THE IMPACTS OF FORESTRY CLEAN DEVELOPMENT MECHANISM
PROJECTS ON COMMUNITY LIVELIHOOD IN ABERDARE FOREST,
NYANDARUA COUNTY, KENYA.

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UNIVERSITY

NOVEMBER, 2018
Declaration

Declaration by candidate

This thesis is my original work and has not been presented for a degree in any university, or any other award.

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Dedication

To all communities and institutions who are seeking to make the world a greener and more sustainable place. Your efforts are highly appreciated.
Acknowledgements

This research thesis has not been from my efforts alone. I wish to acknowledge the people who have had the greatest of impacts on my journey.

First, I thank God for all he has done. His mercies and grace never failed me. To my two supervisors, Dr. Mary Baaru and Dr. Samuel Ochola, your guidance and patience have been invaluable and I could not have done this without you. To my late father David Maina and my mother Alice Maina and my two brothers, your faith and perseverance helped me through the tough times. Thank you beyond measure and God bless you. Finally to the respondents both in the institutions and community, this thesis would have been incomplete without the sacrifice of your time to answer my questions and advice in regards to my fieldwork. From the bottom of my heart, I thank you all.
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<tbody>
<tr>
<td>AR CDM</td>
<td>Afforestation Reforestation Clean Development Mechanisms</td>
</tr>
<tr>
<td>CA</td>
<td>Community Associations</td>
</tr>
<tr>
<td>CDM</td>
<td>Clean Development Mechanism</td>
</tr>
<tr>
<td>CFA</td>
<td>Community Forest Association</td>
</tr>
<tr>
<td>CIFOR</td>
<td>Centre for International Forestry Research</td>
</tr>
<tr>
<td>CoP</td>
<td>Conference of Parties</td>
</tr>
<tr>
<td>CSO</td>
<td>Civil Society Organization</td>
</tr>
<tr>
<td>EMCA</td>
<td>Environmental Management and Co-ordination Act</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organization</td>
</tr>
<tr>
<td>GBM</td>
<td>Green Belt Movement</td>
</tr>
<tr>
<td>GHG</td>
<td>Green House Gas</td>
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<tr>
<td>GPS</td>
<td>Global Positioning System</td>
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<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
</tr>
<tr>
<td>JI</td>
<td>Joint Implementation</td>
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<td>KFS</td>
<td>Kenya Forest Service</td>
</tr>
<tr>
<td>KI</td>
<td>Key Informants</td>
</tr>
<tr>
<td>NEMA</td>
<td>National Environmental Management Authority</td>
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<tr>
<td>NWFP</td>
<td>Non Wood Forest Products</td>
</tr>
<tr>
<td>PDD</td>
<td>Project Design Document</td>
</tr>
<tr>
<td>SD</td>
<td>Sustainable Development</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
</tr>
<tr>
<td>UNEP</td>
<td>United Nations Environment Programme</td>
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<td>UNESCO</td>
<td>United Nations Educational, Scientific and Cultural Organization</td>
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<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
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OPERATIONAL DEFINITION OF TERMS

Afforestation - The direct human induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human induced promotion of natural seed sources.

Carbon leakage - an increase of carbon emissions in a country/region by a company as a direct result of stringent carbon policies in the original country of the company, leading to an increase in greenhouse gases.

Chama - a merry-go-round fund raising group of people, i.e. an investment group

Climate change - a change in climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods.

Empowerment - improving the access of women and youth to community institutions, their involvement in the decision-making process in regards to the project and as well as their participation in community institutions.

Jiko - a device for cooking and/or heating food

Non-Kyoto Projects - voluntary carbon sequestration projects, that are not approved under the Kyoto Protocol’s Clean Development Mechanism.

Reforestation - direct human induced conversion of non-forested land to forested land through planting, seeding and/or the human induced promotion of natural seed sources on land that was forested but that has been converted to non-forested land.

Table banking - a strategy of lending money among members where during the group meeting, mostly once a month, members place their contributions on the table and those interested in getting a loan borrow from the contributions.
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ABSTRACT

Over the past five decades, global forest area has been diminishing rapidly due to deforestation. Over 1.6 billion rural people globally depend on forests for their livelihoods, with about 70% of the African population relying on forests for their survival. In Kenya, many communities rely on forests for their everyday needs, yet they are diminishing yearly at an approximate 12,000 hectares per year. Projects such as the Afforestation Reforestation Clean Development Mechanism project have been designed to aid in rehabilitating forests. In Kenya, there are three such projects. Our study area, Kamae-Kipipiri was selected as it was the only site located in the Aberdare forest. The general objective of the study was to assess the actual impact that the AR CDM project has had on community livelihood and on the environment, so as to ascertain is relevance in the area and the community. The study used a descriptive research design which was considered suitable as it led to an assessment of information regarding behavior, attitudes and other characteristics of the target group. The community has formed three community forest associations: South Kinangop, North Kinangop and Lari, with about 11,000 members. The community forest associations are further sub-divided into 110 sub-groups. From the 110 groups, stratified random sampling was employed to select 3 respondents from each group to give 330 respondents, and the chairpersons from each of the 110 groups were selected via purposive sampling to give 110 respondents. The total 440 respondents were administered with questionnaires. 3 key informants were interviewed during the study as well. Information from the questionnaires was analysed using MS Excel; The SSN matrix tool analysed and ranked results from the questionnaires and the Spearman’s’ rank correlation was used to evaluate significance of the project to the community. Results were presented in graphs, pie charts and tables. On socio-economic development, 80% of the respondents observed an improvement on their professional skills and 35 % of the respondents observed an improvement on the education acquired. However, no improvement was noted on improvement of roads and health facilities. Other benefits observed included income generation opportunities and formation of community based institutions (chamas) among the women and youth. The correlation results between the AR CDM project and the socio-economic indicator showed that $R = 1$, indicating a high positive correlation. This means that the project had a positive effect on community livelihoods, and the project considered statistically significant in relation to socio-economic development of the community as $\rho =0$. The matrix tool also produced a similar positive impact result. On the effect on the environmental status,15% of the respondents identified an improvement of indoor air quality. Water availability improved after project inception, according to 35% of the respondents. Soil conditions improved according to 25% of the respondents after project inception, while 50% observed a positive effect on biodiversity of the forest. There was no significance of the project towards the environment as $\rho =0.6$, with a low negative correlation between the project and the environment as $R=-0.4$ according to Spearman’s correlation. This observation agrees with that from the matrix, with biodiversity having a minor negative impact (-1). On women and youth empowerment, 42% of the respondents indicated women and youth were involved in the decision-making process, as men still make most decisions in relation to community development. However,85% of the respondents reported that the economic and social status of women improved after project setup. The SSN matrix tool indicated there was
a major positive impact (+2) towards the empowerment of women and youth. The project did not meet on its main purpose to restore biodiversity as it had a minor positive impact (-1) from the results, and further supported by 50% of the respondents. However, it impacted positively towards livelihoods in terms of socio-economic development and women empowerment. The study recommends that AR CDM project should plant trees that are indigenous to the area of implementation, and should encourage communities to engage more on reforestation activities, rather than use sale of carbon credits as the key objective.
CHAPTER 1: INTRODUCTION

1.1 Background of the study

Forests are an important element towards the survival of very many species, both flora and fauna. However, over the past five decades, global forest area has been diminishing rapidly especially due to deforestation (World Bank, 2004). According to the World Bank (2004), over 300 million people globally depend on forest resources while over 1.6 billion rural people depend on forests for their livelihoods. In Africa, it is estimated that forests cover up to 23% of the Continent with about 70% of the population depending on forest resources for their survival (Chidumayo et al., 2011). According to Kenya’s Climate Change Action Plan (2012), Kenyan forest cover as of independence in 1963 stood at 11%. As of 2011, the forest cover stood at 6% with the country losing approximately 12,000 hectares of forest per year. The loss has been attributed to illegal logging, charcoal production, overgrazing and clearance of forests for land use by the surrounding communities (UNEP, 2014). This is further supported by the World Development Indicators, focusing on deforestation and biodiversity, where the World Bank Group identify that Kenya in 1990 had about 47,000sq kilometres forest area, while in 2015, the forest area stood at 44,000sq kilometres (World Bank, 2017). The diminishing forests in Kenya are due to have an impact on the human population (especially the forest dwellers), wildlife, climate, rivers and streams (Kenya Forest Service, 2014). Despite the threat diminishing forests is posing to the world, a much greater threat is being faced. This threat is climate change.

The United Nations Framework Convention on Climate Change (UNFCCC) define climate change as a change in climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods. According to a study carried out by the Meteorological Office in the United Kingdom in 2011 (Gosling et al., 2011) on climate
projections and impacts in Kenya, results showed that Kenya has experienced an average increase in temperature of 3°C in the years between 1960 and 2011. Extreme precipitation events have been observed such as the drought in 2005-2006 and flooding in October and November in 2006. It is such cases as observed in Kenya and all over the world in the past decade that has seen countries working together to mitigate effects of climate change. One of such efforts is the Afforestation Reforestation Clean Development Mechanism (AR CDM) project.

The AR CDM project focuses on rehabilitation of degraded lands as a method of mitigating climate change effects. It is a product of the Kyoto Protocol which is a legally binding agreement under which industrialized countries will reduce their collective emissions of greenhouse gases by at least 5.2%, compared to the level in the year 1990 (UN, 1998). The commitment period was between 2008 and 2012, however, it was extended in the year 2013 up to year 2020. Globally, there are about 41 active AR CDM projects as of January 2013, 13 of these being in Africa (UN Risoe, 2013). In Kenya, there are 3 AR CDM projects the first one having been established in 2009 by the Green Belt Movement (Green Belt Movement). The three projects are located in Kirimara-Kithithina, Kamae-Kipipiri and Kibaranyeki in Central province (NEMA, 2012). These areas are located in the Aberdare and Mount Kenya ecosystems.

Findings from a research conducted by the Rhino Ark (2011) showed that the Aberdare forest cover decreased by 30% in the years between 1987 and 2000. This led to a serious degradation of the ecosystem which in turn affected the surrounding communities who rely on the forest for their livelihoods as many of them are farmers. Different initiatives have since been set up in the Aberdare forest to aid in afforestation activities. Such include The Rhino Charge in the Aberdare, the Forest Carbon Facility Program by the World Bank, tree planting initiatives by the Kenya Forest Service and the Ministry of Environment. The impacts of these
projects to communities and wildlife have been well documented on their homepages and best practises can be adapted, however, not much information is available on the implication or impacts that AR CDM projects have had globally on communities, agriculture or sustainable development (Green & Unruh, 2010; Olsen, 2007). Community perceptions on the influence of AR CDM project on the forest services and in return in their way of life has not also been assessed in Aberdare forest hence the need for this study.

1.2 Statement of the Problem

The National Climate Change Response Strategy (NCCRS) of the Ministry of Environment and Natural Resources reports that climatic changes are expected to increase desertification and forest degradation, with adverse impacts on the livelihoods, biodiversity, environmental services and economic benefits derived from the forestry sector (Steibert et al., 2012). This situation will lead to more private and government institutions developing strategies and projects that will aid in mitigating the climate change effects. One of such projects is the AR CDM project.

Within the first commitment period of 2007-2012, there has been limited documentation on the impacts or influence of AR CDM projects globally despite the perception that it would produce diverse results compared to other non CDM projects (Green & Unruh, 2010). Limited information minimizes the platform on which one can analyse and deduce best and worst practises that a project has had on the intended target herein being the communities. The AR CDM project in Kenya is rated as a small-scale project by the UNFCCC, and this means that the project should foster active community participation (Green Belt Movement, 2009). Without adequate documentation of the impacts of AR CDM projects, the projects in Kenya and even globally may not be adapted properly by the community or adjust to the environment. This in turn will increase their vulnerability to climate change effects. If the country is to benefit from development projects such as AR
1.3. Objectives of the Study

1.3.1 General Objective

To assess the actual impact that the AR CDM project has had on community livelihood and on the environment, so as to ascertain is relevance in the area and the community.

1.3.2 Specific objectives

i. To determine the impact of the AR CDM project on socio-economic activities of the communities in Kamae-Kipipiri;

ii. To analyse impact of the AR CDM project on the environmental services provided by the forest; and

iii. To determine the impact of the AR CDM project on women and youth empowerment.
1.4 Research questions

i. What impact has the AR CDM projects had on the socio-economic activities that the communities engage in?

ii. Is the AR CDM project having any effect on the environmental services that the forest provides to the communities?

iii. Since the establishment of the AR CDM projects in Kamae-Kipipiri, how has the project influenced the economic and social standing of women and youth in the society?

1.5 Justification

Many researchers have identified rural people to be forest dependants. Increased deforestation and the onset of climate change effects is proving to have adverse effects on the livelihood of forest dependent communities.

By assessing the impacts of the AR CDM project, the study will help in informing the communities that depend on forest resources on how to maximize on opportunities presented to them by future projects in their area and what to expect from them. Secondly, the recommendations yielded from the study will provide insight to the communities and policy makers that will hopefully, aid in the formulation and better implementation of public policies regarding community development and forests. Thirdly, the results and conclusions deduced from this research will provide useful information that could be used during planning and for effective execution of projects so as to ensure community fulfilment.

1.6 Conceptual Framework

The study has been conceptualised based on research conducted by UNEP on the potential impacts of CDM projects on sustainable development (Olhoff et al., 2004), the potential impacts of the AR CDM project as described in the Kamae-Kipipiri Project Design
Document (Green Belt Movement, 2009) and from the guidelines agreed upon in the Kyoto Protocol (UN, 1998). In Article 10 b (1) of the Kyoto Protocol, it clearly describes the appropriate regional programmes under which CDM projects can fall under, hence the AR CDM. Under Article 12 (2) of the Kyoto Protocol, it clearly states that the purpose of CDM projects will be to achieve sustainable development and for purposes of emission reductions. For sustainable development to be realised, positive contributions in the social, environmental and economic aspect have to be achieved. This clearly shows the foundation upon which the Kamae-Kipipiri AR CDM project is based on, with an addition of improving the biodiversity of the area as per the PDD.

