UNIVERSITY OF NAIROBI

VALUATION OF TIMBER PLANTATION IN KENYA: - A CASE STUDY OF SITOI TEA ESTATE, ELBURGON AND KAPTUMO.

BY

OJIJO ELISHA OCHIENG

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A RESEARCH PROJECT SUBMITTED TO THE UNIVERSITY OF NAIROBI, DEPARTMENT OF REAL ESTATE AND CONSTRUCTION MANAGEMENT, IN PARTIAL FULFILMENT FOR AWARD OF DEGREE IN MASTERS OF ARTS IN VALUATION AND PROPERTY MANAGEMENT.

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DECLARATION

I **Elisha Ochieng Ojijo**, hereby declare that this research project is the outcome of my original work and has not been presented for an award of a degree in any other university.

CANDIDATE: OJIJO ELISHA OCHIENG
REG.NO: B92/89645/2016

SIGNATURE: **…….**

DATE: **…….**

This research project has been submitted for examination with my approval as university supervisor.

SUPERVISOR: PROF. GEORGE K. KING'ORIAH, PH. D M.B.S.

SIGNATURE: **…….**

DATE: **…….**

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DEDICATION

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ABSTRACT

Highlighting the overall importance of timber plantations linked to job creation, contribution to gross domestic product and environmental sustainability, necessitates a study on wholistic and accurate valuation methods. Establishing the value of timber plantation is fundamental because without accurate valuation, motivation on investment in tree and forest management will be low. Guided by standards set by International Accounting standards (IAS 41) that require valuation of biological assets to be based on fair value valuation method, namely income, cost and sale comparable approaches instead of historical cost, timber plantation valuation in Kenya have only focused on tangible plantation outputs to near exclusion of other non-market services/benefits.

Western Rainforest region was selected owing to its extensive bio-diversity, within the region, Elburgon, Kaptumo and Sitoi tea estate were purposively sampled as case study areas, due to their ease of access to the wanted data and multiplicity of benefits derived from their respective timber plantation. Data was collected through interviews and questionnaires in both random and purposive sampling design to Valuers, farmers and plantations visitors. Data collected were aimed at developing a case that was judged to be satisfactory in meeting the study objectives of identifying timber plantations valuation methods in Kenya, evaluating their accuracy, establishing constraints to timber plantation valuation and making recommendation on the appropriate mechanisms to enhance timber plantation valuation.

The study revealed two categories of timber plantation valuation methods in Kenya, market and non-market methods. Market methods are cost, income and sale comparable and are used in valuing physical plantation products while non-market methods are for intangible services and are premised on willingness to pay or accept. The market methods were found to be accurate since their resulting values were within the 1%-15% acceptable accuracy but they were unreliable because they didn't capture non-timber benefits. Further, the study revealed constraints to timber plantation valuation to include quantification of indirect benefits, lack of data, determination of interest rate and heterogeneity of timber assets. The study recommends the use of a hybrid approach that is, total economic method also obtainable by adding 30.93% (found to be the non-timber benefit) to the values returned by market approaches. It further recommends the use of adjusted discount rate which reflects the added risk of timber plantation and integration of technologies such as database management system (DBMS). In addition, it stresses the need for due diligence, networking and civic education through continuous professional development programmes for Valuers on forest resources.

ACRONYMS

CPD-Continuous Professional Development

CVM-Contingent Valuation Method

DBMS-Database Management System

DBH -Tree Height and Diameter at Breast Height

DEPT-Department

Ed-Edition

FV-Fair Value

FAO- Food and Agriculture Organization

FERT-Fertilizer

GDP-Gross Domestic Product

GBCA-Green Building Council of Australia

GIS - Geographic Information System

HBU -Highest and Best Use

HC-Historical Cost

HPM-Hedonic Pricing Model

I.P.D.M-Integrated Pest and Diseases Management

IAS- International Accounting Standards

IFRS-International Financial Reporting Standards

ISK-Institution of Surveyors of Kenya

IVSC-International Valuation Standards Council

KEFRI- Kenya Forestry Research Institute

MAS-Malaysia Accounting Standard

OECD- The Organisation for Economic Co-operation and Development

RECM-Real Estate and Construction Management

RICS-Royal Institution of Chartered Surveyors

TCM-Travel Cost Method

TEV-Total Economic Value

TUV - Total Use Value

TNV- Total Non-Use Value

UNCTAD-United Nations Conference on Trade and Development

UoN-University of Nairobi

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INTRODUCTION

1.1 Background of the Study

Kenya is sparsely forested with about 7.4% of forest cover, yet with an extra 27% of additional wooded vegetation cover (Forest Resources Management and Logging Activities Taskforce Report, 2018). The major areas of upland forests occur in Mt. Kenya, the Aberdare range and Mt. Elgon. Around 6% of Kenya's forests are preserved together with more than 60 national parks, sanctuaries and reserves (Kenya Private Forestry Sector Status and Potential Report, 2016). The forests provide the necessary raw materials utilized in timber and timber product enterprises throughout the nation. In 2016, the sector including forest, employed around 294,500 people and contributed US $ 89.72 million or 1.3% of the GDP (Economic Survey, 2017).

According to Michael, et. al., (2016), timber a major product of forest, plays an important role in relation to; **Environmental sustainability** that is, renewable, feasible resource that store carbon dioxide and expand green star vitality energy rating, this is the framework that surveys and assesses the maintainability of activities at all phases of the built environment life cycle (Lindup, 2014). According to GBCA Report (2002), timber construction has real advantages for versatile re-use. Existing timber structures can be strong when altered and timber can also be effectively cut, formed and shifted. Where new developments are required, timber spots lighter loads on existing structural frames and foundations, this hence can earn a project up to two Green Star; **Design Advantages** for example, timber materials have tasteful intrigue, are less costly in contrast with other available construction materials and are flexible; and **Product Performance** i.e. timber gives acoustic, thermal and reliable performance, in a fire event, timber discharges in a foreseeable way enabling designers the capacity to create long lasting, strong and fire impervious timber buildings.

Establishing the value of timber plantation is therefore crucial, without an accurate estimation of plantation values, little spurs interest to invest in tree management, without such investments, the physical state and functionality of trees diminishes. At this point, trees shall be regarded more as liabilities than assets, hence removed and frequently, not supplanted (Tyrvainen, 2001). These hence necessitate the need of a study, regarding how the values of timber and timber products should be estimated through accurate valuation methods, which are essential to promote productive use of the land, enhance environmental sustainability and protection. Failure to ensure that timber plantation are properly valued, would put a wide range

of stakeholders into financial risk, for example; financial institutions that use timber and timber products as collateral for loans, a case in point, according to KFS Report (2014), more than 700 farmers in arid and semi-arid areas have had access to soft loans to grow trees from the Ministry of Forestry using trees as security; secondly, shareholders who have invested in quoted or listed companies for example; Kakuzi, Williamson Tea Ltd and Kipchorua Tea Co.Ltd and the companies themselves that may be susceptible to hostile overthrows in case of improper valuation of their properties.

It is for these reasons that, IVSC (February 2013), IFRS (January, 2013) and RICS, have standards on how timber plantations should be valued. However, acceptance by these bodies to use fair value valuation methods namely income, cost and market approaches rather than historical cost in biological assets valuation as stipulated by International Accounting Standards (IAS41 December, 2000), have faced a lot of challenges in different countries. For example, in Malaysia, fair value approaches have been found to be demanding an onerous responsibility since one has to distinguish timber plantation in diverse location, different varieties, distinctive features of each tree that grows and at what frequent intervals. This according to MAS7, is tiresome and requires extensive book keeping hence the preference to historical cost (The Edge Malaysia, Sept.28th 2009). South Africa on the other hand, has not adopted uniform prescribed fair valuation standard, to them, forest assets valuation can either be done on the basis of a modified cash basis or accrual basis. This lack of uniformity and clear standards has led to non-uniform timber plantation valuation (Biljon, 2012).

In Kenya's context, lack of standards particularly in timber plantation valuation, has made Valuers to rely more on fair value valuation standards set by IAS for this most important sector. But according to Ndung'u (2012), the use of fair valuation methodologies to value timber plantation in Kenya has been curtailed by limited understanding on the dynamics of timber plantations, timber products and benefits. In order to capture plantations values entirely, he stresses on the need to apply fair value/market valuation methodologies in conjunction with non-market valuation approaches namely, total economic value, travel cost, hedonic price and contingent valuation methods. In light of the fore going, and as suggested by Omunga (2001), we need to learn more, and more quickly, about the role that timber plantations play in the working of ecosystems. Gaps in our present information of these connections currently limit our appraisals of the dangers imposed when biodiversity decreases, and hinder more complete economic valuations (Kowuor, 2005).

1.2 Problem Statement

Acceptance of International Financial Reporting Standards and International Accounting Standards by many countries have necessitated a paradigm shift in the valuation of biological assets/resources, that is, valuation of these resources to be rooted on fair value, not traditional historical cost. In Kenya however, these standards have not been complied with wholly. The previous research done by United Nations Conference on Trade and Development (UNCTAD, 2006) to investigate the extent of compliance by limited agricultural firms quoted on the Nairobi securities exchange, reveal low level of compliance to IFRS 13 standards, ranging between 17% to 39%. The research concluded by attributing this low compliance to lack of awareness to the new standards as well as tedious process required in order to capture the biological assets values entirely.

Historically, valuations of timber plantation were based on historical cost (HC) which generally assumed that inflation isn't existent in the economy (Diewert, 2005), but problems showed up when there was large change in price due to inflation, this consequently made the values not to be compatible at all to the current market valuation. In an attempt to solve the HC major weakness, IAS 41 (December, 2000) introduced fair valuation methodologies namely income, cost and market approaches. Fair value in this case, should be the quoted market price in an active market. However, active market where all items traded are homogeneous and where information is readily available to general public as defined by IAS 39 (December, 2003), is hypothetical and may not exist especially for timber that occurs in different establishment phases and different geographical location, some of the timber products are not even traded in the market (Josep, 2005). The significant gap with the fair valuation procedures is that they depend on traditional and neo-classical economic hypothesis which don't focus on ecological issues as they are viewed as side-effects (Adamowicz, 1992). As such, valuation has repeatedly failed to sufficiently capture the benefits of timber that neither come to the market nor for other grounds amply be valued in economic basis.

Consistently, timber has been the forest product whose value has dominated valuation, occasionally to near debarment of any other products (Watson, 2002). The use of forests only for wood has changed which calls for another emphasis of timber resources as supplier of other goods and services such as environmental roles (Emerton and Karanja, 2001). Within this context, there is a need to advance and incorporate non-market valuation methods which will account for these wide varieties of goods and services associated with the timber plantations.

1.3 Research Objectives

1.3.1 Overall Objective

The overall objective of the study is to evaluate methods employed in the valuation of timber plantations in Kenya.

1.3.2 Specific Objectives

1. To identify timber plantation valuation methods in Kenya.
2. To evaluate their accuracy in determining timber plantation values
3. To establish challenges and constraints of timber valuation in Kenya
4. To recommend appropriate mechanisms to enhance timber plantation valuation

1.4 Research Questions

1. What methods are employed to value timber plantation in Kenya?
2. How accurate are these methods in determining the values of timber plantations?
3. What are the challenges and constraints facing timber valuation in Kenya?
4. What are the appropriate mechanisms that should be adopted to enhance timber plantations valuation?

1.5 Research Proposition

The formulation of this research is steered by the objectives and questions of the research with the intention of facilitating better apprehension on the study subjects. The primary prepositions are;

i. Fair valuation methodologies are widely used by Valuers to value timber plantation in Kenya.
ii. Fair valuation methodologies are accurate and they are reliable in capturing the timber plantation values entirely.

1.6 Significance of the study

Timber plantations are expandingly alluring interest, because of the ballooning demand for forest products, conservations, recreational needs as well as investors contemplation for long term solid investments. According to Elad (2004), majority of the biological assets companies and stakeholder's still use opinion-based valuations, which are pegged on the past transaction, to establish the values of timber plantation with little or no regards given to environmental benefit, this has often resulted to undervaluation (Spring, 2005). An appropriate

valuation approach of timber plantations as recommended by this research will make a paradigm shift as it will capture other environmental benefit besides timber. This will reflect the true value of timber plantations which in the long run, shall aid in strategic allocation and conservation of such sites leave alone guiding the allocation of resources.

Critical thinking and in line with Environment and Development Conference (the "Rio Summit"), demands for complete valuation of all goods and services of the forests (UN, Agenda 21, Chapter 11), there is need to apply methods that capture the entire timber component and to shift from private profitability valuation, where the valuation prominence has conventionally been financial worth creation while societal and environmental gains considered secondary. A full valuation thus, should go beyond financial worth. This study hence furnishes the Valuers with imperative knowledge and prowess that enables them to give recognition and appreciation to other gains such as environmental and societal benefits that accrue from timber plantation, besides cash flows from tangible timber products only.

