why there is a relationship between variables or why one variable can affect the other for example why the provision of Carbon credit incentives motivate farmers to plant more trees in their farms and why other farmers are not motivated to do so, what is the relationship between ownership of land and afforestation? All these research questions are answered by means of explanatory analysis, thus explanatory analysis explains the nature of certain relationship that hold between two or more variables while the descriptive analysis simply provide an accurate description of observation of a phenomena through the application of statistical techniques.

4.2.2 Combating climate change (number of trees planted)

This is the dependent variable from the model. The results shows that the incentive package which was given to the farmers motivates the farmers to plant more trees in their farms, while there are still other farmers who does not see the benefit of planting trees in their farms so they have few trees according to their needs. This is due to various reasons as lack of awareness of the importance of trees in the environment and lack of more land for the farmer to plant more trees in the farm instead of planting other food crops.

Table 4.1 Number of trees planted

	N	Minimum	Maximum	Mean	Std. Deviation
number of trees	120	3	13000	620.67	1349.671
Valid N (list wise)	120				

Table 4.1 above shows the number of trees that the farmers have planted in their farms since 2008. The participants were 120. It was observed that since 2008, the minimum number of trees planted by a single farmer was three trees. Maximum number was 13,000 trees per person. On average every member planted 620 trees. However, the standard deviation is so big that is 1349. This shows that some farmers have planted trees, but others have not planted trees although they are in the same area.

Table 4.2: The mean number of trees planted before and after the intervention

	time of visit before and after	N	Mean	Std. Deviation	Std. Error Mean
Number of trees before and after	before	120	323.67	598.556	54.640
	after	120	620.68	1349.671	123.208

Table 4.2 shows the mean difference of number of trees the farmers have before and after the intervention (before they were given incentives and after they get incentives which was seeds, seedling and cash paid per tree). Table 4.2 shows the impact of incentive in increasing the rate of tree planting, the results shows that there is a mean increase of the number of trees planted after the intervention by 620.68 compared to the mean number of trees 323 that the farmers has before the intervention. This depicts the benefit of offering incentives to farmers to plant more trees for combating climate change.

4.2.3 The role of institution on the incentive provided for combating climate change

The results in Table 4.3 shows that the kind of institutions that exist in the area of the study are informal institutions in nature because their characterized by social unwritten roles, this is because most of the people apply informal norms rather than formal legal rules to resolve most of the issues that arise among them. People frequently resolve their disputes in cooperative fashion without paying any attention to the laws that apply those disputes. Again land ownership entitles are in informal form in nature, this is because most of the farmers they own land in form of inheritance, therefore there is no legal procedures/ formal procedures which are followed instead people follow their custom and traditional roles. Due to this there are few formal institutions which play a greater role on the incentives provided to farmers. The respondents say that GEPAT (Green for Education and Poverty Alleviation Trust) as a formal institution provides incentives to farmers for tree planting in order to combat climate change.

Also Informal institutions play a very important role in informing the farmers about the importance of planting trees for environmental protection and combating of climate change. Thus, the farmers were informed to be registered as members in a tree planting project that offers incentives such as seeds, seedlings, training and cash for those farmers who have trees and want to plant more trees in their farms and also for those farmers who does not have trees but want to plant trees. Table 4.3 shows the increased number of trees planted for most of the farmers who register and receive carbon credit incentives in a tree planting program though most of them are males rather than females (shown in Table 4.3).

Table 4.3: Kind of Institution

	Frequency (n)	Percent (%)
formal institution	1	0.8
informal institution	119	99.2
Total	120	100.0

Table 4.3 shows the kind of institutions that exist in the area of the study, as it is explained above, the people in the study area are controlled with informal roles, that is, their custom, norms and believes rather than legal roles or state laws. In the case of the roles of institutions in the incentives provided for combating climate change, 99% of participants respond that informal institutions do not play a greater role rather than the role of passing information that there is a formal institution that provides incentives to farmers for planting trees to combat climate change. The remaining 0.8% of farmers says that there are few formal institutions that provide incentive to farmers for planting trees to combat climate change. This implies that there is a need for other formal institutions to join hands to offer incentives to farmers so that they can increase the rate of tree planting for combating climate change.