With proper implementation of the project, results such as improved socio-economic status through income generation activities, sale of carbon credits and increased supply of non-wood forest products (NWFP) should be observed, as illustrated on Figure 1.1. The project should also restore the natural habitat for plant and animal species indigenous to the forest, reduce soil erosion in the area, improve the quality of water and improve soil fertility according to the PDD (Green Belt Movement, 2009). This should in overall improve the environmental status of the forest, which the community rely on for sustenance of their livelihoods. However, if the project is not well implemented, communities may continue to live under impoverished conditions, with little or no improvement on their socio-economic status and the forests may continue to diminish (Figure 1.1). Without proper documentation of the actual impacts of the AR CDM projects, more AR CDM projects may continue to be implemented nationally, regionally or even globally. This would be without much success, as the developers are not well informed on effects of their projects towards sustaining community livelihoods.

Since the establishment of the AR CDM project, there are bound to be impacts observed by the community on their everyday lives as well as to the forest. If the expected positive
contributions identified in the PDD documents have been achieved, then there will be noted improvement on the socio-economic status of the community as well as thriving environmental services and products from the forest therefore, moving closer towards sustainable development. However, if the project is observed to influence negatively on livelihoods and the forest, the situation in Kamae-Kipipiri may continue to degrade and minimal or no emission reductions will be recorded. This will lead to the objectives of the AR CDM project not being attained. If so, there may be an observed continued reliance on project funded activities for reforestation purposes within the area, and in the larger Aberdare forest.
OBJECTIVES OF THE AR CDM PROJECT

Proper Implementation

1. Restore natural habitat for indigenous species
2. Reduce soil erosion
3. Improve quality of water
4. Improve soil fertility
5. Increase income generating activities
6. Increased supply of NWFP
7. Encourage beekeeping

Improper Implementation

1. Threatened survival of trees planted
2. Reduced total water flow from the area
3. Lack of community enthusiasm to plant due to low direct benefits
4. Unfair distribution of development benefits

POSITIVE IMPACT TOWARDS:

a) Community Livelihoods (e.g. improved living conditions)
b) Environmental protection (e.g. flourishing forest biodiversity)

NEGATIVE IMPACT TOWARDS:

a) Community Livelihoods (e.g. impoverished lifestyles)
b) Environmental protection (e.g. forest degradation)

SUCCESS OF THE AR CDM PROJECT

FAILURE OF THE AR CDM PROJECT

Variables; Dependent – The community, Environment; Independent – AR CDM project

**Figure 1.1** Potential outcomes of AR CDM dependant on project implementation.

Source: Based on Green Belt Movement (2009), UN (1998)
CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The review has been organised thematically. This was found suitable as it allows for different topics relevant to this study to be introduced. The information provided offers a background of what the project is, its relation to community livelihoods globally, then regionally. It also discusses the benefits that different researchers have identified to have been actualised globally and within Africa. Finally, it reviews the status of the AR CDM project in Kenya, the identified potential impacts and potential challenges it is likely to have.

2.2 Background of Clean Development Mechanism

Climate change has become one of the most threatening issues of the modern world. Its effects have impacted on the livelihoods of people, politics, economy of many nations and on the environment. Climate change effects imply that the local climate variability the people used to experience in the olden days are changing and at a great speed (UNFCCC, 2007). This has therefore, brought the need for adaptation and mitigation measures to help curb the effects of climate change. One such measure is the AR CDM project under the Kyoto Protocol. The protocol is a legally binding agreement under which industrialized countries will reduce their collective emissions of greenhouse gases by 5.2% compared to the year 1990 (UN, 1998). The goal of the Kyoto Protocol was for Annex 1 countries to lower their anthropogenic carbon dioxide equivalents by at least 5 per cent below 1990 levels in the first commitment (UN, 1998).

National targets ranged from 8% reductions for the European Union, 7% for the US, 6% for Japan among others (UN, 1998). The protocol broke new ground with its innovative cooperative mechanisms aimed at ensuring global cost effectiveness in curbing these emissions (Olhoff et al., 2004). The core requirements of CDM projects, including AR
CDM is that the projects should provide real, measurable and have long term climate change mitigation benefits leading to sustainable development and biodiversity conservation (Kant, 2010). The AR CDM projects entail reforestation and afforestation of degraded lands and forests. The Kyoto Protocol defines reforestation as ‘the direct human induced conversion of non-forested land to forested land through planting, seeding and/or the human induced promotion of natural seed sources on land that was forested but that has been converted to non-forested land.

The Kyoto protocol also defines afforestation as ‘the direct human induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human induced promotion of natural seed sources’. The forest has also been defined in the Kyoto protocol as ‘a minimum area of land of 0.05-1.0 hectare with tree crown cover of 10-30% with trees with the potential to reach a minimum height of 2-5meters at maturity in situ. Forestry projects under the CDM were found to be suitable for developing countries because they require low technology to grow trees hence would be accessible to rural communities. They were also found to be suitable due to the high land degradation in Africa and the high dependency of wood resources for energy (Desanker, 2005).

Forests play a major role in the survival of flora and fauna species globally through the environmental services they provide. In Kenya, forests provide social, economic, environmental and even religious services to various communities in the country hence have a great effect on their livelihoods. Deforestation and degradation of the forest therefore impact on the livelihoods through reduced biomass energy, soil erosion and siltation, reduced water infiltration in the soil and reduced precipitation (Steibert et al., 2012).
The only AR CDM project in Kenya was spearheaded by the Green Belt Movement under the Aberdare Range/Mt.Kenya small scale restoration initiative. Kirimara-Kithithina and Kibaranyeki project sites are located in the Mount Kenya reserve forest, while Kamae-Kipipiri project site is found in the Aberdare reserve forest.

2.3 Relationship between livelihoods and AR CDM project

By influencing the type and location of where a forest should exist and who benefits from it, AR CDM has the potential to impact livelihood strategies (Smith & Scheer, 2002). Article 12.2 of the Kyoto protocol specifies that all CDM projects should aid the host country, here being the developing nations in achieving sustainable development (UN, 1998). This particular objective holds the basis for livelihood issues of the communities the project is to be implemented in. The World bank (2004) identified that over 1.6 billion rural people depend on forests for their livelihoods while about 70% of Africa’s population depend on forest resources for their day to day lives (Chidumayo et al, 2011). Many groups were opposed to AR CDM as they feared exclusion of the local people in the project planning and management. However, it is argued that if the AR CDM was well designed, it could contribute to better livelihoods by improving access and management to forest resources in ways that could benefit local people and contribute to reduction of greenhouse gas emissions (CIFOR, 2000).

Seeing how forests are of great importance to the communities of the world, one can foresee the relevance of AR CDM projects internationally, regionally and nationally. Smith & Scheer (2002) analysed the different project types that exist under the AR CDM and identified various potential livelihood benefits and risks that could be associated with this project. Project types ranged from large-scale like the industrial forest plantation in the Brazilian Amazon, agroforestry projects such as the Scolel-Te project in Mexico to protected forests such as the Noel Kemptt project in Bolivia and among others in eight different countries. They
identified livelihood benefits to include employment, social services if project is run by a company, daily sustenance materials (such as food, fuel, medicine), cash income from sale of forest products, inputs to farming (such as animal fodder, green manure, climbing poles), services to farming (such as wind breaks, fencing, erosion control, soil fertility), aesthetic and cultural values, rehabilitation of local ecosystem services and restoring biodiversity.

The sustainable livelihood concept (Carney, 1998) specifies five types of assets that need to be expanded or made more productive to achieve sustainable livelihoods under sustainable development in AR CDM. These include natural capital (such as forests, water, land), physical assets (such as electricity, roads, hospitals), financial capital (such as credit, savings), human capital (such as health, labour, education) and social capital (such as membership in groups). It is important to note that AR CDM impact on the above assets may vary and some may not provide significant livelihood benefits (CIFOR, 2000). However, this concept provides a much-needed platform for assessing the relevance of AR CDM to livelihoods.

2.4 Benefits and challenges of AR CDM globally

Majority of the studies available on AR CDM focus on the potential implications of AR CDM projects. Green & Unruh (2010) reviewed that most of the articles available on the potential of AR CDM drew their conclusions from reviewing case studies of voluntary forest carbon projects and forest conservation projects. The project design documents of AR CDM projects have identified only potential socio-economic and environmental benefits though the compulsory Environmental Impact assessment (EIA) and Socio-economic assessment (SEA) that are mandatory for AR CDM projects. Limited academic or grey literature is available on actual contributions that they have actually had on communities, agriculture or even sustainable development (Green & Unruh, 2010). This has also been supported by Kirkman et al., (2012) who concluded that most of the research available in relation to AR
CDM, communities and forests, focuses on the challenges and barriers of project implementation and on the potential that the AR CDM projects have. Spalding-Fecher et al., (2012) also from their research came to the same conclusion, whereby the local NGO’s and different CDM stakeholder groups with which they engaged in all agreed that the lack of sustainable development being a mandatory monitoring requirement in all CDM projects, leaves out the need for the real impacts of CDM projects to be reported or known. The information on the potential benefits is nonetheless essential for this study as it provides a baseline for comparison purposes on the actual findings of this research.

As of January 2013, there were 5547 registered CDM projects globally. Out of these, only 41 projects were registered under AR CDM. 14 projects are in Latin America, 13 in Africa, 12 in Asia and 2 in Europe (UNEP Risoe, 2013). This poor number of registered AR CDM has been attributed to the long and tedious bureaucratic process, complicated methodological requirements, issuance of temporary credits and the fact that they can only be implemented in forest potential countries (Chokkalingam, 2004).

The first large scale AR CDM project was approved in November 2006, the Guanxi watershed management in the pearl river basin, South China. An assessment carried out in May 2007 by FAO in the area showed that there had been observed positive contributions of the project in regards to biodiversity, reduction of soil erosion in the area and an improvement of the livelihoods of the communities’ dependent on this area (Franziska & Heiner, 2007). The livelihood changes according to FAO (Franziska & Heiner, 2007) was through income generated from employment, sale of forest products and sale of carbon credits.

According to Green & Unruh (2010), the Guanxi watershed project had positive influences to the community such as an increase in local institutional capacities and they also noted some negative influences such as it created an unfavourable income sharing ration between the land users and the forest companies and inadequate tenure security. These challenges
form a risk of creating an untrustworthy environment between the communities and the partners which it turns could hinder further improvement on their livelihood. In Asia, stakeholders held a policy dialogue in the year 2012 to discuss impacts that AR CDM have had on the Asian communities. Outcome of this discussion included that the AR CDM projects contributed to net mitigation of greenhouse gases from the first stage of implementation, it contributed to sustainable development through promotion and the wide use of low-carbon technologies and reduction in air pollution (Chokkalingam, 2004). The report that came from this dialogue also reported that India had experienced some negative effects however specifics were not mentioned.

Smith & Scheer (2002) analysed different project types that exist under the AR CDM in Brazil, Mexico, Ecuador, Indonesia, India, Bolivia and Zimbabwe and identified various potential livelihood benefits and risks that could be associated with this project. Project types ranged from large-scale, agroforestry to protected forests. They identified livelihood benefits to include employment, social services if project is run by a company, daily sustenance materials (such as food, fuel, medicine), cash income from sale of forest products, inputs to farming (such as animal fodder, green manure, climbing poles), services to farming (such as wind breaks, fencing, erosion control, soil fertility), aesthetic and cultural values, rehabilitation of local ecosystem services and restoring biodiversity. Their research was also able to identify some challenges that had been experienced in the AR CDM projects of the eight countries they researched on. The most common was tenure conflicts. In the areas where the AR CDM project had been implemented, local rights had been ignored while some communities had been inadequately compensated. In other project areas, the companies in charge of project implementation had claimed lands of local people who lacked legal documentation despite having lived there for many decades. Another challenge they identified was that of depletion of economically important wildlife due to increased
human activity during project implementation. This was common in large scale projects such as the PROFAFOR project in Ecuador.

In India and Indonesia, Smith & Scheer (2002) noted that the biggest challenge was labour exploitation and disruption of social support networks. In Zimbabwe, they noted that poorly designed and underfinanced projects failed to produce sustainable livelihoods and viable forest enterprises. This in turn led to equity distribution problems in terms of income, local use rights and products. Another common challenge they identified was that of community rejection towards AR CDM projects. This was because agricultural lands are of greater use to communities than forest lands. Hence during rehabilitation, without proper compensation and development of alternative job opportunities, the success of the project was under threat.

2.5 Contribution of AR CDM projects in Africa

Africa has been considered to have a large potential for development (Desanker, 2005). One of the intentions of the creation of AR CDM was to allow for the uplifting of African nations through technology transfer, community-level development benefits, enhanced private sector investment and market development (Desanker, 2005). It is important to note that in Africa, most forests are managed by communities, hence this deprives many forest communities from using their skills for CDM mitigation efforts and in improving their economic status as all CDM projects are supposed to be implemented by the private sector (Kant, 2010). Another important observation made was by Jindal et al., (2008), where they highlighted that since most projects in Africa are fairly new, there were very few studies on AR CDM projects and their impacts on the host country or the project participants, herein the community.

In Africa, the first and the largest AR CDM project is the Humbo Assisted Natural Regeneration project in Ethiopia (Afrol News, 2013). Some of the identified impacts include
restoration of 2,700 hectares degraded forest land, sale of carbon credits from the project has enabled for an income stream to the local communities which has enabled them to improve their livelihoods in terms of health and nutrition. The benefits to the local community in terms of livelihood and economy have superseded that of carbon revenues (Afrol News, 2013). However, during a research by the Japan Overseas Plantation centre for Pulpwood in East Africa, Jopp (2007), it concluded that the project has not been reaching its target carbon sequestration targets therefore the income from carbon credits is not enough to cater for the community needs or the project implementer.