The research also goes a long way to describe various practical valuation methods for timber valuation, making them to be readily understandable to sector stakeholders. Further, clear discussion of the production of timber step by step by the study will play a pivotal task in educating the farmers, Valuers and investors. This in long run shall culminate into the increase in environmental conservation as well as timber production.

For a long time, valuation in Kenya has dominated only land and building, with little on loose assets. This study necessitates the need for diversification of the roles of Valuers, it challenges valuation firms to engage in biological assets valuations and consultation, advising on different tree plantation stages, attaching values to each stage, so as to broaden their market base. Apart from contributing to the existing literature in the field of valuation in general to ensure sustainability in the industry in Kenya, the result of the research further enhances appropriate and better valuation of timber plantation in a way that convinces the policy and decision makers on the need to conserve, protect and expand tree plantations. Future scholars may also use this research as a premise for further exploration in the area of timber plantations and valuation. Moreover, the later findings and recommendations shall help the Institution of Surveyors of Kenya in setting the timber valuation standards if need be.

1.7 Scope of the Study

The study is dependent on the available financial, equipment and time resources. Consequently, the research will be limited to case study area namely Elburgon, Kaptumo and Sitoi Tea Estate. The content of this research includes; timber history and production, methods of timber plantation valuation, their advantages, disadvantages and applicability. The study also investigated the challenges facing Valuers when they are carrying out timber plantation valuation and proposes recommendation on the best ways forward on timber plantation valuation.

1.8 Organization of the Study

Chapter One;

This is an introductory. The chapter explores areas like the background to the study, statement of the problem, objectives of the study, research questions, propositions, significance and scope of the study.

Chapter Two;

Reviews the related literature, history and production of timber, historical and fair value concepts as well as literature on timber and timber product valuation methodologies.

Chapter Three;

In this section the characteristics of the study area are provided. The samples and sampling procedure, and methods used in collection and analysis of data are highlighted.

Chapter four;

Entails data analysis, empirical presentation of the analysed findings to give a clear picture of the intended message

Chapter five

Provides research findings, conclusion, recommendations and constraints to the research. It also gives areas of further study

CHAPTER TWO
LITERATURE REVIEW

2.0 Introduction

Based on the overall aim that is to evaluate methods employed in the valuation of timber plantations in Kenya, a preliminary exploration of relevant literature has been undertaken. This chapter focuses on theoretical and practical basis of timber production and valuation. The literature review have been divided into two parts; timber plantation establishment, production, benefits and cultural practices, have been vastly explored, documented and adorned in the first part of literature, while part two has illustrated the timber plantation valuation methodologies.

2.1.0 Timber Plantation Overview in Kenya

Kenya is sparsely forested with about 7.4% of backwoods cover, yet with an extra 27% of other wooded land cover (Forest Resources Management and Logging Activities Taskforce Report, 2018). The major areas of upland forests occur in Mt. Kenya, Mt. Elgon, and the Aberdare range. Kenya has approximately 60 national parks, which are responsible in the preservation of up to 6% of the forests in the country (Kenya Private Forestry Sector Status and Potential Report, 2016). The forests are the chief provenience of raw material that are used in timber and timber product industries in the country. The sector, including forest, employed an estimated 294,500 people in 2016 and contributed US $ 89.72 million or 1.3% of the GDP in 2016 (Economic Survey, 2017).

Data indicates that approximately 159,800 hectares of land was covered by industrial wood in 1997 (Matiru, 1999), and a decade later, Kenya had approximately 4.22 Million hectares of forest cover (The Star, April 26, 2018). This delivered about 90% of industrial wood, the other 10% being imported and from private farms (Economic Survey, 2018). Forested areas are extensively dispersed within Central, Coast, Rift Valley and Eastern regions of which the Rift Valley region is estimated to have the highest forest cover of up to 47% (Wood and wood product Report, 2005). In the saw processing industry, the saw mill operators at times consolidate the procedure of timber production and assembling of furniture and joinery generation. (Private forestry sector in Kenya status and potential report, 2016). The success of Kenya timber industry can be attributed to the following factors;

1. Good infrastructure

Presence of good network of roads which are well maintained, linking the plantations, has ensured faster and convenience transportation of harvested timber as well as easier provision of agricultural extension services (Collins, 2005).

2. Contextual factors

These include the availability of land and natural permanent water sources, for example, River Molo, River Njoro and River Makalia in the study areas, these provide adequate water for irrigation and manufacturing purposes. The forested areas also have dense population hence adequate labour provision.

3. Institutional framework

Forest Board and Kenya Forest Service has been created under *Forest Act 2005* under section 3(1) and 6 and their mandate clearly stipulated to regulate, develop, promote and coordinate forest related activities, these have impacted positively in promoting timber industry in the country.

4. Climatic factors

Kenya experiences a differing scope of climatic condition. Mild atmosphere wins from 1500m above the sea level with a temperature of between 30 degrees Celsius during the day and between 6 degrees Celsius to 12 degrees Celsius at night (Ngugi, 2007). Rainfall is all around dispersed in growing areas with two crests in April-May and September-October covering roughly 60-80 days in a year allowing ample sufficient radiation for the major part of the year (Kenya geology and atmosphere magazine, 2006). These elements support all year generation of trees.

2.1.1 Classification of Timber

According Baldyga, et.al. (2007), timber species are broadly divided into two main groups namely;

1. Softwood
2. Hardwood.

2.1.1 a) Softwood

These are gotten from conifers trees whose leaves are needle-like and usually bear cones. They are the most normally utilized timber materials conventionally because of their affordability compared to hardwoods, are promptly accessible, simple to work with and are less thick than hardwoods (Gibbs, et.al 2010). Examples of softwood species include; Radiata Pine, Oregon (Douglas Fur), Meranti, Cedar (Western Red) etc. (Moortele, et.al., 2015).

2.1.1 b) Hardwood

Comes from deciduous trees which shed their leaves at the end of the growing season or during a dry season. These are majorly broad leaf trees that shed their leaves in winter (Hardwood Market Report, 2014). According to (Harris, et.al., 1999), there are two groups of hardwood, depending on where they grow.

i) Temperate hardwoods

These are found in temperate areas of the world, such as Europe, North America, South America, Asia, Australia and New Zealand. Some of the common temperate hardwoods are oak, birch and beech (Gibbs, et.al, 2010).

ii) Tropical hardwoods

These are found in tropical areas such as Central and South America, West and Central Africa and South East Asia. Ordinarily, this type of hardwoods is long lasting and tougher in contrast to softwood. Moreover, these hardwoods are ornamental in nature thus can be used in decoration. Examples of hardwood species are; Cypress, Pine, Blackbutt, Silvertop Ash,Yellow Stringybark, Ironbark, Jarrah, Messmate, Bluegum, Redgum, Spotted Gum, Southern Mahogany etc. (FAO, 2012).

2.1.2 Timber Species in Kenya

Kenya boast of both hardwoods and softwoods. Table 2.1 summarizes some of the useful tree species in Kenya.

TABLE 2.1 SUMMARY OF TIMBER SPECIES IN KENYA

Name	Description/Use	Image
Casuarina equisetifolia	This is an evergreen tree growing to 6–35 m (20–115 ft) tall. The tree can be used for shingles, fencing, and branches (harvested sustainably) are said to make excellent, hot burning firewood.	
Yellowwood (*Podocarpus falcatus*)	A medium-sized, deciduous tree with a vase-like form growing to up to 30feet. Its wood (podo) is good in building boats and ships. It has an average lifespan of 100 years.	
Croton megalocarpus	A dominant upper canopy forest tree reaching heights of 40m or more. It is great for restoring soil and reduces heat in areas (shade cover).	
Water pear (aka *Syzygium guineense*)	The tree grows to a height of 15 to 20m. Its roots are invasive making it suitable for urban planting. It also produces edible fruits and leaves.	
Fountain Tree (*Spathodea companulata*)	A native tropical dry forest tree that grows between 7–25 m tall. Its edible, and can be used for timber or medicine. Also known as Nandi Flame in Kenya.	
Lead Tree (*Leucaena leucocephala*)	A small, fast-growing mimosoid (flowering) tree, or shrub growing up to 16 feet in height. It is considered for biomass production.	
Moringa (*Moringa oleifera*)	A quick shooting, deciduous plant with an average height of 10–12 m. Its leaves are used for extracting oil and purifying water.	

Name	Description/Use	Image
African Olive (*Olea africana*)	Towering always green shrub sometimes teeny tree 2-15m high. It has a polished grey bark with a base which is uneven. Its wood is durable and is used for the making of furniture and turnery	
Meru Oak (*Vitex keniensis*)	This is a gigantic swift growing deciduous tree, which can grow up to 35 m high and it has become endangered due to over exploitation. It produces appealing grains and is majorly used as a source of durable wood.	
Pines (*Pinus patula*)	Grows to a height of 30 m or more and attains dbh of up to 1.2 m. It produces excellent fuel wood and its fibre is used in commercial manufacture of pulp in the paper industry The rotation age is 28 years	
Mukau tree (*Melia volkensii*)	Indigenous tree species in the mahogany family which grows up to 15M high. Its timber is durable and resistant to termites. The flowers provide perfect bee forage. Its shoots can also be used as fodder It generates up to 300 kg of fruit annually when mature, the seeds can also be collected all the year round. The tree extracts can also be used as anti-feedant to control insects.	 

Name	Description/Use	Image
Cypress	This is a non-native tree which is popularly known for its timber despite the time it takes mature fully They take averagely 25-30 years to maturity It is a giant tree with a height of 25–42 m and a trunk diameter of 2–4 m **Classes of Cypress include;** **a)** *Cupressus Lusitanica* (White Cedar) - grows to 40 m tall. The leaves are needle-like, 2–6 mm in length, with shoots which are smooth at the top. **b)** Italian Cypress (*Cupressus sempervirens*)- It is a middle-sized coniferous evergreen tree with an estimated height of 115 ft tall. They also have a conic crown with even branches. It is very long lasting, with some trees existing beyond 1,000 years. Italian cypress is customarily used in Kenya as an ornamental tree and it used for beautification. It has a scented wood that is durable and can be used to construct doors.	   

Name	Description	Image
Eucalyptus Saligina (Sydney Blue Gum)	Eucalyptus trees are fast growing and can be harvested within 6-8 years. It is one of the most profitable investments when considering the duration, the tree takes to mature. The tree is the most commercialized type of tree that is common in Kenya. It can grow up to ceiling height of 65 meters. The trunk has an even pale grey or white or brownish bark.	 
Eucalyptus Regnans	They are generally one of the world's tallest tree species with the tree reaching a height of 114 meters. It is cherished for its timber which when harvested has been used primally in saw logging and wood chipping. Its timber is ranked as middle weight (around 680 kg/m³) and also has coarse texture. It is also a great commercial income contributor in Kenya that why it is grown in many parts of the country. It takes averagely (15 - 25 years - for timber) (5 - 12 years for other uses) to mature.	  

Sources (Kenya Forest Services Brochure, (2014), Maundu &Tengnas, (2005), Mutua, et al., (2005), Forest Landscape and Kenya Vision 2030 & KEFRI, (2015).

2.1.3 Development Inputs for Establishing Timber Plantation

These refer to the components that are required for establishment and running of a tree plantation. They include; offices, workshop, store for fertilizer and pesticides and staff housing. Farm equipment requirement include; spraying equipment, hand tools, trolleys, grading equipment, stubble shaver, cooper plough, 4-wheel drive, D4-crawler, hoe harvesting knife, CAT D6, toolbar twin ridger, chisel plough, sub-soiler and bulldozers (James and Lenny, 2013). In additional to land cost, there are additional cost for land clearing, grading, drainage, furrowing, secondary land preparation, construction of access road, electrical and telephone installation (Jukka, 2006).

2.1.4 Land Preparation for Tree Planting

TABLE 2.2 PROCEDURAL STEPS FOR TIMBER PLANTING

Procedural Steps	Activities Undertaken
Step One	Site assessment which includes observations of the soil characteristics, any planting obstacles, type and quantity of vegetation present.
Step Two	Removal of trees stumps, grasses and levelling hereon by bulldozers
Step Three	Construction of roads or pathways in between the plantation Waterways should also be constructed in this stage for runoff discharge
Step Four	Undo any left hard pan using a sub-soiler
Step Five	Scalping to remove sod layer to a depth of 4 to 6 CM in strips of at least 30 CM, trees are planted in the middle of the scalped area
Step Six	Ripping to ensure any rainfall is stored in the soil profile and to provide a good environment for seedling roots by aerating the soil.
Step Seven	Mounding to allows moisture to easily enter the soil and easy seedling roots penetration
Step Eight	Furrowing to create deep, wide furrows at regular spacings across the planting site
Step Nine	Spray Glyphosate 2 metres wide along each row to control weeds.