Table 1.4: The number of trees increased/ decreased

	Frequency (n)	Percent (%)
Increased	96	80.0
Decreased	24	20.0
Total	120	100.0

Table 4.4 shows the number of respondents who increased tree planting and those who decreased tree planting as results of incentive provided. The findings shows that 80% of respondents are seen to have many trees that is, they plant more trees after receiving incentives while only 20% of farmers have fewer trees meaning that they did not plant more trees after they have received incentives. This means the incentives given to farmers to plant trees have positive impact as the rate of tree planting has increased.

Table 4.5: Gender of the farmer

	Frequency (n)	Percent (%)
Female	39	32.5
Male	81	67.5
Total	120	100.0

The results in Table 4.5 shows the gender of the farmers who are involved in tree planting where by 32.5% of all respondents are female while 67.5 are males. This is because traditionally the men are considered to have responsibility and titles even in works that their wives do more than them, so most of women register their husband as the one who will be recognized in receiving incentive from tree planting project while women are the ones who plant and take care of the trees in the farm. This depicts the existence of informal roles and believes in this society.

4.2.4 Impact of education in combating climate change

Education level of the farmer is a very crucial factor which determines his attitude, perception and knowledge in different development issues. The farmers who are highly educated are assumed to have wider knowledge in many things than the farmers who are not educated.

In the context of this study, it is assumed that the farmers who are highly educated (who have secondary education or university/college education) plant more trees than the farmers who have lower education such as primary education or no schooling. In addition educated farmers are assumed to own a larger size of land which they use them to plant more trees compared to the lower educated farmers who own small portion of land that they plant few trees. In this study, the results in table 4.6 shows that most of the farmers have lower education level while very few farmers are highly educated. But few farmers regardless of their education level own large size of land for which they plant many trees.

Table 4.6: Level of Education of the Farmer

	Frequency (n)	Percent (%)
Primary school	85	70.8
Secondary school	17	14.2
College/university	5	4.2
No schooling	4	3.3
Vocational education	9	7.5
Total	120	100.0

Based on Table 4.6, the results shows that 70.8% of farmers attain primary education, 14.2% have secondary education while only 4.2% of farmers have higher education (college/university education), 3.3% of farmers they do not go to school and 7.5% have vocational education. The results clearly show that most of the farmers have lower education, and only few farmers have attained higher education. the findings shows that only few farmers who have attained higher education own large farms and they have planted many trees, while those who have lower education own only small farms that they plant few trees. This depicts that most of the farmers who have lower education their understanding and knowledge about environmental issues is lower also.

4.2.5 Contribution of advocacy in combating climate change

Advocacy or in other word extension services is a process through which people became familiar with a new knowledge and skills. This new knowledge and skills is provided with extension agents who provide technical support to farmers so that they can be able to make sure trees are planted in acceptable manners by considering the roles of planting trees in the land. Therefore technical support (advocacy) is very important in tree planting. In this study advocacy is measured in terms of the availability of extension services and extension agents who provide technical support to farmers in tree planting. In Table 4.7 below, the results shows that there is lack of extension agents and therefore most of the farmers did not get technical support in tree planting as a results other trees are not grown well and this discourage other farmers who does not have any knowledge in tree planting.

Table 4.7: Responses on whether farmers get any technical support

	Frequency (n)	Percent (%)
Yes	41	34.2
No	79	65.8
Total	120	100.0

Table 4.7 shows the responses of respondents when they are asked if they get any technical support, 34.2% of all respondent say that they get technical support while 65.8% say they did not get any technical support. This implies that there are few extensions officers, and this lead to lose of trees due to lack of technical knowledge on how to plant trees and to take care of them.