The Kibale National Park rehabilitation project in Uganda is another AR CDM project managed by Face the Future and the Ugandan Wildlife Authority (Forest Carbon Portal, 2013). Some of the contributions that the organisation identified included environmental impacts: increased biodiversity of vegetation in the area due to planting of original vegetation in the area, improving quality of water in the surrounding area, restoring the habitat of chimpanzees and other primates. Social impacts such as creation of employment opportunities for local communities from planting, weeding, tending etc., enhancing togetherness within the community and rising of women empowerment (Forest Carbon Portal, 2013). One notable constraint according to Jopp (2007) in Kibale, was that the project design was too expensive. Another notable negative social impact was that the project did not provide for another source of revenue other than carbon credits which limited the income generation of the community. The project also faced tenure conflicts such as noted by Smith & Scheer (2002) in their research. Political influence and poor governance was mainly to blame for this (Jopp, 2007).
2.6 AR CDM in Kenya

The Green Belt Movement initiated the pilot AR CDM in 2009 (Green Belt Movement, 2011). Their aim was to experiment and learn how such projects could contribute towards community livelihoods though payment of ecosystem services, while mitigating against the impacts of climate change and improving conservation of biodiversity in highly degraded areas. This project has been rehabilitating 1600ha of land in the Aberdare and Mt. Kenya region and it was designed to have positive impacts on the environment and the community (Green Belt Movement, 2009).

2.6.1 Potential contributions of AR CDM to Aberdare community

As discussed earlier in the chapter, every PDD of every AR CDM project must contain the results of the Environmental Impact Assessment and Strategic Environmental Assessment conducted as a requirement for this project. The results for these assessments highlight the impacts that the project could have to the community when implemented. As such, the following impacts were highlighted in the PDD of Kamae-Kipipiri (Green Belt Movement, 2009):

- On the environmental impacts, the project would absorb an estimated 12,000 tonnes of carbon from the atmosphere every year; it would restore the natural habitat of indigenous species of plant and wildlife; reduce soil erosion thereby improving the quality of downstream water supply; enhance the local climate to some limited extent and through tree planting; and it would help in breaking the soil hence improve the depleted soil fertility. The negative impacts projected include threatened tree survival for the first 5-10 years due to foraging game, fire, drought and weeds.

  The findings for the socio-economic assessment estimate that the project will bring about a number of benefits to the local communities including paid labour; purchase of seedlings from community managed nurseries; increased supply of non-wood forest products in the mid to long term including animal fodder, deadwood and medicinal plants for local
utilisation. Other benefits include income from sale of other non-wood forest products such as mushrooms, medicinal bark and future income generation from beekeeping. Potential negative impacts on the socio-economic aspect according to the PDD (Green Belt Movement, 2009).

would be experienced if the project is not implemented well or at all. The Preliminary budget allocated is not sufficient which could lead to either lack of community enthusiasm to plant or lack of maintenance of the trees after planting. Another potential negative impact would be intra-community conflict due to unequal distribution of the longer-term development benefits. Raised expectations from project staff to the community could lead to disappointment in the future (Green Belt Movement, 2009).

2.6.2 The Green Belt Movement and AR CDM in Kenya

Upon further research, the Green Belt Movement had foreseen potential problems with the success of the AR CDM project in Nyandarua County. It was therefore important to highlight the potential constraints that the implementing entity had identified so as to add on to why this study was necessary. The report by Green Belt Movement (2011) concludes that unless a number of issues are addressed, the project will not meet its expected goals, which will in turn affect community livelihood. The following was observed:

- **Financial constraints**: Project development is expensive. Lack of upfront funding and the long-time communities have to wait before realising financial returns from carbon credits make it impossible for communities to take up forestry projects.

- **Biodiversity**: Carbon projects are encouraging growth of exotic trees rather than the indigenous species which is posing a threat to biodiversity. It is affecting forest products and services which are in turn affecting water resources, food security and rural community livelihoods.
• *Local community participation:* Green Belt Movement noted that the project since it is internationally structured does not allow for full and effective participation of rural communities. Without proper grassroots governance structures and adequate investment in the community, there is a likelihood of conflict to arise as observed in Brazil (Smith & Scheer, 2007).

• *Leakage:* Unless a good governance system is in place to address the issues and provide solutions for the actual drivers of deforestation and forest degradation, the AR CDM projects may end up doing more harm than good.

• *Institutional Framework:* Despite the willingness of the Designated National Authority (DNA), in this situation it being NEMA, to support rural communities, they lack skills, policies and finances to adequately handle AR CDM. There is need for strong national forest authorities if such carbon projects are to succeed in Kenya and in Africa.

• *Complex methodologies:* The methodologies and terminologies defined in the PDD for project implementation are too complex even for the professionals hence more complex to the rural communities. If not simplified, the projects will remain impractical to the rural communities to whom the projects are aiming to improve their livelihood.

Similar challenges observed above were also identified by Green & Unruh (2010), Spalding-Fecher *et al.*, (2012), Jopp (2007), Smith & Scheer (2002), CIFOR (2000), Muys (2004), and UNFCCC (2012) all in their research regarding AR CDM projects.

Despite the potential that AR CDM has in Africa and in Kenya to create sustainable community livelihoods, the lessons from Green Belt Movement (2011) indicate there are key factors that are acting as barriers towards this potential being achieved. The question therefore, remains what AR CDM has actually done for our communities in terms of impacting their livelihoods despite the external forces that exist.
CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents procedures that were used to collect, measure and analyse data in view of the stated objectives. The chapter is organised in the following subsections: study area, sampling procedure and sample size, data collection methods and procedures, sampling analysis and research ethics.

3.2 Study Area

The study was carried out in Kamae and Kipipiri sites both in the Aberdare ranges, which host the Aberdare forest as shown in Figure 3.1. Kamae is located in Lari constituency while Kipipiri is found in Kinangop constituency. The two areas are classified as one site, Kamae-Kipipiri (-0.445218, 36.535014), under the small-scale AR CDM project led by the Green Belt Movement. It has ground coverage of 227.1ha divided into 6 sub areas: Kipipiri East & West, Kamae East & West and Kamukombi-ini North & South all within a 40km radius (Green Belt Movement, 2009). The specific areas where the project is located has been identified as the bio carbon site on the map as shown in Figure 3.1.

The study area was selected as it was the only project site located in the Aberdare forest. The site was also found to be suitable due to its accessibility, and availability of key respondents for this particular site. The other two AR CDM projects are located in Kibaranyeki and Kirimara-Kithithina which are found in Mount Kenya forest. The Aberdare forest is found on the Aberdare ranges in Central Kenya and is situated within 36°30’E, 0°05’S and 36°55’E, 0°45’S. It stretches over 125km from Nyahururu in the North and Limuru in the South. It has two rainy seasons; April- May and October – November. They receive an annual average rainfall of 900-2600mm with low mean annual temperature of 17.5C depending on the side
the slope faces (NEMA, 2012). Kamae-Kipipiri receive an annual rainfall amount of 1,200-1,600 mm as they drop towards the west into the Rift Valley.

**Figure 3.1** Map of Kenya showing Nyandarua county; Extended Nyandarua county map
Figure 3.2: Kamae-Kipipiri project sites in the Aberdare range.

Source: Green Belt Movement (2009)
The study area also has a relatively low mean annual temperature of 17.5 °C and these two conditions provide favourable conditions for tree growth (Green Belt Movement, 2009).

The Aberdare range has various vegetation zones which include the closed-canopy forest belt that covers majority of the Aberdare range. Kamae-Kipipiri falls under this forest belt. The forest is gazetted as forest reserve; however, part of the upper forest falls under the Aberdare national park. The forest belt is characterized by a high variety of forest types due to its wide altitudinal range and different climatic zones within the range. Kamae-Kipipiri however, has been highly deforested and degraded due to illegal logging and charcoal burning, such that it had been a grassland since 1987 (Green Belt Movement, 2009).

The community living in Kamae-Kipipiri have been described to be low income earners according to a survey conducted by the Green Belt Movement in the year 2011. This has partly been attributed to the poor road conditions in the area that inhibit transportation of their produce to the local markets, which are located far from the area.

3.3 Study design

A descriptive research design was considered to be suitable, as it led to an assessment of information regarding behaviour, attitudes and other characteristics of the target group.

3.4 Sampling Procedure and Sample Size

The Kamae-Kipipiri AR CDM project required that communities in these areas form community associations if they were to be involved in the project and to receive benefits from it. This led to formation of three Community Forest Associations (CFA’s), i.e. Lari CFA, South Kinangop CFA and North Kinangop CFA to cover the 40km radius. Singleton & Straits (1999) define a target population as the population which can be used to generalize results. The target population for this research was hence determined to be all members of the three CFAs, as they were directly involved in the project hence directly impacted by the project.
The estimate population size of all the members of the three CFA’s was over ten thousand individuals. Three key informants were also included as part of the target population. This involved one project staff from the Green Belt Movement, project contact person from Lari CFA and the project contact person from Kinangop constituency. The contact persons were relevant to this research as they were the middle persons between the community and the project implementer, Green Belt Movement. They therefore were found to have been more exposed during project implementation compared to other community members.

The number of groups that were available were 110 in total. This is because the CFA’s had further sub divided their members into smaller groups of about 100 members each. A stratified random sampling technique was then used on the CFA groups. This technique was seen fit as it allowed for the CFA members to be grouped into three: men, women and youth which was relevant for this study. A simple random sampling technique was then used to select one individual from each group selected form the stratified random sampling technique. A purposive sampling technique was used to select the chairpersons of each of the subdivided group. This was found to be important as they could offer an overall view of their groups which would add immensely on the data collected.

According to Mugenda & Mugenda (1999), when the target population exceeds ten thousand individuals, the desired sample size should be ideally 384 individuals. This research however, yielded a sample size of 440. From the stratified random sampling technique, 330 individuals were selected from the 110 groups, with each group providing three individuals from the strata. The purposive sampling technique allowed for selection of 110 individuals who were the chairpersons of each group and this gave a total of 440 individuals. A grand total of 443 individuals were selected, this is including the three key informants. The sample size was found to be sufficient as it exceeded the recommended sample size by Mugenda & Mugenda (1999) and hence increasing the efficiency and the precision of the data collected.
3.5 Data collection methods and instruments

Both primary and secondary data were collected in this study; and these included both qualitative and quantitative data.

3.5.1 Key Informant Interviews

Semi-structured interviews were used to source in-depth information from the 3 key informants. The 3 informants were used as they were an integral part of the AR CDM project design for the country, as well as the implementation team in Kamae-Kipipiri area. This tool was found to be very resourceful as it allowed for key questions to be asked while offering some flexibility on how they would be administered while still meeting the objectives of the study. Singleton & Straits (1999) explain that semi-structured interviews have specific objectives while permitting freedom on how they are met, and they are limited to certain sub-topics and key questions are developed in advance. Both face-to-face and telephone interviewing methods were used on the key-informants due to their availability.

3.5.2 Questionnaire

Use of semi-structured questionnaire for the CFA members was found to be an appropriate way to collect first-hand information from the community. The data collected from the questionnaires included social and economic status of the community before and after the project was implemented. These offered a baseline for comparison on whether the project had any impact on them. The data collected also included community perceptions on the status of the forest and the products and services they obtained from it for their day to day lives, before and after AR CDM project implementation.

According to UNEP (Olhoff et al., 2004), the SSN matrix tool was first established by Helio International in 1999, then modified by the South South North Organization to be used as a checklist tool for appraising CDM projects. The tool consists of additionality filters,
sustainable development indicators and feasibility indicators. For the purposes of this study, only the sustainability indicators were used. A project’s performance is assessed against the list of indicators one is using for a particular study, in this instance it was assessed against the sustainability indicators provided for in Table 3.1. Issues that have been raised regarding this tool include that it is difficult to provide for all sustainable indicators for all projects despite most being identified in the tool. Secondly, there is bias towards use of qualitative indicators hence, the application of the scores will be highly subjective. Thirdly, the tool has issues on measurability, operationality and in use of the number of desirable indicators one can use. On the other hand, it is said to fulfil the desirable properties of completeness and comprehensiveness. The tool is also said to provide results that aid to determine the replicability of a project.
**Table 3.1** Sustainable Development Indicators of the SSN matrix tool

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Local/regional/global environment</strong></td>
<td></td>
</tr>
<tr>
<td>Water quantity</td>
<td>• Number of people with access to water</td>
</tr>
<tr>
<td>Indoor air quality</td>
<td>• Ability to breathe and see indoors</td>
</tr>
<tr>
<td>Soil condition (quality)</td>
<td>• Fertility, erosion</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>• Destruction or alteration of natural habitat</td>
</tr>
<tr>
<td><strong>Social sustainability and development</strong></td>
<td></td>
</tr>
<tr>
<td>Livelihoods of the poor</td>
<td>• Distributional equity: changes in income and improved opportunities.</td>
</tr>
<tr>
<td></td>
<td>• Access to services: water, health, education, access to facilities etc...</td>
</tr>
<tr>
<td></td>
<td>• Access to energy services: coverage of reliable and affordable clean energy services, security of energy supply</td>
</tr>
<tr>
<td></td>
<td>• Human and institutional capacity: Empowerment: access of local people to and their participation in community institutions and decision making processes.</td>
</tr>
<tr>
<td></td>
<td><strong>Effects on education and skills.</strong></td>
</tr>
<tr>
<td></td>
<td>Gender Equality: empowerment, education/skills and livelihoods of women.</td>
</tr>
<tr>
<td><strong>Economic and technological development</strong></td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td>Job creation</td>
</tr>
<tr>
<td>Technological self-reliance</td>
<td>Skills development, technology transfer</td>
</tr>
</tbody>
</table>
Ranking:

-2: Major negative: i.e. where there is significant damage to ecological, social and/or economic systems that cannot be prevented through mitigative measures.

-1: Minor negative: i.e. where there is measurable impact, but not enough to cause significant damage to the social, economic and/or ecological systems.

0: No or negligible impact: i.e. where the ecological, social and/or economic systems have not changed from the baseline.

+1: Minor positive: i.e. where the ecological, social and/or economic systems have minimal improvements.

+2: Major positive: i.e. Where the ecological, social and/or economic systems have significant improvements.