Rathfon, et.al., (1995), Harris, et.al., (1999), Reegan Walker Guidelines, (2015), Ontario Extension Notes on Preparing the Site for Tree Planting, (1995).

2.1.5 Standard Practices for Timber Plantation

2.1.5 i) Propagation

Water the seedlings well in their compartments the night prior to planting. Set up the area where the seedlings will be planted, disposing of competing vegetation, for example, grasses and bushes. Every seedling ought to have around 1-square-foot region of cleared soil (Thornley and Cannell, 2000). Tree seedlings ought to be planted around 8 feet apart or in amazed rows of 7 feet apart for a windbreak. Plunge a planting bar, shovel or even durable trowel vertically into the ground around 6-8 inches down (Harris, et.al, 1999). The fertilizer application recommended at planting is as shown in table 2.3;

TABLE 2.3. SUMMARY OF RECOMMENDED FERTILIZER APPLICATION AT PLANTING

10 to 15 kg	Manure (good quality, properly matured and dry);
0.7 kg	Maxi-fos or Double Superphosphate;
15 kg	Gypsum (in case the soil is heavily charged with sodium);
1.25 kg	Sulphate of ammonia; and
1.08 kg	Potassium chloride.

McKenna & Woeste (2004)

2.1.5 ii) Drainage and Soil Improvement

Poor seepage typically, is connected with soil salt levels and accordingly, the refinement of the waste potential is vital (Willem and Ben, 2014). It is essential for the soil to be covered, either by mulching or the use of organic material since they improve water penetration bringing about improved seepage (Juan, et al, 2017). In saline soils, filtering ought to be done to drain away excess salts that is, applying of abundance irrigation system to keep salts from building up in the soil (Lin, et al., 2001).

2.1.5 iii) Weed Control

Weeds usually contend to deny tree water, light, nutrients, etc. and can shrinks yields substantially to even upto 72% (Bey, et. at, 1976). As such, it's quite important for the weeds to be managed. Weeds can be controlled through; using herbicides and manual weeding. Some herbicides commonly used are glyphosates at 2L/Ha, Diuron 80 WP 2.0 – 2.5 kg/ha, Ametryn

80 WP 2.5 – 3.0 Kg/Ha (Dougherty and Lowery, 1991). Cultivation is the most effective method of mechanical weed control and it entails the use of equipment such as rototillers, discs, hoes, and other similar pieces of equipment. As indicated by Hansen et.al., (1984), cultivation is the most reliable method that can be used to control the weed.

2.1.5 iv) Fertilizer Application

To maximize returns from your fertilizer, Pirone (1972), proposes you consider; what nutrients are there, how much of each nutrient is needed, what source of fertilizer should be used, and how and when should they be applied. Types of fertilizer commonly used are;

a) Inorganic fertilizer

These usually in NPK ratio and can either be in 10-10-10 mix or while 29-0-4 doesn't contain phosphorous. Nitrogen is essential in the production of foliage. As such, fertilizers with a high concentration of nitrogen will reinstate bright green hues to your foliage. Phosphorous enhances blooms, and increases the production of flowers. Potassium reinforces the immune systems of the plant and benefits their overall health (Hass, 1987). To figure out how much fertilizer you'll need, you need to consider the tree's age or the diameter of the trunk. In general, you need a pound of fertilizer per year or a pound of fertilizer per inch of the trunk's diameter (Pirone, 1972). It is worth noting that excessive use of inorganic fertilizers can lead to high concentration of salts in the soil, that may harm the trees (Barrett & Youngberg, 1970).

b) Organic fertilizer

Organic fertilizer provides biotic elements and nutrients, which collectively contribute to upkeep tree rotation and revamp soil conditions, the most commonly used is composts. Ngugi (2007), citing Neil Griffins (1998) outlines that, the use of compost animal manure during land preparation help in reducing weed spreading.

2.1.5 v) Pest and Diseases

Important pests are; sirex wood wasp, gumleaf skeletonizer, moths, spring beetles, leaf, bark and stem beetles, lerps and psyllids and galler, while tree diseases include; kirramyces leaf diseases, pink disease, brown root rot, shoot blight, pink disease, amongst others (Lovett, et al., 2006) & Milan and Andrej, 2013). For pest and diseases management, William (2001), recommends the use of integrated pest and diseases management (I.P.D.M) which is dynamic methodology that uses all the accessible techniques to productively control pests, diseases and weeds while limiting pollution in the environment. These techniques are as shown in table 2.4

TABLE 2.4. INTEGRATED PEST AND DISEASES MANAGEMENT (I.P.D.M) METHODS

	Method of Control	***Example of the activity***
1	Biological control	Employing predatory mites
2	Cultural control	Plant non- infested seedlings to improve tree stands
3	Genetic control	Using diseases resilient variations
4	Mechanical or physical methods	Insect screening around the garden or uprooting of weeds
5	Quarantine control	Isolating infested plants
6	Systematic control	Planned and timely use of farm chemicals

(William (2001) and Andrej and Milan, (2013)

2.1.5 vi) Harvesting and Extraction

Harvesting is a general term used to portray the felling of trees and setting them up for ferrying to the rightful designation or mills. It incorporates both the thinning and clear-felling tasks (Enters, et.al, 2002). Thinning is the intermittent expulsion of the weak and small trees from a plantation to create space for the better trees to develop, while clear felling is the cutting down of all trees. Clear felling customarily occurs when the rotation period winds ups and can be done through mechanized harvester or manual motor harvester or chainsaw felling.

Extraction involves moving timber from the felling point to the forest road (FAO, 2004). According to Akay, et.al, (2004), the various extraction methods include; Forwarders**,** skidders and cable system. An appropriate method is chosen depending on the different conditions of the site.

2.1.6 Benefits of Timber Plantation

The *Forest Act of 2005* considers forest products to include bark, beeswax, caves, charcoal, vines, earth, fibers, firewood, fruits, galls, seeds, sups, rubber, spices and trees, among others. Timber a major product of forest plantation has diverse uses which include but not limited to; air dispensers, windows, poles, wood carvings, charcoal amongst others (Kenya Forest Services Brochure, 2014) and (Wood and wood product report, 2005). According Michael, et.al. (2016), timber supersedes other construction materials because it is the only 100% inexhaustible asset of construction material, this inexhaustibility allows for an increased

labour force in the building industry both directly and indirectly, subsequently improving the local economy.

Besides the usefulness of these physical products from timber plantation, an established timber plantation, whether private, public or communal, also plays other non- physical important roles ranging from conservation, environmental protection, recreational, and wildlife habitation. According to Adamowicz, (1992), timber from managed plantations has greenhouse effects, they are also safe and sound ecologically to handle and dispose in addition to their aesthetic value. These benefits of timber plantation can be summarized into five classes pegged on which benefit is accruing, as shown in table 2.5.

TABLE 2.5 CLASSES OF TIMBER PLANTATION BENEFITS

Class Category	Product /Benefit Accruing
Extractive	charcoal, firewood, furniture timber, building poles, medicines, honey, fibre, cultivation, grazing and hunting.
Non-Extractive	recreation, education/research, habitation, amongst others.
Indirect	cooling climate, cleansing air, river source, rain formation, soil erosion prevention, bio-diversity conservation, genetic materials, amongst others.
Non-use	cultural and religious, heritage and aesthetic value
Option	Future use

Authors Summary, (2019).

2.2 Valuation of Timber Plantation

2.2.1 Introduction

Britton, et al. (1998), defines valuation as an art or science of approximating the worth of a particular interest in property for a given purpose, at a given time, accounting for all features of the asset and also taking into account all other factors of the market. Simply, valuation is the estimate of the price of an asset for sale (Reynolds, 1985). There are many reasons why timber plantations are valued, these include; for privatization purposes, to establish economic viability of a deposit, insurance, auction, taxation, investment, forest land rental assessment, amongst others. The basic principles of valuation are universally applicable to all valuation problems. There are three major principles of valuation that dictate the method to be adopted, these are;

First is the principle of highest and best use (HBU). Under IVSC 2000, highest and best use is described as the most plausible utilization of a property which is physically conceivable, appropriately justified, legally permitted, financially attainable and which results in the most astounding estimation of the property being valued. Second is the principle of substitution, this states that when indistinguishable commodities are present, the one with the least price draws the top-most demand (Appraisal Institute, 2001). Third is the Principle of utility. Utility is ability to satisfy desires for a consumer good, and ability to create goods or services as a factor of production. A property's utility is derived from the legal rights that the owner possesses and therefore restriction of ownership rights influences value of property (Wyatt, 2007). From this principle, the worth of a property is a driven from future benefits the property will produce (Waihenya, 2005).

2.2.2 The Concept of Historical Cost (HC) in Timber Valuation

This is the original fiscal worth of an economic asset (MacNeal, 1939), it generally assumes that assets and liabilities will not change their value and retain it from their dates of acquisition and that the underlying buying cost of the asset is designated across accounting periods as a total of intermittent deterioration remittances. The relating verifiable HC is in this manner, the underlying purchase cost less the aggregated deterioration remittances over earlier periods (Diewert, 2005). This method was dominantly used in the past before the introduction of the just value. Some of its advantages include but are not limited to; it is straight forward to produce, it does not transcribe gains until they are discerned hence it develops records that are easy to work with (Carson, et.al., 1994).

Besides the advantages, historical cost has also been criticized in equal measures that is, historical cost method is not reproducible nor objective since different Valuers won't really make similar presumptions about the suitable measures of chronicled depreciation cost. According to Josep (2005), the significant problem is that, authentic cost end of period esteems, will be completely unimportant in a high inflation condition; that is, they won't reflect current opportunity costs or market values. In this way historical cost values may be objective and yet, they are unessential. Conservatism conflicts HC with precision by asking, in the event that we needed to be extremely courteous, why not expect all the transitional asset values to be nil? (Charles and Kathleen, 2011).

The major gap with historical cost valuation is how to take into consideration the alteration in the price of the timber (maybe from general inflation) from tree planting time to

the end of the accounting period. As such, HC valuation therefore, may not mirror any present market valuation for the timber and its product, thus in an inflationary situation, HC deterioration expenses will be underquoted while income will be overstated on the other hand. Reynolds (1985), also challenged this inferred assumption after witnessing the colossal inflation that occurred during World War I and concluded that price level can never be constant. He further argues that, a dollar spent today will totally be different tomorrow, thus ignoring time value for money is the lamest assumption Valuers can come up with (Vera and Maino, 2012). According Josep (2005), historical cost valuations make it difficult to obstruct awful investment ventures, keeps from disposing them, in this manner, accumulating volatility to hit the market sometime in the future. This hence produce crash prices, increases unpredictability and diminishes proficiency with respect to market valuation.

2.2.3 The Concept of Fair Value (FV) in Timber and Timber Product Valuation

Ratification of International Financial Reporting Standard (IFRS, January, 2013) by many countries has had a paradigm shift in biological assets valuation through emphasizing that valuation has to be pegged on fair value (FV) minus cost to sell rather than HC (IAS 41, December, 2000). The FV in this case according to IFRS (2012), is the price that an asset will exchange for at the date of valuation between consenting parties. The process of determining fair market value is similar to that recommended for market value which is estimated amount at which an asset/liability should exchange for on the date of valuation between consenting parties (willing buyer and seller) in arm's length transaction after adequate marketing has been done so as to ensure that parties act prudently and without compulsion (IVS 104, April, 2016).

For timber and timber product, fair value (FV) can be derived from a reported price in a vibrant market for timber and its products. According to IAS 41 (2014), active market in this case, is where; the items traded within the market are homogeneous that is, the product traded has essentially the same physical characteristics and quality; willing buyer and seller can normally be found at any time, thus neither will act under any compulsion and finally the prices for commodities are available to the public. However, in the absence of active market, IAS 41 further recommends other methods of coming up with fair value as bridged in table 2.6.

TABLE.2.6. FAIR VALUE GUIDE

Rank	Standard	Precondition	Valuation method
1	IAS41 &17	Active/vibrant market Exists	Recorded and reported prices at the active market
2	IAS 41, 18-19	No vibrant market exists but market determined prices can be derived	The most recent market transaction price and/or prices of sector benchmarks or typical commodities
3	IAS 41, 20-21	No market determined prices can be derived	Present value of anticipated net cash flows discounted at present determined rate of discount

IAS 41 (20th June 2014).

Unlike historical cost that is more opinion and assumptions based, fair value gives reasonable and rational values that can be relied on regardless of the economic situation. Indeed, even on account of blended attribute report (when a few things are valued at market while others are conveyed at traditional cost), fair value accomplishes better results, and it gives dependable signals of financial troubles (Josep, 2005).