4.3 Result for Regression Analysis

For the purpose of the study, the following model was regressed

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \mu$$

Table 4.8: Stata output of the multiple linear regression analysis

Linear regression		Number of observation= 120 Prob > F = 0.0000 R ² = 0.4774
Ntrees	Coefficient	P > [z]
Seedlings	1.475161	0.144
Seeds	0.8002484	0.000
Farm size	125.6805	0.004
Cash paid	0.010308	0.000
Constant	-656.9488	0.000

Where;

Ntrees = number of trees planted

Seeds = number of seeds provided

Seedlings = number of seedling provided

Cash paid = cash paid for the number of trees planted

Farm size = size of the farm owned by the farmer

The Model;

$$Y = -656.9488 + 1.475161X_1 + 0.8002484X_2 + 125.6805X_3 + 0.010308X_4$$

4.4 Interpretation of the Variables from the Model

R² in multiple linear regression model is known as the Multiple Coefficient of Determination which measures the goodness of fit of the regression equation; that is, it shows the amount of variation in the dependent variable that is caused by the independent variable in the model. In our model R² = 0.4774, whereby this means that 47.74% of variation of dependent variable i.e. Number of trees planted is accounted for by the independent variable i.e. number of seeds provided, number of seedling provided, amount of land owned by the farmer and amount of cash paid for number of trees planted. In addition the F test which is the test of the overall significant of the model that is indicated by prob > F = 0.0000 tells us that our model as a whole is statistically significant.

4.4.1 Incentive package provided to farmers

4.4.1.1 Seedlings (Number of seedlings provided to farmers)

The coefficient of β_2 that is the number of seedlings provided to farmers is given by 1.475161. This means that all other factors held constant (*ceteris paribus*), a unit (1 seedling) increased in number of seedlings provided to farmers, on average will lead to the increase of number of trees planted by 1.475161.

It is not statistically significant ($p = 0.144$) even at five percent level, this is due to the fact that the number of seedlings that was available to be given to the farmers was very few, and therefore only few farmers were given the available seedlings in a limited quantity. Although free seedlings provision has direct effect on increasing the number of trees to be planted and it motivate other farmers to start planting trees in their farms.

4.4.1.2 Seeds (Number of seeds provided to farmers)

The coefficient of β_3 is the number of seeds provided to farmers that is given by 0.8002484. This means that all other factors held constant (*ceteris paribus*), if the number of seeds provided to farmers' increases by a unit (1 kg), on average the number of trees planted will increase by 0.8002484. The coefficient of β_3 is statistically significant ($p = 0.000$) at 1% level. This is to say seeds distribution to farmers has a significant effect in increasing the number of trees planted because the farmers will have easy access of getting seeds for free so that they can plant trees in their farms. Therefore free distribution of seeds to farmers is positively related to the increase of the number of trees, because as the quantity of seeds provided to farmers increases, the rate of tree planting increases and this will lead to the increase of the number of trees planted for combating climate change.

4.4.2 Cash paid for the number of trees planted

The coefficient of β_5 is the amount of cash paid to farmers for the number of trees the farmer has planted is given by 0.010308. This means that all other variables held constant (*ceteris paribus*), when the amount of cash paid to farmers per trees planted increases by a unit (in Tshs), on average the number of trees planted will increase by

0.010308. β_5 is statically significant ($p = 0.000$) at 1% level of significance which means that the amount of cash paid to farmer per number of trees planted has significance effect on increasing the number of trees planted. Cash paid to the farmers has positive contribution in increasing the rate of tree planting because the cash secured from tree planting other farmers used that cash to buy other land for planting more trees so as to increase the amount of cash received from tree planting.

Again this encourage other farmers who did not plant trees in their farms to start planting as they know that the cash that they will get per each tree they plant it will increase their income.

4.4.3 Size of the farm owned by a farmer

The coefficient of β_4 is the size of the farm owned by a farmer is given by 125.6805. This means that all other factors held constant (*ceteris paribus*), on average the number of trees planted will increase by 125.6805, if the size of the farm owned by a farmer will increase by one acre. β_4 is statically significant (0.004) at 1% level of significance, which means farm size is the significant predictor of the number of trees planted. There is a positive relationship between size of the farm and number of trees to be planted, as the size of the farm owned by a farmer increases the farmer will also be able to increase the rate of tree planting according to the size of the farm that he has. Therefore the farmers who have large size of farm plant more trees than those who have small size of the farm.