NB: All changes are to be considered relative to the baseline situation (i.e. without the proposed project).

The SSN matrix tool was also found to be most suitable for this research as opposed to other tools such as CDM Sustainable Development (SD) tool, cost-benefit analysis, cost-effectiveness analysis, multi-criteria analysis, VER+ (Verified Emission Reductions), VCS (Voluntary Credits), GS (Gold Standard) and ISO (International Organization for Standardization) 14064 because (Olhoff et al., 2004):

- CDM SD tool provides for analysis of afforestation and reforestation projects in terms of carbon stocks and GHG emissions and this is not an area of focus in this study. It is also not suitable for small-scale projects in which our project site falls under.

- Cost-benefit analysis is a suitable tool for analysing project level impacts on economic terms and is unsuitable for small-scale project analysis as it is an expensive method
to use. The research is assessing impact on community livelihood which includes the social and environmental aspects, which are lacking in this tool.

- Cost-effectiveness analysis involves the examination of costs for mitigation options against the potential reduction of GHG emissions. This is irrelevant for this study hence not a suitable tool.
- Multi-criteria analysis is a tool that is most useful in identifying the potential impacts of a CDM project. However, this research is focusing on the actual impacts of the AR CDM project on community livelihoods.
- VER + is a standard for CDM projects generating Verified Emission Reductions. This research is focusing on community livelihoods hence not an appropriate tool to use.
- Gold Standard is a voluntary quality standard in the designing and implementation of carbon offsetting projects. The Kamae-Kipipiri AR CDM project is not being assessed for its qualification for a Gold Standard in this particular research hence the tool is not necessary.
- VCS and ISO 14064 tools are based on GHG emissions and this is not an area of focus for this particular research.

The SSN matrix tool provides the necessary indicators that are required for this study, hence, the most suitable compared to the above. The tool has been used by various countries as well to assess the sustainability indicators of their various CDM projects. They include Japan, South Africa and Brazil (Olhoff et al., 2004). It is important to note that there is no universally agreed list of sustainable development indicators for any CDM project (UNFCCC, 2012). For the purposes of this research, indicators that impact directly on community livelihoods were used. The full detailed list of the SSN Matrix tool can be found in Appendix A.
Questionnaire was administered with the aid of key informant 2 and 3 as they had access to
the CFA members. This was because they had access to the 110 chairpersons, who then
administered randomly a questionnaire to one man, woman and youth member (gender
irrespective) in their group. This allowed for data to be collected from a total of 330 persons.
The informants then gave the 110 chairpersons' the same questionnaires to fill so that a total
of 440 questionnaires were distributed to the target population. The key informants did not fill
in the questionnaire as their information was collected through the interviews.

3.6 Data analysis

The study was able to generate both qualitative data from the interviews and
quantitative data from the semi-structured questionnaire. Desktop documentary analysis was
used on the secondary sources. The secondary sources here being articles and scholarly
books. The analysis allowed for questions raised from the objectives to be answered more
objectively hence, aid in drawing conclusions and recommendations. Quantitative data from
the questionnaire was edited, sorted and summarised using Ms Excel. The questions from the
questionnaires were extrapolated from the SouthSouthNorth (SSN) matrix tool which is an
internationally accepted analysis and decision-making tool in the area of sustainable
development in relation to any CDM project (Olhoff et al., 2004). In order to fully grasp the
influence of the project on livelihoods, data was also obtained in regards to amenities the
community valued most. An in-depth analysis of the situation before and after the project
was also conducted, allowing for a broader view on the contribution of the CDM project, or
lack thereof towards their way of life to be obtained.

The data was presented in form of graphs, charts, pie-charts and Tables where applicable.
Data from the questionnaires was also assessed against a list of indicators presented in Table
3.1, using the ranking system provided by the SSN matrix tool (Olhoff et al., 2004). A more
detailed list of the tool is presented in Appendix A.
Qualitative data from the key informant interviews was used to compliment the analysed quantitative data. The data was presented as verbatim.

All data were also compared to the sustainable development (SD) indicators provided by the UNFCCC, as they are the agency in charge of all matters related to CDM projects from their conception to project approval.

From data collected from the questionnaire, information was separated on whether an indicator being assessed showed an improvement hence, a positive impact; or depreciated, hence the negative impact. To further rank the information as a positive or negative 1 or 2, the following formula was used:

\[
\left( \frac{\text{Total no. of respondents indicating positive or negative change}}{\text{Total no. of respondents}} \right) \times 100
\]

If the change observed was positive and the result was less than 50%, then it was ranked as a minor positive change. If it was more than 50%, then it was ranked as a major positive change. If the change was negative, then a result of less than 50% was considered a minor negative change, and if it was more than 50% it was considered a major negative change.

The results obtained from the SSN matrix tool were also added up, per indicator to determine whether the overall impact was positive or negative. The following formula was used to determine the percentages. If the indicator had a grade of less than 50%, then the overall impact is determined to be negative. If the grade is more than 50%, then the impact is determined to be positive.

\[
\left( \frac{\text{Sub-total score of an indicator}}{\text{Maximum score the indicator can achieve}} \right) \times 100
\]
Spearman’s rank correlation was also used to assess whether the AR CDM project impact on the community was significant. This information was used to enrich the data collected from the SSN matrix tool. The equation was found suitable as it measures the strength and direction of association between two variables, and also because there was no linear relationship between the variables. The formula used was:

\[ r_s = 1 - \frac{6 \sum D^2}{N^3 - N} \]

where:

- \( D \) – Difference in ranks
- \( N \) – Number of cases

where the value \( r_s \) means:

- \( r_s = 1 \)  a perfect positive correlation
- \( r_s = 0 \)  no correlation
- \( r_s = -1 \)  a perfect negative correlation

Data from the SSN matrix tool on the socio-economic and environmental impact of the project towards community livelihoods, was subjected to the formulae above so as to attain the necessary results.

3.7 Research ethics

Singleton & Straits (1999) define research ethics as ‘a set of moral principles against which the actions of scientists are judged.’ The potential research benefits must be weighed against the potential research costs so as to control the ethical implications it may have towards the larger society.
Due to the sensitive nature of this study, in that some information provided by the key informants was solely to be used for research and not for use by any other entity, consent from all the participants was obtained. Anonymity and confidentiality was also guaranteed to the participants hence no names or personal information was collected from either the key informants during the interviews, or from the community through the questionnaire.
CHAPTER 4: RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents the findings of the study related to study objectives and research questions. It begins by providing outcomes in relation to effects AR CDM projects have had on the socio-economic activities that communities engage in and on environmental services that the forest provides to the communities. It further provides information on effect of the project on women and youth empowerment. It finally explores challenges experienced by communities during the process of AR CDM project implementation.

4.2 Sustainable development indicators in Kamae-Kipipiri

The ranking system used provided a total score of 20 as shown in Table 4.1. This is based on assumption that each indicator can score a maximum of +2 hence grand total of 20. The tool used as an extract from the full version in this study, aimed to assess the impact of livelihoods.

Table 4.1 reveals a score of 2 out of a sum total of 8 under the local environment, which represents a 25% contribution towards the local environment and is thus considered negative. According to information gathered from respondents, the number of people with access to water supply improved slightly (+1), quality of air indoors improved (+1) due to introduction of energy saving jikos that produced less smoke thus more visibility and breathable air within the homes. Soil condition was reported to have improved within the area due to tree plantation (+1). However, the findings show that as there was no observation by the community on reappearance of previous species within the area and in addition, there was plantation of exotic species in the area, all which are measures of negative impact in relation to biodiversity (-1).
Table 4.1 Results from the SSN Matrix tool analysis

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Contribution towards:</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Local Environment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Water quantity</td>
<td>+1</td>
</tr>
<tr>
<td>2</td>
<td>Indoor air quality</td>
<td>+1</td>
</tr>
<tr>
<td>3</td>
<td>Soil condition</td>
<td>+1</td>
</tr>
<tr>
<td>4</td>
<td>Biodiversity</td>
<td>-1</td>
</tr>
<tr>
<td><strong>Livelihoods of the poor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Distributional equity</td>
<td>+2</td>
</tr>
<tr>
<td>6</td>
<td>Access to essential services</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>Access to energy services</td>
<td>+1</td>
</tr>
<tr>
<td>8</td>
<td>Human &amp; institutional capacity</td>
<td>+2</td>
</tr>
<tr>
<td><strong>Economic and technological development</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Employment (numbers)</td>
<td>+2</td>
</tr>
<tr>
<td>10</td>
<td>Technological self-reliance</td>
<td>+2</td>
</tr>
</tbody>
</table>

Sub-total: 11  
Grand total: 20

The contribution towards livelihoods of the poor according to Table 4.1 scored 5 out of 8, which represents a 62.5% contribution hence a positive impact. From the results, contribution towards distributional equity was observed to have improved. Distributional equity here refers to improved distribution of wealth and opportunities. The observation was explained by increased opportunities within the community, through sale of jikos and beekeeping as per 76% of the respondents. The community has also organised themselves into associations such as the CFAs. This platform has enabled development of systems that would allow for equal distribution of equity (+2), should the project start earning income from sale of carbon credits. The project as shown on Table 4.1, did not impact positively towards access to essential services (0). The same number of people still used previous means and...
resources to access health facilities and schools. According to the PDD (Green Belt Movement, 2009), the community of Kamae-Kipipiri are located far from the market and transport services are not as frequent or available as they would wish. This condition was not improved as well.

Access to energy services was noted to have improved (+1), as agreed to by 65% of the respondents. This was mainly influenced by introduction of energy saving jikos that use clean energy which is reliable and affordable to the community. They collect deadwood from the forest which is more reliable and affordable than charcoal. Impact on human and institutional capacity was the highest with a score of +2 on the SSN matrix tool. The sub-indicators such as empowerment, show that there was improved access and participation of community members in the community institutions (Table 4.1) and further supported by 85% of the respondents (Figure 4.5). Training and teaching sessions provided for by Green Belt Movement staff enhanced the community’s education and skills as indicated by 80% of the respondents, and gender equality was encouraged as women and youth were allowed to participate in the project hence, enhancement of livelihoods of women in the community.

The greatest contribution of the AR CDM project was towards economic and technological development. Results from the SSN matrix tool (Table 4.1) show that a score of 4 out of 4 was achieved which translates to majority (above 80%) of the respondents agreeing to the findings. According to the PDD (Green Belt Movement, 2009), there was hardly any income generation opportunities in the area prior to the project. With project implementation, 80% of the respondents agreed there was additional job creation through sale of jikos they constructed and sale of honey from the beehives they put up. The training on seedling preparation, planting and management contributed to their skills development and transfer of technology.
The overall score of 11 out of 20 (Table 4.1) yields a 55% representation of the contribution of the AR CDM project towards improving the livelihood of the Kamae-Kipipiri community. This result according to the SSN tool indicates an overall positive contribution in the area, using the indicators listed.

However, there was need to evaluate whether there were additional impacts by the project that were not included as part of the measurements in the SSN matrix tool nor mentioned in the PDD but were relevant to the Kamae-Kipipiri community. This would aid in improving the data collected and analysed by the SSN matrix tool.

4.3 Effects of AR CDM on socio-economic activities

The research sought to understand what changes took place in terms of the social and economic activities that the communities engaged in before and after implementation of the project. This was through comparison of the stated potential outcomes in the project PDD with that from the respondents. It was also analysed by comparing the conditions of their socio-economic activities prior to the project and after so as to get a better view of the impacts the project has had.

4.3.1 Comparison between Proposed Kamae-Kipipiri CDM effects against research observed outcomes.

The proposed effects mentioned in the PDD in relation to socio-economic benefits were listed, and used as a checklist against the data collected from the questionnaires as shown on Table 4.2. The PDD highlighted 6 potential socio-economic outcomes should the project be implemented. Comparing this information with that from the respondents, 83.3% of the proposed positive outcomes were actualised. This can be interpreted to mean that the project was well implemented in the area hence contributing positively towards the communities’ livelihood. Key Informant 2 (KI 2) and 80% of the respondents supported this
Table 4.2: Comparison between expected PDD outcomes and actual outcomes

<table>
<thead>
<tr>
<th>Proposed socio-economic outcomes in the project design document</th>
<th>Actual outcome from analysed data</th>
<th>Percentages (positive changes)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Positive Outcomes</strong> overall = 83.3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paid labour</td>
<td>Achieved</td>
<td>100%</td>
</tr>
<tr>
<td>Income from purchase of seedlings from community managed nurseries</td>
<td>Achieved</td>
<td>80%</td>
</tr>
<tr>
<td>Benefits from sale of other non-wood products such as mushrooms, honey etc.</td>
<td>Achieved</td>
<td>54%</td>
</tr>
<tr>
<td>Increased supply of non-wood forest product including: deadwood, medicinal plants for local utilization</td>
<td>Achieved</td>
<td>74%</td>
</tr>
<tr>
<td>Ecotourism</td>
<td>Not Achieved</td>
<td>100%</td>
</tr>
<tr>
<td>Bee-keeping</td>
<td>Achieved</td>
<td>54%</td>
</tr>
<tr>
<td><strong>Negative Outcomes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of enthusiasm to plant trees due to insufficient funds</td>
<td>Achieved</td>
<td>60%</td>
</tr>
<tr>
<td>Unequal distribution of long term development benefits such as carbon credits</td>
<td>Not Achieved</td>
<td>100%</td>
</tr>
<tr>
<td>Poor investment returns from tree planting rather than food production</td>
<td>Achieved</td>
<td>70%</td>
</tr>
<tr>
<td>Lack of morale and future disappointment by the community due to high expectation given during project implementation.</td>
<td>Achieved</td>
<td>80%</td>
</tr>
</tbody>
</table>
finding, by confirming that women and youth had especially taken up the tree nursery initiative and converted it to lucrative business that has been able to uplift their economic status. The results do agree with observations made by the Forest Carbon portal (2013) in Kibale National Park, Uganda in regards to income generation, where in 2014 it was reported to have provided jobs for 257 people, majority of them women from the tree nursery initiative that included planting, tending among others.