2.2.3.1 Criticisms of Fair Value (FV)

1. Subject to manipulation

Unlike historical costing that assume constant price level, fair value components are subject to many managerial alterations so as to consider the prevailing economic, social and political situation. This will result into variation of values depending on personal judgment, expectations and gut feelings of a manager or Valuer. Pablo (2004), contends that, fair valuation is subject to added manipulation such as using higher interest rate to cater for unforeseen political or social instability, this may lead to poor measure of actual worth and performance.

2. Unrealistic assumptions

The assumptions of active perfect and complete market which according to Lawrence and David (2007), can be defined by three pillars namely; Perfect Competition, Perfect Information, and Complete Markets. A market with such features according Rees & Hayward (2000), tend to be hypothetical since such cannot be found in real life situation.

3. Volatility

Fair value takes into account risk factors such as management, enactment/political risk, logging risk, sales and marketing risks, rivalry risk, innovation risk, litigation risk etc. (Rui, et.al, 2007). Besides the risk factors considered, in cases of inflation, the values may also be increased by great percentages to account for the cost of inputs. But as the economy recess, fair value valuation will return values that are lower than capital invested. In the same vein, at the point when there are flaws in the market, there is the peril of the rise of an extra source of instability as a result of fair valuation, henceforth a fast move to full mark-to-market routine might be detrimental to financial intermediation and as such to economy (Josep, 2005). These would likewise cause unrealistic changes in net profit of timber enterprises (Charles et al., 2011).

4. Incompatibility with financial statements

Depending on the price levels, fair values will fluctuate, thus requirement of necessary adjustments on financial statement which sometimes may lead to imparity. Adjustments aimed at marching the prevailing price levels, may result to errors on the valuations and also on the balance sheet which may be misleading. Diewert (2005), opines that FV may not improve the in formativeness of the financial statements but impair because of excessive assumptions and uncertainty on risk associated with future income.

5. Time consuming

Fair value requires more information ranging from baseline for adjustment of risk, prediction of future cash flows and outflows, inflation adjustments factors, amongst others, these may take time to come up with and may increase the cost of valuation. Moreover, some of the information may be irrelevant to both the Valuers and the clients (Hatfield, 1997).

2.2.4 Timber Plantation Valuation Approaches and Practices

According to Kimani (2007), Barbier, (1992) and Pearce and Moran (1994), depending on the timber volume, timber and timber product valuation approaches, are grouped into the following;

a) Arbitrary methods
b) Analytical methods

2.2.4.1 Arbitrary Methods

According to Syagga (1994), these methods are guided by some chosen yardstick which include; fixed royalty rate, value related charges and auction price or seller/buyer negotiation.

2.2.4.1 a) Fixed Royalty Approach

The method relies on charges established administratively by legislation, regulation, codes and ordinances. The charges differ with type of species, diameter, class, locality and grade of timber or other characteristics (FAO, 2003). Traditionally, royalties are calculated on the volume in cubic metres of logs from trees felled after deduction of any defect allowances (Mbugua, 2001). The royalties are paid to the Government for those allowed to cut trees. The Government may deliberately use this tool to restrict logging by imposing temporary harvesting bans through high royalty rate. These in many countries have promoted recuperation of indigenous forests following quite a while of overexploitation and enhanced environmental protection and biodiversity conservation (Omwami, 1992).

In Kenya, the *Forest Act Cap 385 Section 39* requires the minister to fix the amount of royalties or fees payable in respect to each species on or before 30th June each year. With the new forest legislation enacted in 2005, this is the function of the Forest Board. The method however, has been criticized for being less scientific since fixed royalty may not accurately reflect stumpage value and the fixed charges are less responsive to inflation and costs affecting stumpage value. The process of reviewing the rates may also be long due to lack of political good will or change in government regime and sometimes the new rates may be already out of date by the time they are implemented because of delays associated by governmental bureaucracies (Kimani, 2007).

2.2.4.1 b) Value Related Charges Approach

This method relies on royalties derived as a percentage of selling price of the processed or converted product at 30% of the average price of timber. This approach is also applied to market prices, declared prices or posted prices established by the government (Richards, 1994). The method is favored as it is flexible and automatic in adjustment to changing prices and inflation.

2.2.4.1 c) Auction Prices or Seller/Buyer Negotiation Approach

This is based on direct seller/ buyer negotiations, open or sealed bid auction or public log market, invariably, the participants must have thorough knowledge of the forestry industry (Munn, et al. 1995). The approach is recommended under the arbitrary approach since it is flexible in establishing the values of timber as forces in the market are let to dictate the timber value. In a market that is competitive, the approach establishes a true market value of the stumpage since the stumpage will be exchanged for the highest bid price. The method also reduces costs especially of determining stumpage value such as the cost of transport to the market, loading cost, and marketing cost amongst others. The method however, can be time consuming where participants are slow or unwilling to raise their bids and where there are no bidders, the auction may not even be possible. Moreover, the method also does not consider indirect nor optional values of the timber.

2.2.4.2 Analytical methods

Unlike arbitrary approaches, these methods require explicit investigation of timber logging, harvesting, extraction, processing and marketing of forest items from a specific logging niche (Lehuji, 2003). To arrive at the market value, the stumpage worth is residually dictated by deducting all costs associated with handling, processing and harvesting (Pertanika, 2007). This method consists of comparative approach; cost valuation approach; investment valuation approach; conversion return approach and multi-parametric analysis approach.

2.2.4.2 i) Comparable Sales/ Market Price Method

In any market, the sellers rival each other in drawing in the buyer to them, the buyer will compare what is accessible at what cost, and he will buy the good which as he would see it gives the best return at the cost paid (Tonny et al., 2000). Valuers in arriving at the value, must attempt to pass judgment on what value vendors try to acquire, and the decision buyer will make. This approach, therefore, entails assessing and making comparison on what available now in the market (Tyrvainen, 2001). The best practise is to divide timber resources into numerous timber value areas. Then in each area, all sales on timber should be reported accordingly and market stumpage prices empirically tabularised. This method is used in timber and timber enterprises which are small scale operations and can exist in similar geographical formation. Where used, it entails collection of historical data of timber and timber product

transactions, comparison with current information and prices and undertaking necessary adjustments to fit (Hulkrantz, 1992).

According to Waihenya (2005), one of the major advantages of market price approach is that the strategy mirrors a person's ability to pay for expenses and benefits of goods that are traded in the markets, such as timber, mineral or fuel wood. As such, individuals' qualities are probably going to be well defined. The method also uses spot on data of actual consumer preferences thus will reflect estimated amount that timber and timber product will exchange for. According to Wyatt (2007), the method is easy as it just compares the transaction history of similar assets.

The primary criticism of this approach is that it is subjective, both in terms of picking similar sales and with regards to the types of adjustments made to determine value (Helliwell, 2008). It must be noted that the method is grounded on relating like with like (Britton et al, 1989). Thus, as different timber assets divert from the perfect condition of absolute similarity, the method is rendered unreliable. Data about the market could only be accessible for limited timber products and if available it may not replicate value of all benefits of the plantation. In most cases, transaction data used is usually past and historical data that might have no impact or relevance to future market behavior. The method sometimes can be complex since it may require a valuer to simulate and do a detailed analysis of data to discern any variance(s) between the subject timber and each comparable, in order to apply correct adjustment(s) to the sale data of the comparable and to convert comparable prices into acceptable value. Freeman (1994), argues that this method doesn't deduce the market value of other resources used to bring ecosystem products to market, this often leads to understatement of the market value.

2.2.5.2 ii) Cost Approach

The cost approach is rooted in the early classical assumption of a close relationship between production cost and value. The method is adopted where specialized assets require valuation on the basis of existing use instead of market value. According to Diewert (2005), the cost approach is, therefore, used to estimate the amount of money that has been invested in the current timber business. The resulting timber and timber product value hence is equal to the development and production costs of similar timber resource. This is anchored on the premise that timber and timber products are worth at least that meaningful tree management and husbandry expenditure incurred as well as the warranted future necessary costs necessary to improve the timber standing and establishment (Pearce and Pearce, 2001). One vital element

of the cost approach is that only the past expenses which are taken to be sensible and productive are reserved as value (Straka, 2007).

Productive in this case, refers to the consequences of the task that give adequate consolation to justify more work by recognizing prospective for the presence and disclosure of an economic timber quantity. Warranted future costs include a sensible lumbering spending plan to test the recognized potential, thus if lumbering work downgrades conceivably, it isn't gainful and its expense ought not be held as worth or ought to be reduced (Barbier, 1992).

Past expenditures are normally analysed on a yearly premise. Typically, little of the uses more than five or so years before the effective valuation date are held (Binkley, 2009). In outline, the methodology assumes that the measure of lumbering consumption whenever justified, is related to that timber value and it for the most part continues in three stages namely;

Step one; ascertaining the cost of establishment and the value of improvements and machinery that are judged to be productive (value contributors)

Step Two; Deduct depreciation allowed for buildings, plant and machinery

Step Three; add the remainder value of the land estimated from comparable sales to the net asset value and the cost of establishment

Cost method is recommended because lumbering information on cost and other data are easily obtainable for most timber and timber products enterprises. Additionally, it is also a perfect way of likening the relative values of timber establishments (Barbier, 1992). The conventions applied in cost method is also straight forward and logical i.e. the seller will as much as possible try to sell the asset at the minimum what it costs to produce and the purchaser would be prepared to pay for the asset what it would cost similarly elsewhere (Wyatt, 2007). The main disadvantage associated with the method is that skilled judgment is essential in separating the previous expenditures taken to be productive from the ones that do not subsidize to the value of the timber, and to evaluate what is a realistic future lumbering program and cost, these according to Tonny et al., (2000) will leave the method vulnerable to abuse. Born, & Pyhrr (1994), argues that cost is not equal or synonymous with value and to determine the cost of replacing present improvements or providing suitable substitute, yet there may not be exact replicas for comparison and changes in technology make this impractical. Moreover, depreciation assessments are often arbitrary and are difficult to derive from the market, cost method therefore, may just give indicative cost of expenditure rather than the market value (Emerton and Karanja, 2001).

2.2.4.2 iii) Investment Method

The method is premised on the capitalization of the net income which the asset produces. According to Waihenya (2005), this can be written as follows;

Cv = y x yp

Where Cv is the capital value

y is the net income per annum

yp is the years purchase

The approach relies more on cash flows to attain fair value. Cash flow is the total coffers generated from operation (revenue received + expenditure incurred). According to Rees and Hayward (2000), a cash flow procedure should be pegged on; the current and anticipated cost, the receipt generated and benefits accrued, or the cost incurred on disposal of the asset. The effectiveness of this approach relies on the employment of appropriate yield, well captured allowance for outgoings and appropriate rate of return. The approach procedure can be summarized as shown;

TABLE 2.7. SUMMARY OF INVESTMENT VALUATION METHOD PROCEDURE

Activity One	Discern the expected anticipated benefits;
Activity Two	Ascertain the proportion and time of the above benefits;
Activity Three	Determine the extent and period of the expenses required to realize the anticipated income;
Activity Four	Deduct operating expenses per annum from the yearly revenue;
Activity Five	Derive rate of return to be used in capitalization;
Activity Six	Estimate the salvage or residual value;
Activity Seven	Calculate the present value;
Activity Eight	Develop and decide on the suitable value.

Pablo, (2004).

2.2.5.2 iii a) Disadvantages of Investment approach

Inflation, interest rates and exchange rates are volatile in an emerging market, for example Kenya, because of its tempestuous economy, anticipating the levels of these microeconomics factors with certainty for any noteworthy timeframe into what's to come is difficult (Waihenya, 2005). Since factors of production cost keep on changing and sometimes difficult to account for, it is imperative to consider the impacts of inflation and exchange rates

for cash flow streams. However, due these fluctuations, determining discount rate with certainty is difficult. The approach additionally, can appear to be more cumbersome. Wyatt (2007), acknowledges that the method is reprimanded for the obvious absence of market-supported evidence for the estimation of some of the key variables utilized in the construction of a cash flow analysis. Boyd (2003), stresses that for the method to be effective, thorough risk analysis of input variables together with sensitivity and scenario analysis of discount rates must be done. This action of increasingly logical examination of data and data trends as well as sensitivity and scenario modelling can be an overwhelming task.

Baum and Crosby (2008), recognise the complexity of the DCF approach with respect to the quantity and complicatedness of the data required and ponders whether the valuer is well skilled to adopt the method. According to Pearce and Moran (1994), the asassumptions regarding future cash flows and effective economic life of timber and timber products are subjective, the outgoings might be also difficult to ascertain with accuracy and the practice of projecting income as a constant for a future period is unrealistic hence the approach sometimes return market values that are unrealistic in future.