4.4 Conclusion

The findings concludes that the provision of carbon credit to farmers has a positive contribution in combating climate change because most of the farmers after receiving incentives they increased the rate of tree planting for combating climate change. Again, institutions play a role in efficiency provision of incentives to combat climate change in the two wards of Karagwe district through Green for Education and Poverty Alleviation Trust (GEPAT). GEPAT is the only the only formal institution that provide incentive for tree planting for combating climate change.

The Government as well as other NGOs should join hands in offering incentives to rural farmers to plant more trees in order to combat climate change. In addition, education, property rights (land ownership) are seen to have positive impact in combating climate change.

Education gives the farmer good attitude and the knowledge of understanding the importance of combating climate change through planting of trees.

Property rights (land ownership) gives the farmer the confidence of planting trees by knowing that the trees that s/he planted belong to him and not to someone else, so it must be protected. Many farmers who own farms at Kituntu and Rwambaizi are found to have lower level of education (primary education). A few who owns large farms are educated and therefore, plant many trees. Furthermore the results shows that there is a lack of extension officers who provide technical education and advice regarding tree planting in rural areas, while the farmers are in a highly need of having technical advice and education because most of the rural farmers are not educated. Therefore, the stakeholder in climate change mitigation has to invest in education order to reduce the rate of deforestation and increase the rate afforestation. This can only be achieved by giving incentives as well as technical education through extension officers.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter summarizes the entire research findings and gives conclusion and there after provides recommendations on combating climate change via provision of carbon credit in afforestation (tree planting).

5.2 Summary

The study has observed that the carbon credit incentive package has a positive impact on combating climate change. These incentives are distribution of seeds, seedlings and cash given to the farmers who plant trees. The study concludes that combating climate change through tree planting is one of important ways of combating climate change because trees have the capacity of absorbing Carbon dioxide gas and other GHGs. Supporting tree planting is one of green investment required in the world.

Free seeds distribution to farmers is found to have significant effect in increasing the number of trees planted by the farmers because the farmers have easy access to get seeds with low transaction costs. This motivate farmers even those who does not plant trees in their farms to start planting trees as they are aware of where they can go to take seeds for free. However the results also shows that there is a shortage of distribution seedlings which also is very important factor in increasing the rate of tree planting if the farmers will be given at the required quantity.

Cash paid to farmers as per tree they have planted shows to encourage more farmers to plant more trees and for the other farmers to start planting trees in their farms. This is because the cash they get from tree planting help them to cover the cost they used when they start to plant trees and still for the others the cash they receive has been used to open up other farms for planting more trees while others used the cash they receive in their daily needs. Therefore, if the amount of cash to pay the farmers will increase the farmers will be more motivated to plant more trees in their farms.

However it has been reported that there is a lack of Extension services (advocacy) as well as lack of extension Agents who are responsible to visit the farmers and give them technical support by showing them how to plant trees technically and how to manage them so as they can grow well. This lead to lack of good knowledge in trees planting and causes other farmer to plant trees in unacceptable manner hence other trees fail to grow. Again the farmers have reported that their trees are not grown well because they have been attacked by diseases and other bacteria, this is influenced by lack of pesticides and the ability of the farmer to buy the pesticides due to poverty.

Moreover the results show that most of the farmers have primary education while very few of them have secondary education and have attained college/university level of education. again the results indicate that for those farmers who have attain higher education (secondary school/college or university education) they own large size of the farms and have planted more trees in their farms than those farmers who have lower education (primary education). This imply that education has significant contribution in combating climate change because for those farmers who are highly educated they have a a good knowledge on how trees help to combat climate change i.e. the important of trees in the environment and in the life of human beings.