According to 54% of the respondents, some of the community members had undertaken the beekeeping venture, and had been able to earn income from sale of honey. Key Informants 2 (KI 2) and 3 (KI 3) agreed with this finding, beekeeping was actively being practised by some of the community members hence a positive impact (Table 4.2). There was also a noted increased supply of deadwood as highlighted by KI 2. It was highlighted that youth from Lari CFA were engaged in collection of deadwood and the supply had increased (Table 4.2), which in turn reduced the number of trees they cut for purposes of use as firewood.

Ecotourism was the only potential positive outcome that was not realised. All the community members (100%) did not offer a response in relation to this matter on the questionnaire, and KI 1 and KI 2 were not aware of the potential of ecotourism. This is despite the Aberdare forest hosting a wide variety of fauna and flora according to Green Belt Movement (2009) and due to this, it has been nominated by the Kenya Forest Service to be considered as a World heritage natural site (UNESCO, 2016). In other countries, such as Ecuador, according to Smith & Scheer (2002), ecotourism has been very successful where by the community has been engaging with tour operators and environmentalists in preventing hunting and oil exploration by companies and encroachment by squatters into the forest under the PROFAFOR AR CDM project.

According to CIFOR (2000), if the forestry CDM project activities do not have the adequate safeguards, the activities could have negative effects on the local people such as reducing access to resources they depend on for portions of their livelihood. Jindal et al., (2008) as well noted
that despite AR CDM projects having the potential to benefit local communities, they can also have adverse negative effects. The Kamae-Kipipiri PDD outlined some potential negative impacts as shown on Table 4.2., that the project could have towards the community. This included lack of enthusiasm to continue planting trees, a likelihood of unequal distribution of benefits from sale of carbon credits, poor investment returns from sale of tree seedlings and mismanaged expectations. From these mentioned negative outcomes (Table 4.2), 3 out of 4 of them were experienced.

For instance, KI 1 during the interview highlighted that the money provided for the project was never enough to cater for the project implementation which included catering to the community’s activities during the implementation phase. Therefore, the community was not excited to be involved in tree planting. It was also difficult to convince the rural poor community the economic benefits of tree planting. They were not receiving payment directly for trees planted, as is experienced in other non-Kyoto projects such as the Nhambita community carbon project in Mozambique where farmers are paid per hectare of trees grown and managed (Jindal et al., 2008). KI 2 and KI 3 agreed with these findings as well, that the money the CFAs used to receive to aid in maintenance of the tree nurseries was no longer being provided. The members in turn began losing morale with the project. They also both recognised that members were engaging in farming as the tree venture was not bringing enough income as they had anticipated. Financial constraints had been identified by most researchers as a major hindrance to the continuity of the AR CDM project nationally and globally (Green Belt Movement, 2011; Spalding-Fecher et al., 2012; UNFCCC, 2012). This is because it affects the proper and complete implementation of the project, which could contribute to the low enthusiasm by the community, mismanaged expectations towards the community and an overall loss of resources as observed in Table 4.2.
Subbarao & Lloyd (2010) in their research in India, noted that without careful management of expectations of the local community, problems being experience in the CDM projects may be repeated and likely to increase the environmental crisis being experienced worldwide.

On matters of earning carbon credits, all the respondents (100%) agreed that they had not received any earnings from this. KI 1 highlighted that it takes time for a tree to grow to the appropriate height for it to be considered as one which is sequestering carbon, hence able to earn carbon credits and the community was not enthusiastic with this information. Furthermore, should the trees be of appropriate height, the Green Belt Movement (Green Belt Movement, 2009) highlighted that there was a higher chance of the more literate, wealthy and powerful people capturing these benefits and it may be a source of conflict. A similar situation was observed by Jindal et al., (2008) in the Kibale National Park AR CDM project, where the community did not receive any revenue from sale of the carbon credits, and is said to be a source of tension in the area.

Smith & Scheer (2002) in their research in Ecuador, observed how proper planning of the PROFAFOR project from inception to implementation resulted in the above stated negative outcomes of Table 4.2, being minimised in Ecuador. However, they did not specify which exact steps were taken so as to minimize these effects. Jindal et al., (2008) indicated that it was uncertain whether local communities understood the nature of AR CDM projects and their contractual agreements, which could be one of the reasons of why the negative effects on Table 4.2 were experienced.

4.3.2 Community perspective on project impact towards social amenities

Social amenities contribute greatly to the livelihood of any community as they create opportunities for other social and economic ventures. The key socio-economic aspects that the community identified as important to them included development of roads, access to health facilities, and skills enhancement through training, education and information awareness.
From the data in figure 4.1, 5% of the population agreed that the condition of the roads was good before the project and 5% were of the opinion conditions of the roads had remained the same even after the project was set up. This means that the area suffers from poor road conditions and the project has not contributed to the improvement of the roads in Kamae-Kipipiri. The roads were not fixed, nor did their situation improve during the project period. The implementing entity did not offer a reason as to why the road infrastructure was not developed. This is further supported by data from the SSN matrix tool that grades this indicator as none or of negligible effect (0). According to KI 3, road access to the community is of great importance as it allows them to conduct their trade more efficiently.

![Figure 4.1: Socio-Economic status pre and post AR CDM Implementation in Kamae-Kipipiri.](image)

The UNFCCC (2012) identified creation of infrastructure such as roads and bridges to be a key indicator for development for any CDM project, but this has not been observed as indicated above. Research by Green & Unruh (2010) on 14 AR CDM projects as of 2010, support the findings above whereby there was no mention of improvement of infrastructure in any of the PDD they reviewed as is seen above and there was no identified improvement on the
existing roads. Smith & Scheer (2002) also observed the same in their research. Spalding-Fecher et al., (2012) in their research noted that AR CDM PDDs did not mention infrastructure creation as a benefit hence no documented data in regards to this.

The UNFCCC (2012) and the SSN matrix tool (Olhoff et al., 2004) identify improvement of service availability such as health centres or improvement of health as another key social indicator. Access to health facilities were identified according to 87.5% of the target population to have been good before project inception and this has not changed (Figure 4.1). As discussed earlier, the project had not improved the condition of the roads and this could attribute to the no change of the above condition (Figure 4.1). According to KI 1, the health clinics are not located far hence most people walk to the facility or use motorcycles on the bad roads. Green & Unruh (2010), Spalding-Fecher et al., (2012) and Smith & Scheer (2002) in their research, observed that none of the PDDs they analysed had identified access to health facilities as a contribution of the AR CDM project. This was also the case in the Kamae-Kipipiri PDD, despite this being a social concern for the community. The road condition had not improved, there in turn it did not influence increase in mode of transport hence access to the health center remained the same. They accessed them through walking or use of motorcycles.

The UNFCCC (2012) also identifies professional training of unskilled labour as an indicator to sustainable social development, as this knowledge can be handed down and thus would aid in improving the lives of communities for generations to come. Data analysis identified that 65% of the respondents had received professional training on management of tree seed nurseries and replanting prior to the project (Figure 4.1). The project however, was able to improve on their prior knowledge, as 80% of the respondents (Figure 4.2) claimed to have professional know-how of tree planting, seedling and nursery management. Prior knowledge was attributed to previous organisations who had offered training sessions to members of the community (source: KI 3). The data presented was further supported by
KI 1 who said that, members of the community become more aware on processes and knowledge that lead to successful tree planting. This was done through training sessions offered by the Green Belt Movement to interested CFA members. The results obtained above are similar to those observed in Ecuador under the PROFAFOR AR CDM project as researched by Smith & Scheer (2002), where the project activities have provided the local communities with capacity building in nursery and plantation management. This has seen the community have 26 nurseries which had produced 20 million seedlings as of 2001. Spalding-Fecher et al., (2012) noted that less than 40% of the AR CDM PDDs they reviewed, included training or strengthening of local capacities as a social benefit.

Carney (1998) described education as a human capital necessary for sustainable livelihoods under the AR CDM. According to data assessment, education among the respondents improved from 27.5% to 35% (Figure 4.2). This was assessed by the knowledge acquired by the community through sessions offered by the Green Belt Movement. They were made aware about climate change, forests and forestry management, about the AR CDM and from lessons about how to be energy efficient through use of energy saving jikos (Source: KI 1). In addition to this, KI 2 agreed that the community had become more knowledgeable on matters of reforestation and proper forest management. The Kamae-Kipipiri PDD did not mention education or information awareness as a social contribution, and it was also not evident in other PDDs as reviewed by Green & Unruh (2010). The UNFCCC have identified that promotion of education is a social indicator of sustainable development which has been observed above.

4.3.3 Additional socio-economic impacts, not mentioned in the PDD

Other socio-economic benefits were identified that had not been mentioned in the PDD of Kamae-Kipipiri.
a) Technology Transfer

Technology transfer has been defined by the IPCC to mean a broad set of processes covering the flow of know-how, experience and equipment for mitigating and adapting to climate change amongst different stakeholders such as governments, private-sector entities, financial institutions, non-governmental organisations, research/educational facilities.

The Green Belt Movement organisation (Green Belt Movement, 2009) had identified the area as that with low technological knowledge on seedling preparation and raising. Figure 4.2 shows that 80% of the respondents were in agreement of acquiring new skills during project implementation, which has been identified as a positive impact as well on Table 4.1 under technological self-reliance (+2). In addition to above, KI 1 one had the following to say:

‘‘The community through training, were able to learn how to grow their own tree seedlings and plant them more successfully. Parallel programs and training on building energy saving jikos and use of alternative sources of energy, also were conducted in the different areas. The members of community who helped the Green Belt Movement staff during the mapping of the project were also taught how to use GPS machines.’’(November 4th, 2015)

Key informant two (KI 2) had the following to say on the same:

‘‘On evaluation of the area, it is clear that the community were able to adopt some form of new technology. This is in reference to the energy saving jikos that are evident in the area.’’(November 12th, 2015)

The views from KI 1 and KI 2 indicate that there was some of technology transfer obtained during project implementation. The finding above can further be supported by Green & Unruh (2010) on their research of 14 AR CDM projects, that identified technology transfer as one of the attained positive impacts of AR CDM. The same was also observed by Smith
& Scheer (2002) in the Scolol-te AR CDM Project in Mexico, where farmers were taught how to develop energy saving stoves for their own use hence technology transfer. This has further been supported by the results from the SSN matrix tool that agrees that technology transfer has had a major positive impact (+2) on the livelihoods of the community.

According to the UNFCCC (2012), CIFOR (2000) and Spalding-Fecher et al., (2012), AR CDM projects have the potential for technology transfer such as above if implemented well. For instance, the UNFCCC (2012) analysed data from 3949 projects that had been registered and undergoing registration, as of June 2012, under the CDM. Data was collected from PDDs of these projects and from survey responses. Technological transfer was identified as a potential positive benefit in 198 PDDs and from the survey responses, 87% of the 198 projects had experienced this benefit. The UNFCCC also observed that only 30% of the registered AR CDM projects as of June 2012, had identified technological transfer as a potential positive benefit in their PDD. Therefore, the above finding can be used as an additional source of information in regards to technology transfer as an actual impact of AR CDM projects.

b) Income from Sale of energy saving jikos

According to the Green Belt Movement (Green Belt Movement, 2009), Kamae-Kipipiri had hardly any income generating activities. The SSN matrix tool (Table 4.1) however, revealed that income generating opportunities had been achieved from this project and it has had a major positive impact on community livelihood (+2), especially to the women and youth. The income generating activities included sale of honey, sale of seedlings from their nurseries (Table 4.2) and sale of jikos. According to KI 1, the Green Belt Movement taught the community especially the women, on constructing energy saving jikos which they could sell and earn additional income. This has enabled the community members engaged in this endeavour to become entrepreneurs (Source: KI 2). This finding supports the UNFCCC (2012) report, that identified the stimulation of local economy through direct or indirect job creation as an
economic SD indicator. In Nigeria, the UNFCCC (2010) observed the same, whereby the community and especially the young adults were trained in stove assembly which they used as extra source of income from its distribution.

c) **Formation of new community institutions**

The new community institutions here refer to an informal investment group which the community refer to as chamas. The economic benefits that the women and youth have accrued led them to form chamas, which enabled them to save their earnings and manage their financial resources in a more organised manner (Source: KI 2 & KI 3). The SSN matrix tool supports this finding as illustrated in Table 4.1 under human and institutional capacity, that the formation of these new institutions has had a major positive (+2) impact through empowerment of community members. Among other factors such as education and acquisition of new skills, formation of chamas attributed to what 85% of the respondents (Figure 4.4) agreed to be empowerment of women and youth. The UNFCCC SD indicator identified access to community institutions, as economic development indicators, as it encouraged community savings and provided an opportunity for local investment, hence we can conclude that the above result is a positive contribution towards community livelihood. The above contribution has also been observed in Bangladesh where successful implementation of the AR CDM has seen formation of women cooperative associations being developed, and has seen them from just managing tree nurseries to being able to afford good health care and educational facilities (CIFOR, 2000).

d) **Loss of feeding grounds and source of fodder**

According to research done by the Green Belt Movement to determine whether Kamae-Kipipiri was suitable for the AR CDM project, they discovered that the site had been a grassland since 1987, and the existing land use of the site was grassland with removal of fodder (Green Belt Movement, 2009). KI 1 confirmed that the community previously used the site
as a feeding ground for their animals and they used the grass for fodder. On project implementation, the Kamae-Kipipiri PDD identified that the site could no longer be used as grazing grounds, as this was a set up rule under the AR CDM (Green Belt Movement, 2009). Therefore, the AR CDM project interfered with their livelihood. A similar observation was made in the AR CDM project of North West Sichuan, China where the degraded land had been a wasteland since the year 2000, hence the farmers used the area for grazing (Green & Unruh, 2010). Implementation of the AR CDM project in this area impacted on their livelihood.

A correlation analysis between the AR CDM project and the research indicators, i.e socio-economic, was performed to further enrich the information gathered above in relation to socio-economic impacts of the AR CDM project. Using the described indicators on Figures 4.1 and 4.2, the following results were obtained.