2.2.4.2 iv) Conversion Return Method

This Method comprises of overturn/turnover method and business ratio method. Under the turnover method**,** allowance for profit is determined as a percentage of all production (processing) cost, exclusive of stumpage purchases. A 50/50 split of conversion return is commonly applied (Kimani, 2007). In the business ratio method, profit allowance is determined by using the three ratios commonly used in business between profit, operating cost and selling price (Openshaw, 1980). Profit ratio is often applied as it allows straight examination of the net gains and risk margins from a log price without determining the stumpage (Leushner, 1984). The profit margin therefore can be written as:

$$PM_{ij} = [(P_{ij} * PR) / (1+PR)]*V_{ij} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots i$$

Total conversion return (CR) in a given compartment is calculated as follows;

$$CR_{ij} = (P_{ij} - C_{ij})*V_{ij} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots ii$$

The total stumpage value in a given compartment hence is calculated as follows:

$$SV_{ij} = (P_{ij} - C - PM_{ij})*V_{ij} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots iii$$

Where:

SV= Value of the stumpage (RM/ha or RM)

P = Price of the subject log (RM/m^3)

C = Cost of logging (RM/m^3)

PM = profit margin (RM/m^3 or RM/ha)

V = Derived volume (m^3/ha or m^3)

i is species index, *j* diameter class of the subject index

(Davis and Johnson, 2000).

The major challenge of this method is that, it only applicable to timber and timber product which are tangible and hence can be exchanged in the market. In addition, it doesn't reflect the cost of raising stumpage.

2.2.4.2 v) Multi- parametric approach

This is mostly applicable in urban forests where tree have multiple uses beside saw-log production such as urban beatification (aesthetic value), provision of cool shade, urban wildlife habitat, firewood value amongst others. Some of the world beautiful cities owe their valuable ranking to overall diversity of urban trees hence the emphasis to attach a value to urban trees (Barbier, 1992). The formulae of obtaining the urban tree value is assumed to take the following forms depending on different countries or cities, these are;

The North American method (CTLA, 2000). This takes into account the utilitarian aspect of trees and adapts the following formulae.

Value = [area of subject trunk (cm^2) × price cm^2] × location × species × condtion

The Swiss method- According Flook (1996), this incorporates a multiplicative procedure, and is written as;

$$Value = E \times B \times U \times D$$

Where (E) is the species; (B), health and aesthetic value, (U), location of the tree and (D) tree size.

The Finnish method-this according to Helliwell (2008), can be calculated as follows;

$$Value = S \times P \times L \times E$$

Where S is the section of the trunk, P is a value established and tabulated per cm^2 of section (which varies according to species), L is a variable defining the location (open country or city), and E represents the condition of the tree on a descending scale from 1 for completely healthy to 0.2 for a very ill and weakened specimen.

The French method-This attempt to establish the most likely cost of replacement, and it is a modification of Swiss method with an inclusion of T index to cater for the cultivation care required for the maintenance of the specimen (Moore and Arthur, 1992). The expression used in the valuation of trees:

$$Value = E \times B \times L \times D \times T$$

Where (E) is a species index; (B), an index of health and aesthetic value (L), a location index, (D) size index and T is the cultivation care.

The major challenge with multi- parametric approach is how to obtain aesthetic aspects.

2.2.5 Theory of Non-Market Valuation Methods

Demands for holistic forests valuation has necessitated the need for non-market valuation methods. According to Kowuor (2005), policies in our current society have had an impact on the status of natural resources, in terms of how people uses them or intends to use them, even those who do not use them, may sometimes be affected by the decisions made by the actual users. Values of such natural resources, therefore, arise from the choices that people make so as to derive benefits. Non-market approaches thus emanate to capture all these benefits and to correct market failures in cases where markets do not adequately take into account the outcomes both market and non-market, that people value. The methodologies under non-market that aid in capturing these valued benefits, include but not limited to; travel cost, hedonic price, contingent valuation and total economic value

2.2.5 a) Travel Cost Method.

This approach is favoured as it reflects the desire for the environmental attributes from a specific recreational asset (Kimani, 2007). It is divided into two, that is, zonal travel cost and individual travel cost. Zonal travel cost method is based on data relating to the zones of origin of site visitors. It is applicable where visitor's origin is evenly distributed and also where there

are adequate important points of origin to a single site. According to Pertanika (2007), the model proceeds as follows;

Step One; Discern the site;

Step two; Distinguish the zones of origin and allocate visitors to the appropriate zone;

Step three; Calculate zonal visits per household to the site and average travel costs for each zone to the site;

Step four; Use census data to derive variables relating to zonal socio-economic characteristics-number of households per zone;

Step five; Derive demand curve and obtain zonal household consumer surplus estimates by integrating the demand curves- point at which the zonal visits per household falls to zero;

Step six; Calculate aggregate zonal consumer surplus to obtain an estimate of total consumer surplus.

The Individual Travel-Cost Method on the other hand, relies on individual data to estimate the demand and value of the recreational facilities. It requires the valuer to administer an on-site questionnaire to visitors to elicit data of visit frequencies over a given period of time, cost of travel to the site, recreational preference, use of substitute sites and socio-economic characteristics.

Travel cost approach to natural resource valuation has been favoured as it is based on actual behaviour rather than hypothetical situations where individuals imagine how much they would spend were they to visit a site. Individuals are actually observed spending money and time, and their economic values are derived from such activities (Spring, 2005). The major shortcoming of this approach is that it is tedious and aassuming that trips to that site are separable to all other sites may be unreal. Moreover, the question of over-sampling of frequent visitors to the recreational facilities, may lead to results that do not represent the population.

2.2.5 b) Hedonic Price Method (HPM)

This approach encompasses the application of surrogate markets to place a value on environmental resource. It relies on data given by various households when they make their location decisions and it assumes that environmental characteristics and public goods affect the productivity of real property (Watson, 2003). Individuals derive satisfaction by residing in serene or green environment, this approach hence attempts to approximate premium that a population place to live in green environment, so as to benefit from the amenities arising from

such an environment. For hedonic pricing technique to work, three situations must be present, these are; environmental variables should have an impact on land prices, the relationship between the variables and the environment must be sufficient to predict changes in land prices and finally, the changes in land prices should be able to measure the underlying welfare changes (Kimani, 2007). Hedonic price method proceeds by first collecting relevant information and data on a sample of houses including the environmental attributes under consideration. Data in this case, may be divided into two broad categories, namely;

a. Specific data category- These include observed property transactions
b. Local data- Based on neighbourhood, amenity, environmental and socio-economic factors in the area where the property transaction occurs

The next step is to calculate the value of the environmental quality using the partial coefficient in the multiple regression or any other appropriate derivative method- marginal willing to pay (WTP). The most common application of HPM in environmental valuation is in relation to the public's willingness to pay for housing. Consumer theory postulates that the purchase price which a potential buyer is willing to pay, is dependent upon the existence and level of a wide range of housing attributes including; structural characteristics, neighbourhood characteristics and environmental quality. Using a multiple regression model, it is possible to isolate and value the effects of environmental characteristics on property prices (Tyrvainen, 2001).

This method has been criticized for relatively being complex as it requires high levels of statistical analysis, the scope of environmental attributes which can be measured is also limited to things that are related to housing prices. Moreover, the assumption that people have the chance to pick the combination of features they prefer, given their income maybe hypothetical since housing market may be distorted by outside externalities such as interest rates and taxes.

2.2.5 c) Contingent valuation method (CVM)

This is based on the understanding that the value of natural resource is more than the market value and includes consumer surplus. CVM, therefore, is used to determine maximum WTP to gain entry into a recreational facility. The approach is pegged directly on willingness to pay (WTP) to acquire a particular service or good, or willingness to accept (WTA) to do away with such a service or good, rather than inferring them from observed behaviours in regular market places (Adamowicz, 1992). It basically asks people what they are willing to pay for a benefit, and/or what they are willing to receive by way of compensation to tolerate the

loss. The method also establishes a hypothetical marketplace in which no actual transactions are done hence successfully achieving valuation for goods that are not exchanged in regular markets. In practice CVM is added to the TCM approach to determine the true value of the facility, especially public facility, thus:

Value of recreational facility= Market Value + TCM + WTP

The approach has been criticised for focusing on passive data rather than actual information from observed revealed behaviours. According to Ammour, et.al. (2000), unlike other non-market methods, survey responses in CVM are not based on an individual's behavioural choice or actual conduct, thus at times they may be subjective and uninformed, leading to high degree of biasness.

2.2.5 d) Total economic value (TEV)

According to Ammour, et.al. (2000), TEV is described as the aggregate of the values of all services that a resource can generate both in the present and in the future. These encompass all utility or disutility attained from ecosystem services using a standard unit of account such as money or any other medium of exchange that grants comparisons of the benefits of various goods. The method is based on the understanding that a forest has both market value and non-market value and, therefore, the valuation process should adopt the contingency valuation approach to account for all benefits of a forest (Adger & Brown, 1995).

According to Dominic (1995), the total value of the forest (TVF) can be expressed as follows;

$TVF = f(X_1, X_2, X_3, X_4, X_5)$

Where:

TVF an acre of forestland total value,

X_1 *is the extractive forest benefits (EFB),*

X_2 *is the non-extractive forest benefits (NEFB),*

X_3 *is the indirect forest benefits (IFB),*

X_4 *is the options benefits (OB),*

X_5 *is the non-use forest benefits (NUFB)*

In essence, the total value of an acre of forest land can be restated as follows:

$TVF = (X_1 + X_2 + X_3 + X_4 + X_5) - X_6$

Where:

TVF is the total value of an acre of forestland,

X_1 *(extractive forest benefits-EFB) can be ascertained by use of arbitrary or analytical methods*

X_2 *(non-extractive forest benefits-NEFB)*

X_3 *(indirect forest benefits-IFB)*

X_4 *(options benefits-OB)*

X_5 *(non-use forest benefits-NUFB)*

X_2, X_3, X_4 *and* X_5 *can be ascertained by use of the travel cost approach for recreational or WTP/WTA*

The major challenge associated with TEV method are two-fold, that is, on the off chance that markets do not exist either for the ecosystem service itself or for goods and services that are indirectly related, at that point, the data required for the methodology will be inaccessible. Be that as it may, where markets do exist however are distorted, for example due to a subsidy scheme or because the market isn't competitive, costs won't be a decent impression of inclinations and negligible expenses. Consequently, the assessed values of timber and timber products will not be objective in giving dependable information for decision making (Pearce & Moran, 1994).

2.3 Conclusion

Timber plantation comprises of two components that are valued separately; first is the site/prairie value which is, land based on what it might fetch if let or sold in its natural unimproved state and secondly is the trees and other timber and timber products that is, based on the benefits produced. For purposes and ease of valuation, trees, timber and timber products can further be classified according to the benefits derived as shown in table 2.8;

TABLE; 2.8. SUMMARY OF VALUES DERIVED FROM VARIOUS TIMBER PLANTATIONS

Value Derived	Name of the Benefit	Description	Example
Extractive values (EV)	Extractive timber benefits (EFB)	Consist of benefits that can be physically removed from the forest	Charcoal, Firewood Furniture, timber Building timber, poles
Non-extractive values	Non-extractive Timber benefits (NETB)	benefits enjoyed in the forest itself	Recreation, habitation, Research
Indirect values	Indirect forest benefits-IFB	These are utility functions fulfilled by forests mostly non-physical in nature.	Cooling climate Cleansing air Bio-diversity
Non-use values	Non-use forest benefits-NUFB)	Are intrinsic worth of a forest regardless of actual or potential use	Cultural, religious, Heritage Aesthetic value
Option values	Option benefits-OB)-	These are deferred benefits of an existing resource for future uses	Sustainability, future

Author's summary, (2019).