In addition, informal institutions are reported to have a positive impact by the role they play on the provision of information to farmers about the provision of incentive for tree planting in order to combat climate change. These informal institutions are found to have great influence on farmers to plant trees as a results the number of farmers who plant trees increases, this indicate that most of the farmers are now aware of the important of trees in environmental protection. Again there are very few formal institutions like GEPAT (Green for Education and Poverty Alleviation Trust) that provide incentives to farmers in planting trees for combating climate change.

Ownership of land which is measured on the size of land owned by the farmer was found to have positive relationship with number of trees planted, because farmers who have planted many trees own large size of land than those farmers who own only small size of land.

Therefore as the size of the farm owned by the farmer increases, number of trees planted also increases. Thus if farmers who have small portion of land to plant trees are being enabled to buy other land the number of trees planted will increase hence the rate of trees to absorb the harmful gases in the atmosphere (Carbon dioxide gas) will increase in that way we will combat climate change in the higher rate.

5.3 Conclusion

The results from this study clearly shows the significant contribution of carbon credit incentives provided to farmers for combating climate change through tree planting have led to the increase of the rate of tree planting for combating climate change. The other factors such as institutions, education level of the farmer and ownership of land are found to have positive impact in influencing farmers to plant more trees in their farms. However the researcher has found that there is a lack of extension services which causes lack of technical knowledge to farmers regarding tree plantation process which are accepted technically. Again the researcher found that there is a need to increase the incentive package such as provision of pesticides which are very important in protecting the trees for diseases and bacteria. Therefore government institution should cooperate with other private institution on offering the incentives needed for the farmers to plant more trees in order to combat climate change which is one of the greatest threats that the world is facing now.

5.4 Recommendations

The following are the recommendation made from the study

- Government institutions should cooperate with other private institutions in offering of incentives so as to attract more farmers in tree plantation field for the purpose of environmental conservation and mitigation of climate change.
- Emphasis should be putted on the provision of adequate technical assistance and extension services in rural areas so as to help tree growers to have appropriate knowledge of how to manage and plant trees in an appropriate manner.

- Farmers should be encouraged and supported in starting their own tree nurseries to assure that seedling distribution fits within the overall tree growing effort.
- The farmers who are engaged in tree planting should be monitored and evaluated frequently so as to know what kind of help they need to ensure that they continue to manage and plant trees in their farms so as to achieve the goal of mitigating climate change through planting of trees.
- The government should set policies that would allow the increase of incentive oriented programs and priority to reforestation and afforestation which help to the greater extent to mitigate climate change due to the capacity of trees in carbon sequestrations.
- The emphasis should also be putted in the promotion of environmental education, awareness raising and capacity building programs in rural communities so as to be aware of the threat of deforestation and the significant of afforestation and reforestation in conserving the environment and at the same time in combating of climate change.
- Research and survey should be emphasized so as to know which type of trees are friendly to a certain environment so as plant trees which do not destroy the soil fertility of a certain area so as the farmers could be able to use the land in growing food crops while at the same time they are planting trees.

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APPENDICES

APPENDIX A

QUESTIONNAIRE FOR THE ASSESSMENT OF THE ECONOMIC EFFICIENCY OF CARBON CREDIT IN TREE PLANTING IN KARAGWE DISTRICT

INTRODUCTION

- Date
- Name of ward
- Name of village
- Name of scheme

PART A; HOUSEHOLD INFORMATION

1. Sex Male/Female
2. Age.....
3. Your highest level of education (select one)
 - a) No schooling
 - b) Primary school
 - c) Secondary school
 - d) Vocational education
 - e) College/ university

4. Your Occupation

- a) Farmer
- b) Employed for wage
- c) Petty business
- d) Self employed
- e) Other (specify)

5. Marital status

- a) Single
- b) Married
- c) Divorced
- d) Widowed

6. Number of children

7. Land ownership

- a) Yes
- b) No

8. Amount of land owned

PART B; INSTITUTIONS

9. Membership of GEPAT

- a) Yes
- b) No

10. Kind of institution exist

- a) Formal
- b) Informal

11. What is the role of the existing institutions in tree planting

.....
.....
.....
.....