**Table 4.3:** Spearman’s correlation results between the AR CDM project and Socio-Economic indicator variables:

<table>
<thead>
<tr>
<th>Socio-Economic Indicators</th>
<th>Pre-CDM (X in %)</th>
<th>Post-CDM (Y in %)</th>
<th>Rank (xRa)</th>
<th>Rank (yRa)</th>
<th>D (=x-y)</th>
<th>D²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roads</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Health Facilities</td>
<td>87.5</td>
<td>87.5</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Professional skills</td>
<td>65</td>
<td>80</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Education</td>
<td>27.5</td>
<td>35</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$\sum d^2 = 0$</td>
</tr>
</tbody>
</table>

R or $\rho = \text{Covariance/XRa St. Dev} \times \text{YRa St. Dev}$
Where:

\[ X_{Ra} = \text{Ranks of } X \text{ value} \]
\[ Y_{Ra} = \text{Ranks of } Y \text{ value} \]

\[ X_{Ra} - M_x = X \text{ ranks minus Mean of } X \text{ ranks} \]
\[ Y_{Ra} - M_y = Y \text{ ranks minus Mean of } Y \text{ ranks} \]

Sum Diff. = \((X_{Ra} - M_x) \times (Y_{Ra} - M_y)\)

\[ r_s = 1 - \frac{6\sum D^2}{N^3-N} \]

Results

**X Ranks**

Mean: 2.5
Standard Dev: 1.29

**Y Ranks**

Mean: 2.5
Standard Dev: 1.29

**Combined**

Covariance = 5 / 3 = 1.67

\[ R = \frac{1.67}{(1.29 \times 1.29)} = 1 \]

\[ \rho \text{ two-tailed value} = 0 \]

The results on table 4.3 imply that the correlation between the two variables, i.e. the AR CDM project and socio-economic impacts, would be considered to have a high positive correlation as \( R = 1 \). This is to mean that the AR CDM project has had a positive influence on the socio-economic aspects of the community, and this answers the first research question of the study.
The P value of 0, which is less than the default significance level of <0.05, implies that the two variables could be considered to be statistically significant. This agrees with findings as shown on Table 4.1, which presents results from the SSN matrix tool, as well as results from the respondents as displayed on Table 4.2 and Figure 4.2 under socio-economic impacts. This information further justifies research conducted by Green Belt Movement (2009) and UNFCCC (2012) in regards to the potential the AR CDM project can have towards socio-economic development.

Therefore, one can conclude that the AR CDM project has improved the socio-economic status of the Kamae-Kipipiri community. Limitation of available literature on the actual socio-economic benefits of AR CDM projects proved to be a barrier for a more detailed analysis on how livelihoods have been affected by the presence of AR CDM projects within the communities. For instance, Green & Unruh (2010) confirmed that there is no publicly available published data that document the socio-economic impacts of the Humbo Assisted Natural Regeneration project in Ethiopia which is one of the biggest AR CDM project in Africa, which could have offered a good platform for comparison analysis.

4.4 Effect of the AR CDM project on the environment

Environmental impacts directly affect community livelihood as it is from nature, where they are able to gather resources for their everyday needs. This is what Carney (1998) described as natural capital relevant for sustainable community livelihoods. The communities living within and surrounding the Aberdare forest rely mostly on the services provided by Aberdare forest to sustain their livelihood. This section therefore seeks to understand how the AR CDM project, through its reforestation activities have affected the forest and its services to the community hence their livelihood. From the SSN matrix tool used, indicators observed included water quantity, soil fertility, biodiversity and indoor air quality.
4.4.1 Community analysis on impact on local environment

The perception of the CFA members on the contribution of AR CDM towards promoting positive community livelihood, using the listed indicators was analysed using MS Excel and presented in Figure 4.2 and Figure 4.3.

It was however, important for the study to first investigate the conditions of the environmental indicators before the project was implemented so as to fully grasp the magnitude of the impact of the project. The results are illustrated in Figure 4.2 and Figure 4.3 which present information gathered in reference to the stated environmental indicators, before and after project implementation. The results shown in Figure 4.3 imply that the project either improved the indicator assessed or there was no significant improvement compared to previous observations shown on Figure 4.2.

Figure 4.2: Status of Environmental Indicators pre AR CDM implementation

According to Environmental Management and Co-ordination Regulations (2009), indoor air is described as air within an enclosed space, such as in dwelling or public building. In relation to this study, indoor air quality is dependent on the freshness of air inhaled and the visibility one has while in the house. This was determined by the presence of smoke in the
house and the ability to breathe easily. Indoor air quality before the project, was described to have been good by 82.5% of the respondents as shown on Figure 4.2. This was attributed to use of alternative methods of cooking such as cook stoves and use of biogas as introduced by previous NGO’s in the area who had carried out projects relating to effective energy use (Source: KI 2). Indoor air quality was observed to have had a slight improvement according to 15% of the respondents. The finding agrees with those observed in the SSN matrix tool which identify this change as a minor positive (+1) change. This could be attributed as discussed earlier, to use of alternative cooking methods such as use of energy saving jikos as provided for by the Green Belt Movement rather than use of firewood.

The positive change identified above has also been observed in Nigeria where there was reduction of smoke production due to introduction of cook stoves into the project hence improved air quality (UNFCCC, 2010). This result can be used to justify what Spalding-Fecher et al., (2012) and UNFCCC (2012) noted in their research, that AR CDM projects have the potential to contribute positively towards improving the quality of air.

![Figure 4.3: Status of Environmental indicators post AR CDM implementation](image)

There was an improvement on the quantity of water available to the community, as agreed by 35% of the respondents shown on Figure 4.3. This was assessed by measuring the number of
people who had access to water in comparison to numbers prior to project implementation. The observations made by 35% of the respondents could be attributed to decreased surface run off due to tree plantation, which hold the soil much better, thus allowing for more water to be absorbed into the ground. This finding could be used to justify a report by Spalding-Fecher et al., (2012), where they identified that majority of the PDDs they were analysing on potential impacts of AR CDM projects on water availability and quality, had an 80% probability of being achieved. Smith & Scheer (2002) and Green & Unruh (2010) also agreed with the above report that improvement of water quality and availability to be one of the key potential benefits of AR CDM. This result however, contradict with findings from the SEA results in the PDD which indicated a potential decrease in water quantity due to tree plantation as trees take up more water than grass (Green Belt Movement, 2009). The findings as shown in Figure 4.3 on availability of water can be used as evidence of actual impact of AR CDM on water quantity, hence considered a positive contribution. The low numbers shown above could also be attributed to the fact that improvement of the water quality and quantity is rather a very long term development benefit, which should increase gradually with growth of the forest. This could explain the response given by 65% of the respondents on Figure 4.3.

For purposes of this study, the measurements for analysing soil condition were borrowed from the SSN matrix tool, where erosion and the extent of land use change were used as the units of measurements. Data analysis as presented in Figure 4.3, shows that 25% of the respondents agree that the soil conditions have improved, and the SSN matrix agrees with this finding and grades it as a minor positive change (+1). The finding can be attributed to increase of ground cover due to tree plantation which aid to reduce soil erosion, and also through the reforestation efforts that have aided in conversion of land from grassland to a rehabilitated forest thus less soil disturbance from the cattle. The UNFCCC (2012), Green & Unruh (2010) and Smith & Scheer (2002) identified soil improvement as a potential benefit of the AR CDM which has been confirmed as above. To further support this, KI 1 said:
'The reforestation activities in the area have encouraged natural regeneration of the forest. This in turn has led to increased discharge of water in the rivers, has helped in undercover regeneration, there has been an improvement of air quality in the area and we can also claim that we are contributing to global reduction of emissions. The tree cover that the young trees provide, and from leaf fall also aided in improvement of the soil.' (November 4\textsuperscript{th}, 2018)

The desktop analysis conducted was unable to provide a case study where soil improvement had been identified as an actual positive impact, however, it was able to highlight where it was identified as a potential impact. This was in the PDDs of TISST Tamil Nadu project in India and the AR CDM project in Albania (Green & Unruh, 2010), where the community noted a significant improvement of the condition of the soil through increased crop productivity. Therefore, one can safely conclude that there is a possibility AR CDM projects can improve soil conditions as observed in Aberdare.

The impact on biodiversity in relation to this study was assessed on a qualitative basis through consideration of any destruction or alteration of natural habitat, compared to that without project scenario. The results from analysis of the questionnaires revealed that 50% of the respondents agreed that there had been a positive change in the biodiversity of both flora and fauna, and the other 50% had not seen any change (Fig. 4.5). The positive change was attributed to an observation by the respondents on increase in bird population and butterflies however, they were not sure if these were all indigenous species of that forest. The uncertainty of the respondents on the species of butterflies and birds provides for both a positive and negative impact because new species would qualify as a negative impact but former species qualify as a positive impact. The new species support the finding from the SSN matrix tool on Table 4.1 that show impact on biodiversity as a minor negative (-1),
indicating the disappearance or introduction of foreign species, herein the birds and butterflies. The finding is further supported by KI 3 who said:

‘‘The expectations that were given to the communities and what we are actually experiencing are different. Some of the things the forest provided before have actually improved, such as more tree cover. However, the trees that were planted, some seem to be dying and others are of no value to us. They do not bear fruit or medicine like the indigenous species and the leaves fall so often that the ground is covered in leaves other than grass in some areas. Other areas have experienced decreased water quantity because the trees that were planted take up more water than they should retain.’’(November 16th, 2015)

The observation by KI 3 indicates that there were foreign tree species incorporated into the project. This is further supported by Jindal et al., (2008) on their research on Africa’s carbon projects, where they noted that exotic tree species threatened local biodiversity and destroyed native species. For instance, they noted that forest areas that were rehabilitated with pine and eucalyptus did not support undergrowth, hence no other plants could co-exist with them. They also noted that eucalyptus trees interfered with availability of water downstream which could explain the observation by KI 3. This also agrees with the Green Belt Movement (2011) report which stated that plantation of exotic trees on a degraded forest that requires its unique indigenous trees, brings forth negative impacts towards biodiversity. The information above further supports the observations made in the Chichina river basin AR CDM project in Columbia where the natural degraded forest was cleared and plantations were cultivated which led to loss of the previous original plant and animal species (Green & Unruh, 2010). The data collected above however, differs from that stated in the Kamae-Kipipiri PDD that states that they would only plant indigenous trees in the area to allow for forest regeneration and improvement on biodiversity (Green Belt Movement, 2009). The Green Belt Movement had
identified that the pressures to collect carbon credits and the rules of all CDM projects as indicated by the UNFCCC to offset GHGs, could foster growth of exotic trees as they are fast growing (Green Belt Movement, 2011). If this is the case, it could explain the negative observations made by 50% of the respondents in regards to biodiversity (Figure 4.4).

To add on to the information above, data collected was assessed using Spearman’s rho correlation between the AR CDM project and the environmental indicators, and results presented in Table 4.4.

**Table 4.4** Spearman’s correlation results between the AR CDM project and environmental indicator variables:

<table>
<thead>
<tr>
<th>Environmental Indicators</th>
<th>Pre-CDM (X in %)</th>
<th>Post-CDM (Y in %)</th>
<th>Rank (x_{Ra})</th>
<th>Rank (y_{Ra})</th>
<th>D (=x-y)</th>
<th>D^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indoor air quality</td>
<td>82.5</td>
<td>15</td>
<td>1</td>
<td>4</td>
<td>-3</td>
<td>9</td>
</tr>
<tr>
<td>Water availability</td>
<td>25</td>
<td>35</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Soil Condition</td>
<td>5</td>
<td>25</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>20</td>
<td>50</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

\[ \Sigma d^2 = 14 \]

R or \( \rho \) = Covariance/X_{Ra} St. Dev \( \times \) Y_{Ra} St. Dev

Where:

\( X_{Ra} = \) Ranks of X value \( Y_{Ra} = \) Ranks of Y value

\( X_{Ra} - M_x = \) X ranks minus Mean of X ranks

\( Y_{Ra} - M_y = \) Y ranks minus Mean of Y ranks
Sum Diff. = \((X_{Ra} - M_x) \times (Y_{Ra} - M_y)\)

Where \(r_s = 1 - \frac{6\sum D^2}{N(N-1)}\)

Results

**X Ranks**

Mean: 2.5
Standard Dev: 1.29

**Y Ranks**

Mean: 2.5
Standard Dev: 1.29

**Combined**

Covariance = \(-\frac{2}{3} = -0.67\)

\(R = \frac{-0.67}{(1.29 * 1.29)} = -0.4\)

\(\rho\) (two-tailed value) = 0.6

The above results indicate that the two variables, i.e. the AR CDM project and impact on the environment have a low negative correlation, as \(R = -0.4\). This implies that the AR CDM project had a low negative impact towards the environment. This result differs slightly with the findings shown in Figure 4.3, where three out of four of the indicators measured showed a slight improvement while there was a negative impact on biodiversity. This could be due to the fact that the correlation subjected all the indicators at once for assessment rather than individually as in the SSN matrix tool and Figure 4.3. The results however, were found to be acceptable because the AR CDM project being a reforestation project, was expected to perform better in terms of improving the biodiversity. Furthermore, according to the Kamae-Kipipiri PDD, the
main purpose of the reforestation project was to restore the natural forest ecosystem and its biodiversity, including planting of indigenous trees. This was not the case observed.

The results do support findings from most research from Subbarao & Lloyd (2010), Jindal et al., (2008), Jopp (2007), Franziska & Heiner (2007), Kamae-Kipipiri PDD among others, who suggested that most PDDs have had minimal environmental benefits identified compared to the socio-economic benefits. Pearson (2006) highlighted that CDM projects have lost focus of sustainable development benefits, and have only focused on the carbon credits aspect which only aids in the socio-economic development of a community. He further noted that there was no surprise that the environment was still degrading due to the negative impacts experienced in most projects. Olsen & Fenham (2008) on their research also noted that the structure of CDM projects fail to penalise implementing organisations on negative impacts accrued outside project boundary. This in turn undermines the goal of climate protection and holistic sustainable development.