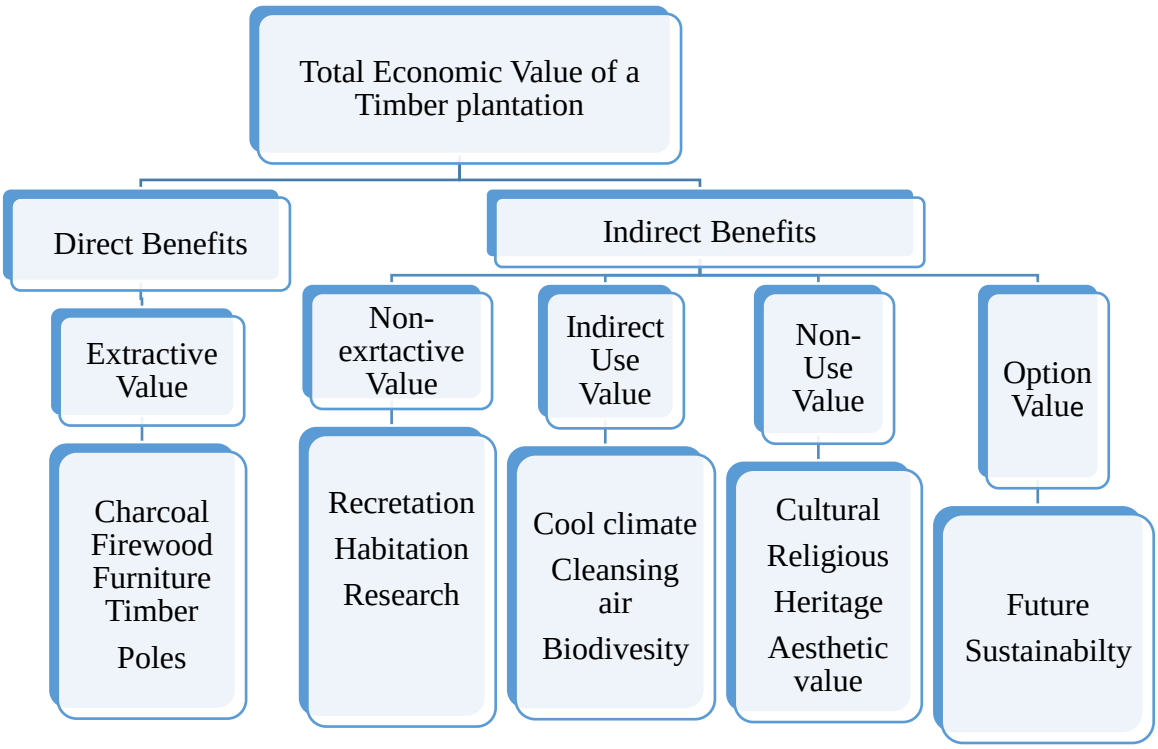
According to VPS 4 paragraph 1.2, there are many bases of valuation. However, for most valuations, the basis of valuation is market value (MV) which is the estimated amount for which an asset or liability should exchange on the valuation date between a willing buyer and a willing seller in an arm's length transaction, after proper marketing and where the parties had each acted knowledgeably, prudently and without compulsion (IVS 30.1). To arrive at the market value, IVS further proposes three major approaches namely; Market, income and cost approaches all which are pegged on the economic postulate of price balance, benefits expectation and substitution. The major concern which these approaches is that, they are based on the model of the neo-classical and classical economic supposition which has no regard for environmental concerns, perceiving them as side-effects (Adamowicz, 1992). Thus, valuation analysis has constantly fall short in capturing many timber benefits that either do not come to the market or amply be valued in economic terms. Historically, valuations of timber and timber products were based on historical cost (HC) which generally assumed that economy is not inflated (Diewert, 2005), but problems showed up when there was large change in price due to inflation, this consequently made the values not to be compatible at all to the current market

valuation. In an attempt to solve the HC major weakness, IAS 41 introduced fair valuation methodologies which are similar to those of IVS. But for IAS, the measurement for the fair value in this case, will be the quoted market price in active market. Active market where all items traded are homogeneous and where information is readily available to general public as defined by IAS 39 is hypothetical and may not exist especially for timber that occurs in different establishment phases and different geographical location, some of the timber products are not even traded in the market.

Besides income, comparable sales and cost-based approaches, more analytical methodologies have been employed to arrive at the value of timber plantations. Notably, multi-parametric method which recognizes that urban trees have multiple functions in addition to wood provision, this method however, is restricted to urban trees and its major challenge has been how to ascertain aesthetic component of an urban tree. Conversion return method is also recommended where profit margins from timber can be calculated from log price net gains and risk margins without prior determination of stumpage. Lastly, there has been the use of non-market methods which are; travel cost, hedonic price, contingent and total economic value methods. Application of these are premised on the understanding that timber has both market value and non-market value and, therefore, the valuation process should adopt the contingency approach to account for all benefits of timber. The major limitation to these methods is non-existence of market for some services that flow from timber plantations. The shortcomings of each of these methods and divergence of different opinions have, therefore, caused uncertainty and dilemma of which method is accurate, reliable and practical to value timber and its products.

Critical thinking and in line with Development and Environment Conference (the "Rio Summit"), demand for more complete valuation of the forests, there is need to apply methods that will capture the entire timber component and to shift from private profitability valuation, where the valuation has habitually stressed on commercial or financial worth creation while societal and environmental gains considered secondary. A full valuation thus should therefore go beyond financial worth; this will give recognition that the Valuer appreciates other gains especially salient environmental outflows.

2.4 Theoretical Model



Source; Field Survey, (2019).

CHAPTER THREE
RESEARCH METHODOLOGY

3.0 Introduction

This chapter describes the methodology that gives details regarding the procedures used in conducting the study. Pertinent issues discussed in this section include the research design, research methodology, population, sample and sampling techniques, background information of the study areas, data collection and analysis methods and ethics in research.

3.1 Research Design

Kothari (2004), referring to Selltiz, et al. (1962), describes research design as the plan of conditions for accumulation and analysis of data, in order gain relevance to the research core aims with precision and time in mind. It is the theoretical structure where research is led, it comprises the outline for collection, measurement and analysis of data. A decent research design ought to be flexible, proficient and affordable. This research will adopt a descriptive case study research design due to the limited research period. Jackson (2009), opines that a case study is an in depth study of a specific circumstance unlike overall phenomenon survey, it is a technique used to narrow an exceptionally expansive field of research into one easily researchable topic.

3.2 Research Methodology

As indicated by Bryman (2004), this is a procedure used to gather data. In his study, Kothari (2004), demonstrated that study methods are every one of those strategies that are utilized for carrying out research, highlighting that research procedure is away to efficiently tackle research problems. The methods to be utilized to secure information are controlled by the kind of information that scientist wishes to gather. It is further confirmed by Patton (1990), that, given the assortment of methodologies available to achieve a research, the technique determination procedure requests due thought of nature of inquiry represented, the kind of information required to investigate the goals of the study, field conditions and the attributes of the particular respondents. The purpose of the study was to evaluate methods of timber plantation valuation in Kenya. The researcher utilized mixed method methods to complete top to bottom assessment of the methods. Kolner (2017), noted that mixed method provides qualities that poise the inadequacies of quantitative and qualitative researches, by utilizing both of them, and letting the strengths of one compensate for the shortcomings of the other.

3.2.1 Target Population

According to Mugenda and Mugenda (1999), target population is an outright set of individuals or subjects, whose observable features are homogeneous and to which the researchers intends to conventionalize the study results. It is however impractical to acquire all applicable data on the research from the entire populace because of the limited time frame and resource scarcity. A researcher consequently, must discern a working population which is the proportion of the entire population with homogeneous features/behaviours (Rea and Parker, 2014). The researcher chose the Valuers, timber plantation farmers and plantations guests that visit the plantation for recreation and related activities who are the main participants in timber plantation valuation.

3.2.2 Sampling Frame

Sampling is the process of choosing a sample from a greater group to act as the basis for assessing or predicting the pervasiveness of obscure piece of data, circumstance or result with respect to the greater group (Kumar, 2005). It is a more preferable where the area of study is a bit extensive, and the researcher cannot cover the whole population and carry out a profound assessment. Given the time and resources limitations, it is necessary to use this technique as the areas of study were quite extensive making it impossible to undertake a research of the entire population. In any research, the sample ought not be excessively huge or excessively little, that is, it ought to be ideal so as to satisfy the required quality, proficiency, adaptability and representativeness (Kothari, 2004). The key factors that must be mulled over in settling on the sample size are the size of the population, timeframe and budgetary requirements. Sampling thus, enhances precision on the study process taking into account sensible budget and time.

3.2.3 Sampling Procedure

a) Case study areas

Depending on climatic condition and diversity of the vegetation, timber plantations in Kenya are classified into four major timber plantation blocks namely coastal forest, montane forest, dry and western rainforest (Wass, 1995). In each of the above zones, there is considerable variation of tree plants communities as shown in table 3.1.

TABLE 3.1 FOREST BLOCKS IN KENYA

Blocks	Forest	Acreage (Ha)
Dry forest	Leroghi	23,400
	Mathews	26,300
	Meru	6,400
	Mukogodo	3,000
	Ngare Ndere	2,500
Western Rainforest	Kakamega	10,100
	Nandi North	8,800
	Nandi South	13,200
	SW Mau and Transmara	50,100
Montane forest	Aberdare	45,900
	Cherengani Hills (East)	30,600
	Cherengani Hills (West)	17,800
	Mount Kenya	51,000
Coastal forest	Arabuko Sokoke	37,000
	Shimba Hills	9,500

Source; Wass, (1995).

Western Rainforest region was selected owing to its extensive bio-diversity. According Virtanen (1991), this is the only tropical rainforest left in Kenya with approximately 45 km² area which is also the habitat to unique animals like the L´Hoest´s monkey (Sayer et al. 1992). As indicated by Mwamodenyi and Omondi (2012), the zone habits up to 400 butterfly species. From the Western Rainforest, the researcher utilized purposive sampling in the determination of the three contextual study areas namely; Elburgon, Kaptumo and Sitoi tea estate. Ilker, et. al. (2016), describes purposive sampling method as a deliberate choice of a participant because of the participant's characteristics hence does not require underlying theories.

The study was bounded to the above sampled three case study areas which were purposively chosen due to their ease of access to the wanted information, variation in the benefits derived from their respective timber plantations and the fact that they are in the same geographical direction, could save on time and resources. Dominating the timber plantation benefits in Elburgon and Kaptumo are tangible traded products such us saw log, poles and charcoal with non-market benefits being minimal. Sitoi tea estate on the other hand, is owned and operated by Eastern Produce Kenya Limited and its tree plantations do not only supply

fuelwood, poles and other tangible products, but is also integral tourist attraction destination besides offering research and biodiversity learning hub (Eastern Produce Kenya Limited (EPK) Brochure, 2018). The three case study areas hence offer diverse timber plantation benefits that were deemed suitable for the study.

b) Key informants

According to Marczyk et. al., (2005), the researcher needs a minimum of 10% of the total population as the sample size. As further indicated by Alreck and Settle (1995), for a sample which is less than thirty informants, the accuracy and practicality may not be assured. According to them, the formulae below determines the sample populace appropriately and is more representative.

$$n = \frac{Z^2 \ pqN}{e^2(N-1)+Z^2pq}$$

In such a case,

N= is the size of the population

n = sample population estimated to have characteristics being measured, assuming a 95% confidence level.

p = the proportion in the target population estimated to have the characteristics being measured (confidence level)

q = 1-p;

e = acceptable error (e = 0.05, since the estimated error of this research is +/- 5% of the value).
Z = the standard normal deviate at the required confidence level of 1.96.

This study adopted the Alreck and Settle (1995)'s formulae to calculate the sample size since it is more representative when it is compared to Marczyk, et. al., (2005)'s 10% apportionment formula.

i) Valuers

The population of the Valuers was drawn from Kenya gazette Notice, March (2018), (Gazette Notice No. 2681) that indicate that the total registered and practicing Valuers are 417.

The determines (n) valuers was;

$$n = \frac{1.96^2\ X\ 0.95(1-0.95)X417}{0.05^2(372-1)+\ 1.96^2X\ 0.95(1-0.95)}$$

Hence, say n =61

iii) Timber plantation farmers

The population of the timber plantation farmers was drawn from Elburgon Revolvy (2019) and Mong'are et.al. Survey Report (2017), that indicate that a total of 67 farmers have tree farms in Elburgon. Kaptumo on the other hand, an electoral ward in Nandi County, has a total of 4,200 households, out of which 118 farmers are actively involved in agro-forestry and own tree plantations (Wambugu, et.al., 2015). The calculated (n) for tree farmers is as shown.

TABLE 3.2 TREES FARMER SAMPLE SIZE DETERMINATION

Study Area	Sample Size Calculation	Sample Size (n)
Elburgon	$n = \frac{1.96^2\ X\ 0.95(1-0.95)X67}{0.05^2(67-1)+\ 1.96^2X\ 0.95(1-0.95)}$	n=35
Kaptumo	$n = \frac{1.96^2\ X\ 0.95(1-0.95)X118}{0.05^2(118-1)+\ 1.96^2X\ 0.95(1-0.95)}$	n=45

Author's sample size determination, (2019).

iii) Plantations visitors

Sitoi Tea Estate is operated by Eastern Produce Kenya Limited and according to EPK Survey (2018), there were a total of 7,912 visitors at the plantation in the year 2017 and this was projected to increase by 1% the following year, thus in 2018 total visitors was estimated to be 7,991.