PART C; EFFICIENCY OF CARBON CREDIT IN TREE PLANTING

12. Who are the providers of carbon credit incentives

.....
.....
.....

13. Type of incentive they provide

- a) Cash (price per tree)
- b) Seeds
- c) Seedlings
- d) Fertilizer
- e) Pesticides
- f) Training
- g) Advocacy services
- h) Others (specify).....

14. If it is cash, how much are you paid per tree
15. If it is seeds, how much seeds did you receive
16. If it is seedlings, how many seedlings did you receive
17. If it is fertilizer, how much did you receive
18. If it is pesticides, how much did you receive
19. If it is training, did you get any training
 - a) Yes
 - b) No
20. If it is Advocacy, did you get any technical support in tree planting
 - a) Yes
 - b) No
21. Did you have extension agents in this area?
 - a) Yes
 - b) No
22. Based on the kinds of incentives you receive, how many trees did you plant in your farm.....
23. How many trees did you have before you receive the incentive
24. Have you planted trees only in your farm?
 - a) Yes
 - b) No

25. If no, what kind of other crops did you plant in your farm

.....
.....

26. How do you use the cash you receive for tree planting

.....
.....

PART D; COST AND BENEFIT OF PLANTING TREES

27. Do you incur any cost in tree planting

- a) Yes
- b) No

28. What kind of cost do you incur in tree planting?

.....
.....
.....

29. Do the incentives you received cover all cost for tree planting?

- a) Yes
- b) No

30. If Yes or No, what is your advice?

.....
.....
.....

31. What are the benefits of planting trees in your farm?

.....
.....
.....
.....

32. What is your advice to other farmers who do not plant trees in their land?

.....
.....
.....
.....

THANK YOU FOR YOUR COOPERATION

APPENDIX B

STATA OUTPUT OF THE MULTIPLE LINEAR REGRESSION MODEL

```
reg Ntrees Seeds Seedlings Fsize Cashpaid
```

Source	SS	df	MS	Number of obs =	120
-----+-----					
Model	103490149	4	25872537.2	F(4, 115) =	26.26
Residual	113281726	115	985058.483	Prob > F =	0.0000
-----+-----					
Total	216771874	119	1821612.39	R-squared =	0.4774
-----+-----					
				Adj R-squared =	0.4592
				Root MSE =	992.5

Ntrees	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
-----+-----						
Seeds	.8002484	.1525524	5.25	0.000	.4980714	1.102425
Seedlings	1.475161	1.003295	1.47	0.144	-.5121738	3.462496
Fsize	125.6805	42.38023	2.97	0.004	41.73338	209.6275
Cashpaid	.010308	.0019804	5.20	0.000	.0063851	.0142308
_cons	-656.9488	178.5828	-3.68	0.000	-1010.687	-303.2107

APPENDIX C

CORRELATION ANALYSIS RESULTS

Correlations						
		amount of land owned	number of seeds	number of trees	number of seedling you receive	cash paid for trees planted
amount of land owned	Pearson Correlation	1	0.148	0.295**	0.151	0.033
	Sig. (2-tailed)		0.107	0.001	0.100	0.720
	N	120	120	120	120	120
number of seeds	Pearson Correlation	0.148	1	0.495**	0.240**	0.248**
	Sig. (2-tailed)	0.107		0.000	0.008	0.006
	N	120	120	120	120	120
number of trees	Pearson Correlation	0.295**	0.495**	1	0.154	0.524**
	Sig. (2-tailed)	0.001	0.000		0.093	0.000
	N	120	120	120	120	120
number of seedling you receive	Pearson Correlation	0.151	-0.240**	0.154	1	0.273**
	Sig. (2-tailed)	0.100	0.008	0.093		0.003
	N	120	120	120	120	120
cash paid for trees planted	Pearson Correlation	0.033	0.248**	0.524**	0.273**	1
	Sig. (2-tailed)	0.720	0.006	0.000	0.003	
	N	120	120	120	120	120
**. Correlation is significant at the 0.01 level (2-tailed).						