From the results on Table 4.4, the significance level of $\rho = 0.6$, is above the default level of $\rho = <0.05$ which suggests that by normal standards, the association between the two variables cannot be considered to be statistically significant. This could imply that the AR CDM project has little or no impact towards improving the environmental status, which is important for improvement of community livelihoods. On the other hand, the significance level of $\rho =0.6$ could also suggest that these results are only applicable to Kamae-Kipipiri, with a low chance of being replicated in other AR CDM project sites.

4.5 Effect of the AR CDM project on women and youth empowerment

For this study, this was done through evaluation of the projects contribution towards improving the access of women and youth to community institutions, their involvement in the decision-making process in regards to the project and as well as their participation in community institutions.
4.5.1 Community Perspective on women and youth empowerment

One of the factors that was used to determine the empowerment of women in this study, was their involvement in the decision-making process in all stages of the AR CDM project. Figure 4.4 shows that 58% of the respondents identified that women and youth were not actively involved in the decision-making process of the AR CDM project. From previous discussions with the key informants, KI 2 highlighted that in North Kinangop, men were the decision makers in relation to this project and this supports the finding shown in figure 4.4.

![Pie chart showing 42% Yes and 58% No]

**Figure 4.4:** Analysis of women and youth and their involvement in decision making

This result however, does not conclude that women and youth were not completely excluded from the decision-making process, only that the men were much more engaged. A report by the UNFCCC (2010) provides information on a project in Nigeria where the community and especially the youth were empowered through being involved in the decision-making process at the community level and through education and training. They had been able to form groups in which they ran their financial affairs through. This is evidence that women and youth can actively make decisions and positively impact the community.
The second indicator that was used in this study to determine empowerment among the women and youth was the improved access to community institutions’. The SSN matrix tool results indicated that the community were empowered through formation and participation in the *chamas* (and this was because, it was assessing the overall community and their access to local institutions and participation as presented in Table 4.1, under human and institutional capacity indicator). The results were not specific to women and youth. A research study by CIFOR (2000) in Ecuador identified an AR CDM project where the community was empowered after developing small community groups and being equipped with management skills to enable them to manage their nurseries better. This agrees with the data on Figure 4.5 where women and youth have been empowered by having access to *chamas* and improving their skills through the training they acquired as illustrated in table 4.1. In Bangladesh, the women were able to form cooperative associations which led to strengthening of community institutions, and this has been identified as a measurement for empowerment (CIFOR, 2000). The above examples do show women and youth empowerment through involvement in community institutions is possible, and it further supports the results presented above.

Spalding-Fecher *et al.*, (2012) in their research observed that only 40% of the AR CDM projects that had been registered as of the year 2011, had identified improvement on human and institutional capacity as a positive contribution in the PDD. It is important to note that empowerment falls under this indicator. Green & Unruh (2010) in assessing 14 AR CDM PDDs, identified only 6 projects that had included strengthening of human and institutional capacities as a potential positive contribution of the project. They could not find actual documented information on where the potential impacts were actualised. This shows there is need for AR CDM projects to include empowerment as part of their contribution to the community as these projects directly impact their livelihood.
A report by UNFCCC (2012) describes the empowerment of women to include the enhancement of their position in society. The position of women here refers to gender equality. The study therefore assessed how the project had impacted on the education, skills and livelihoods of women so as to enrich the information above in regards to women empowerment. From data analysis, Figure 4.5 shows that 85% of the respondents agreed that women had become more empowered as a result of the AR CDM project. This could be attributed to the improvement on their financial status as seen earlier in the chapter, and also through the education and training they have received during the project cycle that has enabled them to be more aware about the welfare of the community and forest. The project impacted skills such as construction of energy saving *jikos* which enabled them to earn extra income, encouraging the formation of *chamas*. Women also began to engage in activities such as weaving and spinning as identified by KI 2, which led to further financial improvement from sale of these products.

**Figure 4.5:** Community insight on women empowerment

The above are an indication of improvement of the livelihoods of these women of Kamae-Kipipiri. The education and training offered to the community is an indication of gender
equality and hence can conclude that the position of women within the society improved, as indicated on Figure 4.5.

According to the UNFCCC (2012), 5% of the total 3,864 CDM projects that had been registered as of June 2012, mentioned specifically the empowerment of women and their position in their PDD. More alarming is that none of the AR CDM project PDDs they analysed had mentioned empowerment of women as a potential positive contribution. To add to this, Spalding-Fecher et al., (2012) in their research also noted that none of the AR CDM PDDs they analysed mentioned empowerment of women as a benefit of the project. The research available focused on strengthening of human and institutional capacity and did not provide specifically for women and their position.

This information clearly identifies a gap in AR CDM projects contributing towards empowerment of women and youth in any society they are implemented in.

4.5.2 Key informant’s perspective on women and youth empowerment

Information analysed from key informants was found to be of importance in regards to this subject matter, as it would enrich the data collected from the respondents. On matters women and youth participation, KI 1 had the following to say:

‘‘The women and the elderly from the two project sites were more involved in the project from its inception to implementation, as they have a higher affinity for projects. They were involved in the trainings we held, the seedling planting process up to the transplanting stages. The youth in the area are very few. Most have relocated to the urban centres. Others who are still within the villages are mostly not engaged in farming and forest activities, hence not many were interested in the project. We found this to be alarming and we recognized a gap where there is need to package programs in a way that will engage the youth.’’ (November4th, 2015)
The study could not conclusively identify the reason as to the absence of youth in the area though the generalised idea was that it was because of preference for white collar jobs. KI 2 had the following to contribute in regards to the above discussion:

‘‘In North Kinangop, we are fortunate to have more youth than elderly people in the area. They did take up an active role in matters related to the project and are still involved in socio-economic activities such as bee-keeping, planting tree nurseries and even weaving and spinning. In regards to women, they also participated in the project since inception.’’(November 12th, 2015)

KI 3 had the following to say:

‘‘Women were more involved in the project activities than the men and they still are involved in forest management activities, as the project seems to have come to a halt in terms of donor presence and contributions. There are not many youths in this area of South Kinangop as they have migrated to urban centres to seek other opportunities.’’(November 16th, 2015)

The above analysis shows that the project was inclusive of women, men and youth from its introduction in the area to its implementation. This agrees with the information provided in the Kamae-Kipipiri PDD (Green Belt Movement, 2009), which proposes to include all community members during all stages of the project. Important to note however, is the observed decrease in the number of youth in the area. The key informants suggested that most of the youth have migrated for purposes of searching for job opportunities, and those who have remained are more active in North Kinangop than in South Kinangop. How this impacts the AR CDM project is an area for further research. In regards to empowerment using the above-mentioned indicators, KI 3 contributed the following:
‘The women and the few youth have been able to earn income from sale of jikos and tree seedlings, this has enabled us to form groups (chamas) that engage in Table banking. The youth have also been collecting deadwood from the forest and sell it for firewood which has enabled conservation of the forest and they have as well joined some of the chamas in the area.’(November 16th, 2015)

KI 2 further contributed to this by saying:

‘‘Women benefited from the project as they were able to develop chamas among themselves, they have engaged in other agro-forestry activities that have made them become really good entrepreneurs. I would also like to add that the men were as equally engaged in the project in this area as the women and youth. However, this area is still a bit more traditional, therefore men were more actively involved in the decisions that were going to affect the forest.’’(November 12th, 2015)

The above information clearly shows that the project allowed for youth and women empowerment in regards to access to community institutions such as the above mentioned chamas. The inclusion of women and youth during the whole project cycle however, does not necessarily mean that women and youth were fully involved in the decision-making process. KI 3 was the only informant who spoke freely about this matter and highlighted that some rural communities still hold men as the primary decision makers of matters affecting the livelihood of the family and hence the community.

The information above also identifies the presence of elderly members in the community being engaged in project activities. This indicates that the elderly are interested in the welfare of the forest and community and are willing to adopt to new ideas such as the AR CDM project, to allow for community development.
4.6 Challenges and Recommendations suggested by the community, regarding AR CDM project.

The key informants were found to have adverse knowledge on the project and were involved in all phases of the project hence their relevance in gathering this information. The information will provide a learning opportunity on practises to adapt and which can be further improved, if the project is to be replicated on other sites or similar forestry projects such as the REDD+ are to be set up nationally or even regionally.

4.6.1 Challenges experienced during AR CDM project implementation

Through face to face and telephone interviews with key informants, the following information was obtained.

- The procedure for AR CDM projects to be approved by the CDM board and implemented was rigorous, expensive and unrealistic for Kenya. This is also similar to observations made by Chokkalingam (2004) in Asian AR CDM projects and by Subbarao & Lloyd (2008) on their case study projects in different regions of the world.

- The project process and language used was too technical for the community and even to the technical staff to understand. Most of the target population are semi-illiterate hence understand basic English, Swahili and their mother-tongue. Hoch (2012) noted that the design principles of CDM projects have been found to be complex, creating a dependence for highly specialized experts to be included during project design and implementation.

- Most of the areas have very few youth members and many elderly people, hence was challenging to carry out the labour-intensive aspects of the project such as helping to map out the area using GPS equipment.

- It was difficult to control grazing practices. In that, reforestation in the area prohibited grazing within the project site. This meant a likelihood of grazing increasing on another
site hence, a higher chance of overgrazing, and even forest destruction in another area of the forest.

- The funds for the project were not sufficient to run the project. This affected the implementation of activities and facilitation of community meetings, according to KI 3. Some of the community members therefore lost morale and stopped paying attention to the reforestation activities under AR CDM and focused on other new projects that were coming up in the area. This will affect sustainability of the project. The development of AR CDM projects require substantial upfront investments (Jopp, 2007), as the investment determines how well a project is implemented (Spalding et al., 2012).

- There was also a poor relationship between the CFA members and the Kenya Forest Service (KFS) staff during the project period. This proved a challenge to the community in their access to the forest which is monitored by the KFS, to perform their duties.
5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of research findings

The Afforestation Reforestation Clean Development Mechanism (AR CDM) project has had a positive effect on the socio-economic status of the community. Most benefits that have been obtained by the community have surpassed those that had been identified in the PDD.

Common effects to those in the PDD and realized by the community include paid labour for transplanting trees, income from sale of tree seedlings and increased supply of deadwood. Bee-keeping was not commonly practised, however, those who did it were able to earn income from sale of honey. The trainings on construction of energy saving jikos and how to use them were an added advantage from the project, which enabled them to earn income from sale of the jikos to other communities. The communities had expectations that their most important social amenities would be improved but this was not the case in all of them. The same number of people still used previous means and resources to access health facilities and schools and the condition of roads did not change. However, there was a slight improvement in terms of professional skills acquired and those who had access to education, through the teaching sessions Green Belt Movement offered improved, hence improving their knowledge.

The project had additional positive impact towards socio-economic development of the community such as technology transfer due to the skills acquired in constructing energy jikos and from lessons on how to use of GPS equipment. Another additional impact was the formation of community institutions such as the chamas, which contributed towards women empowerment. A negative effect that was highlighted and experienced was mismanaged expectations towards the community on the outcomes the project was expected to provide.
The results obtained expressed a divided impact regarding contributions the AR CDM project provided on the local environment. The negative impact on biodiversity suggested that the project proposal activities were not implemented as suggested in the PDD. The results highlighted plantation of mixed tree species, i.e. both indigenous and exotic in the forest and this was affecting the regeneration of the flora and fauna indigenous to the forest. It was as well affecting the previous fruit and medicinal resources that the community used to receive. Other negative effects experienced included loss of feeding grounds and source of fodder since implementation meant cattle being denied access to the site.

However, positive effects were also observed in the area. Indoor air quality improved the most and this was due to the introduction of use of energy saving *jikos*, which produced less smoke in the house compared to the firewood they previously used. Soil conditions improved as well as there was less surface run off due to tree plantation. The condition of the soil is assumed to improve in the long term as the forest regenerates to maturity. Water availability improved slightly as well, indicating that the tree planting process is influencing the water flow in the area.

Most of the youth in South and North Kinangop have relocated to urban centres in search of better opportunities. The available youth in both regions actively participated in the project activities and are engaged in business ventures of their own and have even joined *chamas*. The women were actively engaged in the project activities as well, they have become economically empowered as they have their own small business and have formed *chamas*. The results however, showed that the women and youth were not highly involved in the decision-making process of the project. The area proved to be still traditional therefore the men were mostly involved in the decision-making process. The status of the women, that is their social and financial standing within the community was noted to have improved as well.
This could be attributed to their economic empowerment and inclusion into the project activities.

5.2 Conclusions

It is evident that the AR CDM project has positively contributed to the socio-economic development of the community in the area. Contributions towards economic empowerment on women and youth, human and institutional capacity, employment numbers, access to energy services and technological self-reliance were impacted positively, concluding that the livelihoods of the communities of Kamae-Kipipiri area on the socio-economic aspect were impacted positively. More could have been done on improving the transportation facilities and health services, however, they were not proposed as a development agenda in the PDD. The Green Belt Movement did well on including the community as part of project implementation however, more can be done on including the community during the planning stages as well if the community is to better associate with the project and understand their obligations. The expectations given to the community were high and without fulfilling these expectations, the forest activities that the communities were meant to undertake, such as seedling transplanting and management of the young trees are being ignored. Most of this has been attributed to lack of financial resources to compensate the community for their efforts.

Secondly, the project was not as successful on its reforestation activities as indicated in the PDD. In relation to impact on the local environment, all the data analysed concludes that the AR CDM project has had minimal positive contribution towards improving the local environment, which is vital for sustaining the local livelihoods of the Kamae-Kipipiri community. It is also important to note that from data analysis (Table 4.1; Figure 4.4), the Kamae-Kipipiri project can be concluded to have failed in fulfilling its main obligation to the community, which was to improve the biodiversity of the area.
The environmental services that the community relied on previously that were provided by the forest such as medicinal plants, good rainfall, increased yields of grass and flow of streams have yet to be met. These effects may be experienced in the long term if the project is well maintained. The AR CDM project failed on its main purpose of restoring the natural biodiversity of the area. The biodiversity of the forest has been altered with the introduction of foreign species and it led to negative effects being experienced in the area. Such a case was observed in South Kinangop where some trees planted could not withstand the climatic conditions hence are dying and proving to be of no value to the community or the environment. Considering the project is based on reforestation activities, it is unfortunate that the observed impact on local environment was minimal. Indoor air quality, soil conditions and water availability improved in the area, and there is a likelihood, that these conditions will continue to improve should the project be sustained.