The determined (n) was;

$$n = \frac{1.96^2\ X\ 0.95(1-0.95)X7{,}991}{0.05^2(7{,}991-1)+\ 1.96^2X\ 0.95(1-0.95)}$$

Hence, say n =72

3.3 Study Areas Preview

Elburgon, Kaptumo and Sitoi tea estate made up the study area for this research. Timber plantations play key economic roles in the chosen study areas, a case in point, as witnessed recently where close to a 1,000 youths lost their jobs in Rift-Valley because the government banned timber logging (Daily Nation, March 14th, 2018). Quoting Mr. James Nderitu, a saw miller in Elburgon, "*Without the logs in my timber yard it means that there are no jobs for my workers and I will have no alternative but to close down the saw mill until the ban is lifted*," he further continues, "*I was servicing a loan in one of the banks and since I have no stock it means I will have to look for an alternative means to repay the loan."* (Business Daily, December 29th, 2014).

3.3.1 Elburgon

3.1.1 a) Geographical Location and Climate

Elburgon is located along Njoro- Molo Road, at the North-West of Nandi Hills, about 30 Kilometres west of Nakuru Town and further approximately 196 Kilometres North-West of Nairobi City, it forms part of Electoral Ward of Molo Constituency and it is further subdivided into three location namely; Elburgon, Mariashoni and Turi. It occupies an approximate area of 97.09 Sq. Km and an altitude of between 2,112 - 2,556 meters (Nakuru County Map Book, 2016). Forming part of Nakuru County and bordering Nandi County, the area has a temperate and warm climate and receives an average rainfall of 1126 mm annually with very little rainfall received in the months of December, January and February. The wet months are March, April and May when there are the long rains and when most tree are grown, the short rains occur from August, September and October. Rainfall is well distributed for the most of the year. The average temperature of is 20°C / 68°F with December to March being the hottest months and July being the coldest (Nakuru County Integrated Development Plan, 2018-2022) These factors according Waithiru (2014), favours all year production of timber.

3.1.1 b) Economic activities

Major land uses are; Agriculture, fishing, manufacturing and mining. The main agricultural activities include farming of crops, horticulture, beekeeping and rearing of livestock (Nakuru County First County Integrated Development Plan, 2013-2017). Aside from farming, the lumbering industry fills in as a key economic activity in the town. The timber business fills in as a key employer in the town, lumbering organizations like Timsales ltd, Chekimu Woodmart, amongst others. are only a couple of the logging and sawmilling

processing plants that harvest timber in the study area and beyond (Elburgon Revolvy, 2019). Tree nurseries are also established at some strategic points by the community, the tree seedlings from these nurseries are at times acquired for restoration activities of Nandi and Mau Forest earning an income to the community.

The rivers flowing from the Nandi Complex through Elburgon such as River Mara, River Njoro, River Molo and River Makalia are a lifeline for major tourism destination. However, recently the rivers have been shrinking due to the reduced forest cover in the Mau forest (State of the Environment and Outlook Report, 2010). Apart from tourism, trade and industry are also contribute to Elburgon economic basket, the trading centres such as Turi, Mariashoni and Arimi are dominated by retail and wholesale shops, where forest products such as fuel wood and poles are sold. Fishing is also minor activity in the study area usually in small fish ponds. The fish ponds are mostly located on the banks of the Nderit and Makalia Rivers.

3.1.1 c) Demographic

The total population is 43,436 (IEBC Molo Constituency/Wards Map, 2012). The population is distributed unevenly with avast number of people living in urban centres. The area has a high population density of 447 persons per square kilometre (Nakuru County Map Book, 2016). About 90% of the population live within 0-5 Km range to the forest and use the forest directly and indirectly (Waithiru, 2014).

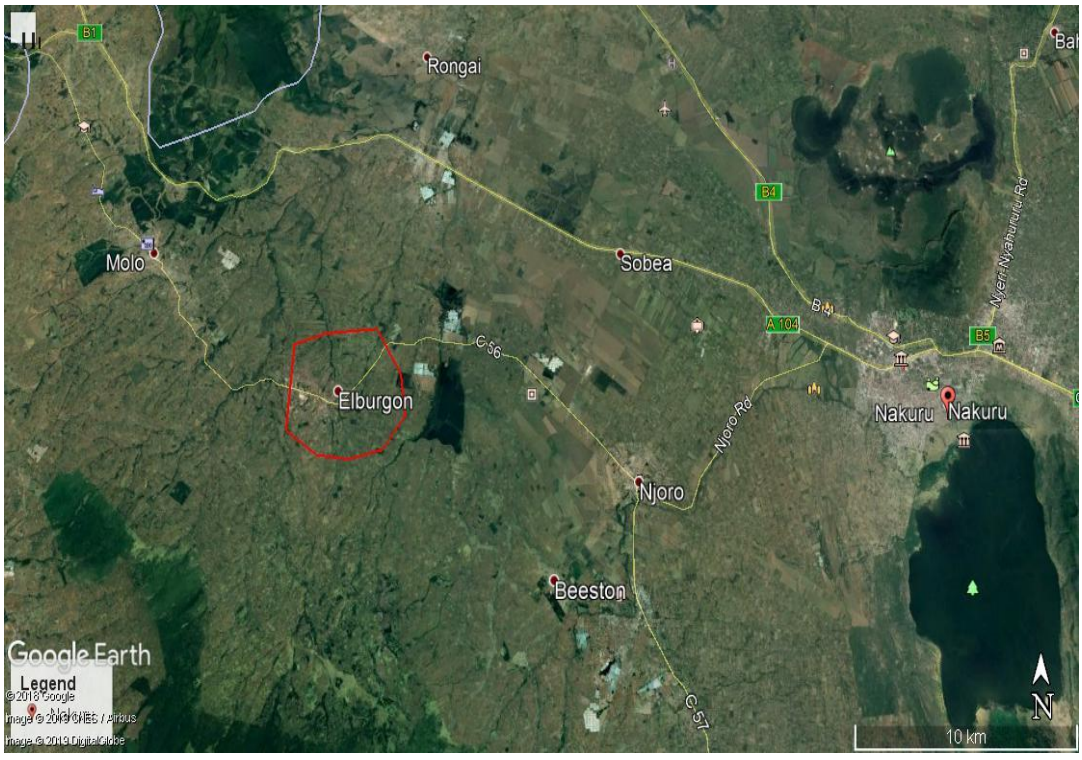


FIGURE 3.1. ELBURGON LOCATION SATELLITE VIEW

Source; Google Earth, (2019).

3.3.2 Kaptumo

Kaptumo is located along Kipsigak-Serem Road, West of Nandi and at the Eastern edge of South Nandi Forest. It is an electoral ward within Aldai Constituency and it is approximately 15 Kilometres South-West of Kapsabet Town (Nandi County Headquarters). It occupies a total area of 97.80 Sq.Km with climate which is warm, temperate with an all year precipitation (Nandi County Integrated Development Plan, 2013-2017). The temperature average is 18.5 °C while precipitation range is 1500-2100 mm/year. The area's altitude (1800M-2100M) and deep fertile loam soils according Wambugu, et.al., (2004), favours all round agricultural production from agro-forestry to cash and food crop production.

Major land uses are; farming, livestock keeping and agroforestry. The baseline survey done by Wambugu, et.al. (2015), indicates that 99% of the homes rely on wood as the main source of energy. Even so, it was established that three-quarters of the households within Kaptumo division were involved in tree planting and protection. In 2014 alone, up to 24,130 trees were planted and 4,917 trees were protected by the farmers. The integration of trees in the are especially leguminous fodder shrubs which have high nutritive has value has aided in the improvement on diets of ruminants likewise to carbon sequestration in the study area. The total population is 24,464 (IEBC Aldai Constituency/Wards Map, 2012) and it is evenly distributed and the highest population density is 250 persons for every square kilometre. There are approximately 4,200 households in the Division and about 7,500 farm families (Nandi County Integrated Development Plan, (2018-2023).

FIGURE 3.2. KAPTUMO LOCATION SATELLITE VIEW

Source; Google Earth, (2019).

3.3.3 Sitoi Tea Estate

Geographical assortment of Sitoi tea estate (one of East Africa Produce Tea Estate) is a crucial contributor to its vastness in fauna. Located in the Nandi Hills, on the equator, West of the Great Rift Valley and approximately 350 Kilometres North West of Nairobi, Kenya's capital, Sitoi has an equatorial rainforest climate, good soil conditions and fairly consistent rainfall, from an altitude of 1000 to 2000 meters height above the sea bed. It also has an all year-round tea picking (Mbui, 2016).

Besides tea production, forestry also plays an important economic role within the study area, the estate has a custodial management and devoted Technical Department and full time Forestry and Environmental Officer, to guarantee there is an intently monitored program to advance catchment zones and every single indigenous forest inside the estate (EPK, Survey Report, 2016). The positive effect of conservation and management of tree plantation has contributed to rich multiplicity of flora and fauna in the area. According to EPK Survey (2018), 125 butterfly species, 47 dragonflies and damselflies, 247 bird species, 96 trees, shrubs and lianas, and 376 wildflowers and herbs; 891 species in total, was found within EPK Estate. The survey further recorded 23% diversity of bird, forest-dependent species such as hornbill. Timber plantation thus in addition to the biodiversity creation, have ensured there is a steady and sustainable supply of fuel-wood used for tea processing as well as enhancement of tourist attraction. The land use in the Sitoi Tea estate is shown in Figure 3.3.

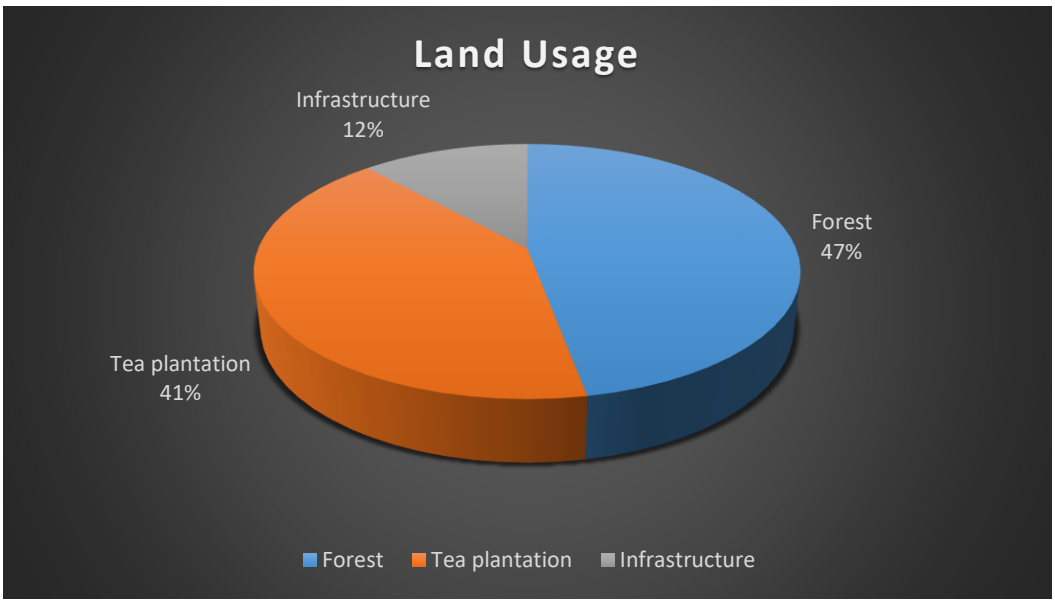


FIGURE 3.3. SITOI TEA ESTATE LAND USE SUMMARY

Source; Eastern Produce Kenya Limited (EPK) Brochure, (2018).

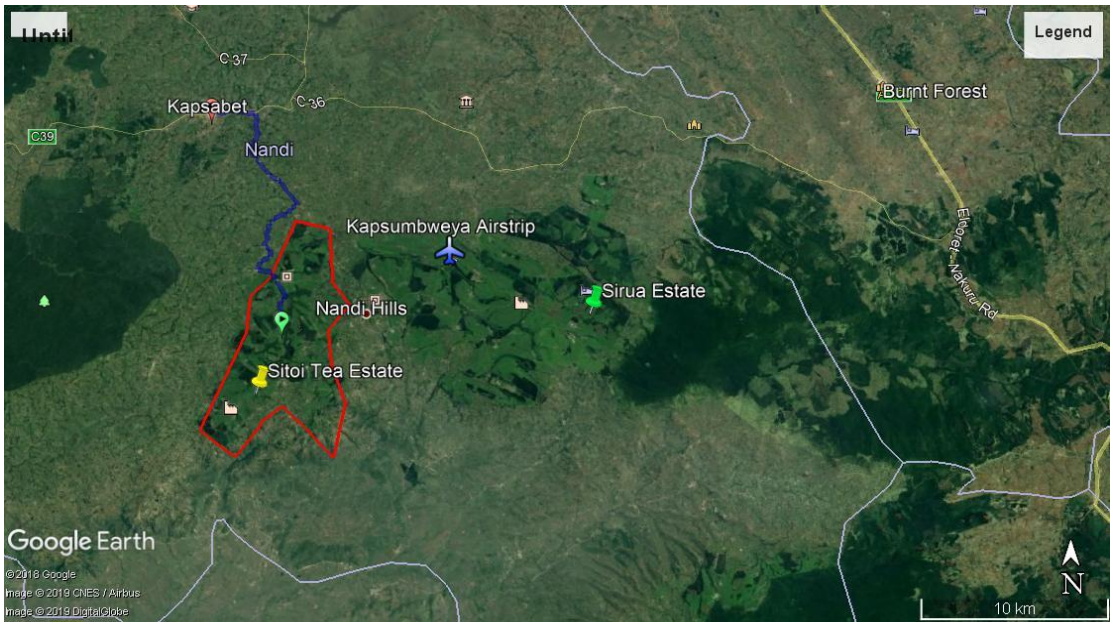


FIGURE 3.4 SITOI TEA ESTATE LOCATION SATELLITE VIEW

Source; Google Earth, (2019).