Thirdly, on youth and women empowerment, they were engaged in the project activities where they were empowered through improvement of access and participation in community institutions. The position of women within the society as well was uplifted as now through various economic activities, they could contribute financially to the family. This contributed towards gender equality.

The study identified the presence of elderly members in the community and their active engagement in the project. This situation was unique as it showed the capacity and desire elders have towards community development. The research also identified that the youth population has decreased in the region. This was observed to have been as a result of rural to urban migration. The effect of this on the project success is an area for further research. In relation to this objective, the conclusion that the project had a positive contribution towards the youth and women empowerment can be made.
5.3 Recommendations

The following recommendations were found to be appropriate in regards to this study and hopefully can be considered should another AR CDM project be implemented in the country.

1. There is need to restructure the language in which the AR CDM project is designed in as it is very scientific. It was a challenge understanding the full content of the project design document of Kamae-Kipipiri during the course of the study. This made interpretation difficult as much terminology and formulae used was complex, and required specialists. It needs to be simplified so that all relevant parties of the project can fully understand all what the project entails.

2. Trees grown the AR CDM project should plant trees that are indigenous to the area of implementation. If exotic trees are to be planted, a research should be conducted on the impact of exotic trees in that area so as avoid doing more harm than good. Exotic tree species were observed to have been planted in the project site.

3. Expectations of the community should be well managed to minimize loss of morale among community members. The community members were not looking forward to continuation of the project in the area, or the introduction of a similar one. It is important for projects to deliver their objectives as this can lead to genuine interest by communities which will then increase the chances of sustainability of the project.

4. Implementing organisations of AR CDM projects need to ensure that the communities understand the nature of the project they are implementing. They should clearly identify and explain to the community the benefits of the project and their obligations towards the project. Further, they should also be included in the project design so as to create a sense of ownership.

5. Proper planning and funding of the AR CDM needs to be taken into serious consideration. It was noted that the funds dispersed for the project were not enough and
this provided financial challenges to the Green Belt Movement during project implementation. The research revealed that they found the process to be expensive, very complex and non-specific to any region. For the project implementers, and the community lost morale as the project were not funding their tree seedling nurseries any more due to lack of funds.

6. The AR CDM project should encourage reforestation activities more and not use sale of carbon credits as a selling point to the communities, if we are to properly rehabilitate our forests, and uplift the community. The community if Kamae-Kipipiri were of the idea that the project was a business opportunity for them to sell of carbon credits and this had not been actualised. Proper reforestation will encourage proper forest regeneration and in turn will deliver the carbon credits. If not, there is an increased probability that indigenous forests and their biodiversity will disappear.

5.3.1 Recommendations by key informants, regarding AR CDM.

The key informants also shared their recommendations regarding this project, in the hope they could aid future organizations address issues they had identified. This would hopefully enrich their approach towards project implementation, hence increase chances of sustainability of their projects in the area. The recommendations included:

- The AR CDM program structures should be simplified and allowed to be flexible so that the implementing entity, can design the project in relation to a particular community. This would reduce the design costs of the project, and increase the success rate of the project as it would be designed to meet a particular community need.

- AR CDM projects in future should not interfere with the core business of the project which is conservation, and not reforestation with the purpose of accumulating carbon credits. This recommendation is similar to that of Pearson (2006), where he
highlights that without clear focus of the purpose of CDM projects, the environment will continue to degrade.

- The complex scientific language that the AR CDM project is designed in, should be simplified to eliminate the need of highly specialised experts, who are expensive to accommodate. The design should be simple enough for local experts to deduce and implement.

- The AR CDM project should improve on the benefits they aim to achieve towards the community. They should be direct benefits and acquired easily, other than the carbon credits the project intends to accumulate and sell after a long period of time.

In contribution of this research towards further studies, the following has been identified as a potential area of research.

- The AR CDM project is an internationally designed project meant to be implemented by developing countries. The rules, regulations and procedures are all developed at the UNFCCC. This in turn dictates how the project will be implemented. Does this therefore influence the outcomes of a project compared to if the AR CDM was designed locally? This is an area that could be explored through research.
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### Appendix A: Full Version of the SSN Matrix tool

<table>
<thead>
<tr>
<th>INDICATOR</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
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<td><strong>Local/regional/global environment</strong></td>
<td></td>
</tr>
<tr>
<td>GHG emissions</td>
<td>Net reduction of GHG emissions measured in CO2 equivalent.</td>
</tr>
<tr>
<td>Water quantity and quality</td>
<td>Water quantity will be measured with the number of people with access to water supply in comparison with the baseline. Water quality will be measured using concentration of main pollutants (including BOD and others) in any effluents generated by the project activity and their contribution, if any, to local water quality.</td>
</tr>
<tr>
<td>Local Air Quality</td>
<td>Air quality will be measured by comparing the concentration of most relevant air pollutants (e.g.: SOx, NOx, particulate matters etc.) generated by the project activity with the baseline.</td>
</tr>
<tr>
<td>Other Pollutants</td>
<td>This indicator is used to evaluate the contribution of the project activity to reducing the flow of pollutants not already considered to the environment, including solid, liquid and gaseous wastes (including, where relevant, toxicity, radioactivity, POPs, stratospheric ozone layer depleting gases).</td>
</tr>
<tr>
<td>Soil condition (quality and quantity)</td>
<td>Soil condition will be measured by comparing the concentration of most relevant soil pollutants, erosion and the extent of land use changes due to the project with the baseline.</td>
</tr>
<tr>
<td>Biodiversity (species and habitat conservation)</td>
<td>Change in biodiversity is estimated on a qualitative basis considering any destruction or alteration of natural habitat compared to the without projects scenario. A positive change will be given by previously disappeared species re-colonising the area, a negative change will be given by species disappearing or by introduction of foreign species. In judging this, inputs from local communities should be considered a key resource.</td>
</tr>
<tr>
<td><strong>Social sustainability and development:</strong></td>
<td></td>
</tr>
<tr>
<td>Employment (including job quality, fulfilment of labour standards)</td>
<td>This indicator is used to evaluate the qualitative value of employment, such as whether the jobs resulting from the project activity are highly or poorly qualified, temporary or permanent in comparison with BAU. Take temporary and permanent as qualifications for job quality.</td>
</tr>
<tr>
<td>Livelihoods of the Poor</td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Poverty alleviation</td>
<td>Poverty alleviation will be evaluated by calculating the change in number of people living above income poverty line compared to baseline.</td>
</tr>
<tr>
<td>Distributional Equity</td>
<td>This sub-indicator is used to evaluate contribution of the project to equal distribution of wealth and opportunity, in particular marginal or excluded social groups. The indicator combines quantitative – changes in estimated earned income (normalised to the project’s starting year) compared with the baseline – and qualitative assessment – improved opportunities.</td>
</tr>
<tr>
<td>Access to essential services</td>
<td>Access to water, health, education, access to facilities, etc. will be taken as an indicator of social sustainability, measured by the number of additional people gaining access in comparison with the baseline. Access must be directly related to the service and not a-spin off.</td>
</tr>
<tr>
<td>Access to Energy</td>
<td>The CDM and JI provide an important opportunity to improve the coverage of reliable and affordable clean energy services, especially to the poor and in rural areas. Where of a relevant scale, security of energy supply (an indicator of a country’s ability to generate the power that is needed for services and the economy in comparison with the baseline), should be taken into account.</td>
</tr>
<tr>
<td>Human and Institutional Capacity</td>
<td>This indicator is used to assess the project’s contribution to raising the capacity of local people and/or communities to participate actively in social and economic development. It comprises the indicative sub-indicators: Empowerment: The sub-indicator is used to evaluate the project’s contribution to improving the access of local people to and their participation in community institutions and decision-making processes. Education/skills: The sub-indicator is used to assess how the project activity enhances and/or requires improved and more widespread education and skills in the community. Gender equality: The sub-indicator is used to assess how the project activity requires or enhances improvement of the empowerment, education/skills and livelihoods of women in the community.</td>
</tr>
<tr>
<td>Economic and technological development</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Employment (numbers)</td>
<td>Net employment generation will be taken as an indication of economic sustainability measured by the number of additional jobs directly created by the CDM project in comparison with the baseline.</td>
</tr>
<tr>
<td>Balance of Payments (sustainability)</td>
<td>Net foreign currency savings may result through a reduction of, for example, fossil fuel imports as a result of CDM projects. Any impact this has on the balance of payments of the recipient country may be compared with the baseline.</td>
</tr>
<tr>
<td>Technological self-reliance (including replicability, hard currency liability, skills development, technology transfer)</td>
<td>As the amount of expenditure on technology changes between the host and foreign investors, a decrease of foreign currency investment may indicate an increase of technological sustainability. When CDM projects lead to a reduction of foreign expenditure via a greater contribution of domestically produced equipment, royalty payments and license fees, imported technical assistance should decrease in comparison with the baseline. Similarly, a reduced need for subsidies and external technical support indicates increased self-reliance and technology transfer.</td>
</tr>
</tbody>
</table>
Appendix B: Questionnaire

PART A

Kindly tick the appropriate answer

a) What were the conditions of the following in the area before and after the establishment of the project

<table>
<thead>
<tr>
<th></th>
<th>Before the Project</th>
<th>After the Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indoor Air Quality</td>
<td>Good</td>
<td>Bad</td>
</tr>
<tr>
<td></td>
<td>Don’t Know</td>
<td>Better</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Worse</td>
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<tr>
<td></td>
<td></td>
<td>Same</td>
</tr>
<tr>
<td>Water Quality</td>
<td>Good</td>
<td>Bad</td>
</tr>
<tr>
<td></td>
<td>Don’t Know</td>
<td>Better</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Worse</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Same</td>
</tr>
<tr>
<td>Water Availability</td>
<td>Good</td>
<td>Bad</td>
</tr>
<tr>
<td></td>
<td>Don’t Know</td>
<td>Better</td>
</tr>
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<td></td>
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<td>Worse</td>
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<tr>
<td></td>
<td></td>
<td>Same</td>
</tr>
<tr>
<td>Soil Quality</td>
<td>Good</td>
<td>Bad</td>
</tr>
<tr>
<td></td>
<td>Don’t Know</td>
<td>Better</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Worse</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Same</td>
</tr>
</tbody>
</table>

b) Did the community use trees from the project site as a source of firewood?

Yes [ ] No [ ] I do not know [ ]

c) Did the project affect the plants and animals that were occupying the forest?

Yes [ ] No [ ] I do not know [ ]

d) Was the effect on the plants and animals by the project positive (good) or negative (bad)?

Good [ ] Bad [ ] I do not know [ ]

e) Has the project improved the financial position of the women and the youth in the society since it began?

Yes [ ] No [ ] I do not know [ ]
f) Were the women and youth involved in making decisions directly affecting the project? Yes  No  I do not know

g) Has the community observed any new business/economic opportunities since the project began? Yes  No  I do not know

h) Did the project bring indigenous tree seedling to be planted? Yes  No  I do not know

i) Were other new species of trees introduced in the area that the community were not familiar with? Yes  No  I do not know

j) Did the project allow for more community members to access education facilities? Yes  No  I do not know

k) Did the project allow for more community members to access health facilities? Yes  No  I do not know

l) Did you earn extra money from sale of

   Honey  jikos  carbon credits  others

Please specify other ………………

m) would you be supportive of this project being extended? Yes  No
PART B

a) What employment opportunities existed before the project was established in the area

b) Which new job opportunities that have been created since the establishment of the project.

c) Has the project introduced any new technology to the community?

is it better than what they previously used?

is it better than what they previously used?

is it better than what they previously used?

is it better than what they previously used?

is it better than what they previously used?

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is it better than what they previously used?

is it better than what they previously used?

is it better than what they previously used?
i) After the project was implemented, did you observe any previous species of plants or animals that were in the area, reappear?

j) Did the reforestation process benefit the community in terms of resources you received from the forest………

if yes, what are some of the products and services you received………………

……………………………………

k) Are there any non-timber products that the community has benefited from since the project began? …………………

What are they?…………………………

l) would you say the project enabled the women to be empowered in relation to their finances and they social standing in society?
Appendix C: Interview Questions (Key Informants)

i. For what purposes did the community use the project site before it was established?

ii. What economic activities were introduced to the community after the project was established?

iii. What new technologies did the project introduce to the community?

iv. What sources of energy did the community use before and after the project?

v. Were the women and youth involved in making decisions that directly affected the project?

vi. Did the social position of women within the society elevate as a result of being involved in the project?

vii. Are there any non-timber products that the community has benefited from since the project began? What are they?

viii. Were there any challenges that you observed that the community experienced during project implementation?

ix. Are there any recommendations that you would suggest in relation to this project?

x. Did the reforestation process benefit the community in terms of resources they receive from the forest..........?

xi. If yes, what are some of the products and services they received?

xii. Would you say women and youth become more empowered as a result of this project?
Appendix D: Informed Consent Form

Consent for participation in interview research

I volunteer to participate in a research project conducted by Ms. Margaret W. Maina, a graduate student at Kenyatta University, Department of Environmental Studies (community development). I understand that the project is designed to gather information about academic work for her Master’s thesis.

1. I understand that my participation is voluntary. I understand I will not be paid for my participation.
2. I understand that the researcher will not identify me by name in any reports using information obtained from the interview, and that my confidentiality as a participant will remain secure.
3. I understand that the information I give will be of benefit for this research and will not be used for any other works.
4. I have read and understand the explanation given to me and I have the right to withdraw for the study without penalty, at any time. I voluntarily agree to participate in this study.

__________________________________________  __________________________________________
My signature                                      Date

Margaret W. Maina  
Interviewer  Date