FIGURE 3.5 MAP OF SITOI TEA ESTATE LOCATION

Source; EPK, Maps and Data Base, (2019).

3.2.5 Data Collection

Data according to Rossi, Wright and Anderson (2013), are the facts collected by the researcher from the study environment. Further, they argue that primary data is the information acquired directly by the researcher on the variables of interest for the particular purpose of the study. Secondary data on the other hand refers to data assembled from so far available provenience. The research primary data was mostly gotten by administration of open and close ended questionnaires to the randomly sampled target respondents, this was due to relative low cost associated with questionnaires, avoidance of potential interview bias and creation of less pressure for immediate response. Hoyle, et al. (2002), refer to this method as the most appropriate and apt for surveys and statistical researches. The questionnaires were accompanied by a cover letter in order to explain to respondents the study significance and the confidentiality of the information. .

Further, oral interviews supplemented with explanations and clarifications were also conducted to the respondents who could not exactly understand the concept of the research. This was aimed at enhancing the aptitude of the researcher to see and correct the respondents' misconception, to probe inadequate or unclear responses and to address any questions so as to obtain complete and meaningful responses. Rapport was also instituted so as to motivate the respondents to give accurate answers and improve the quality of data. Secondary data was obtained from official public documents such as census data, statutes, books, journals, internet, published and unpublished research works, magazines, lecture notes and papers presented in conferences of valuation. Still, it is key to heed that the response rate was not 100%, as will be demonstrated later and some of the information obtained was rejected on technical grounds.

3.2.6 Ethics in Research

This research strictly adhered to research ethics and none of the respondents was forced to fill the questionnaire. There was no plagiarism, fabrication, falsification of results and the responses were not manipulated for self-gain.

3.2.7 Data analysis and presentation

The exercise of data analysis entails diverse assorted stages. The data was decoded and errors and omissions checked. The responses from the questionnaires were analysed to respond to the research objectives. Both qualitative, quantitative data and content analysis were used in the analysis of the responses. Data analysis was constructed on the understanding and

conceptualization of the responses. Content analysis and descriptive statistics were applied to analyse the data, the findings were presented in form of texts, using tabulation, charts and graphs. Frequencies were expressed in percentages for ease of contrast and inferencing.

3.2.8 Data Needs Matrix

The data required were determined by the objectives of the study. Table 3.2 presents an overall depiction of the structure applied in the collection, scrutiny and presentation of data. It recaps the vital data in each objective, source of data, the methods employed in collecting, and analysis used and the output and the presenting of the data that has been analysed.

TABLE 3.3 DATA NEEDS MATRIX

Objectives	Data Needs	Data Sources	Collection Methods	Methods of Analysis	Data Output
Objective 1	Valuation methods	Farmers and Valuers from selected case area of study	Oral interviews, questionnaires, valuation field analysis, websites, books, newspapers, articles and journals	Narrative texts and tables	Narrative texts tables bar graphs
Objective 2	Accuracy of the valuation methods	Valuers, farmers and plantation visitors from a random sample	Oral interviews and questionnaires	Spread sheet, computation of mean, mode and frequencies	Text analytics, tables and bar graphs
Objective 3	Challenges facing timber plantation valuation in Kenya	Valuers and farmers from a random sample and selected case study areas respectively	Publications, oral interviews, questionnaires, websites, books, newspapers, articles and journals	Narrative texts and tables	Narrative texts, tables bar graphs.

Source: Author, (2019).

CHAPTER FOUR
DATA COLLECTION, ANALYSIS AND PRESENTATION

4.0 Introduction

This chapter confers the analysis and presentation of the data collected from the field using methods described in the previous chapter. The data collected was aimed at evaluating methods employed in the valuation of timber plantations in Kenya which was the overall objective and other specific objectives, which are; -

1. To identify timber plantation valuation methods in Kenya.
2. To evaluate their accuracy in determining timber plantation values
3. To establish challenges and constraints of timber valuation in Kenya
4. To recommend appropriate mechanisms to enhance timber plantation valuation

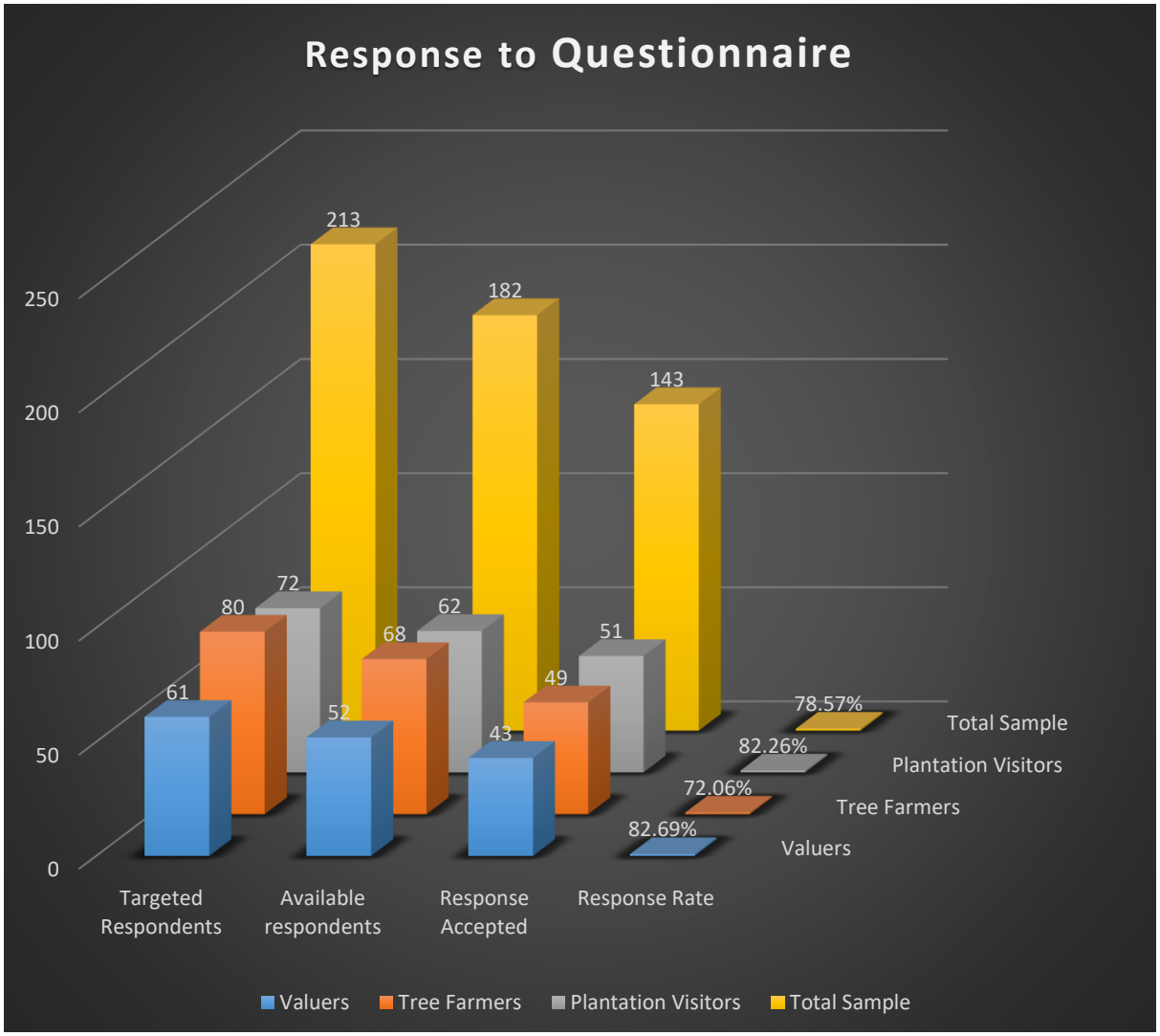
The data gathered were analysed and information derived to inform the objectives of the study. The analysis formed the basis for findings, conclusion and recommendations discussed in the last chapter.

4.1 Response to Questionnaires

The greatest challenge of the study was getting adequate respondents to questionnaires. The questionnaires were prepared and administered in three sets; first set to Valuers, second set to tree farmer and the final set to plantation visitors. Meeting the targeted respondents was hard but the response rate according to those who were available was adequate. Table 4.1 illustrates the response to questionnaires;

TABLE 4.1 DISTRIBUTION AND RETURNS OF QUESTIONNAIRE

Responses	Targeted Respondents	Available Respondents	Response Accepted	Response Rate In %
Valuers	61	52	43	82.69
Tree Farmers (Kaptumo+Elburgon)	80	68	49	72.06
Plantation Visitors	72	62	51	82.26
Total Sample	**213**	**182**	**143**	**78.57**



GRAPH 4.1 DISTRIBUTION AND RETURNS OF QUESTIONNAIRE
Source: Author's Survey, (2019).

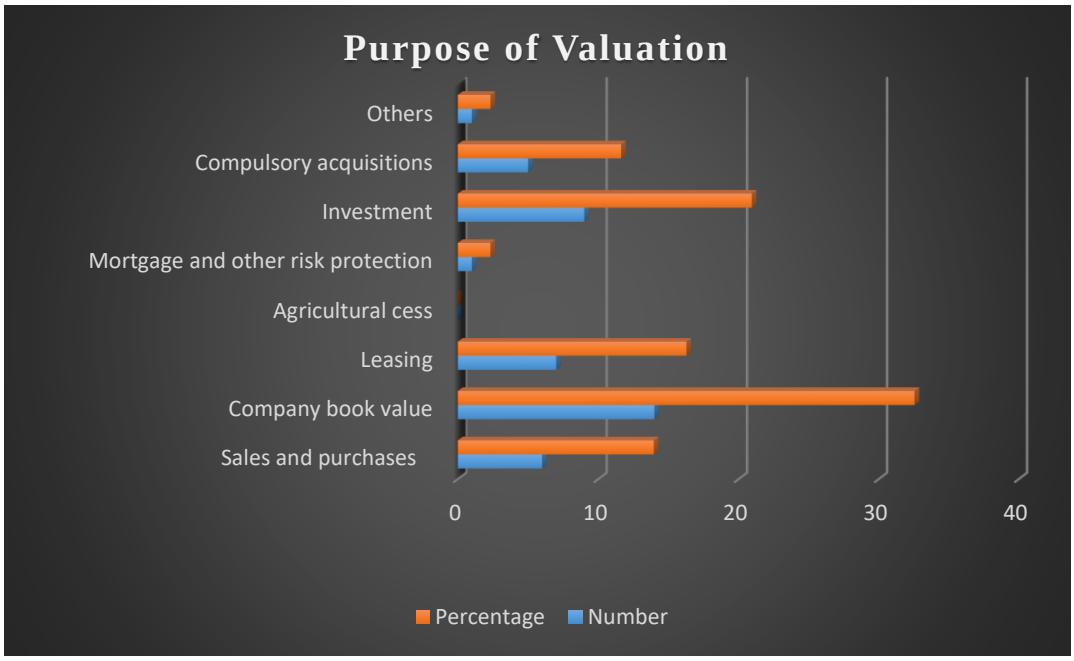
According to table 4.1 and graph 4.1, the researcher was able to receive responses from at least 78.57 percent of the respondents who availed themselves. Despite not meeting the targeted respondents, the information obtained were detailed enough to draw recommendations and conclusion on the researcher's problem from the 78.57% respondents, on average, who answered the questionnaires. The response rate was considered representative enough of the targeted population, as illustrated by Mugenda and Mugenda (1999), unless the rate of response is very low below 50 percent, it's prudent to presume that the sample is representative enough. In addition, interviews were conducted where the researcher found necessary.

4.2 Timber Plantation Valuation Methods in Kenya

4.2.1 Timber plantation valuation purposes

TABLE 4.2 VALUATION PURPOSES

Purpose of Valuation	*Percentage (%)*
Sales and purchases	13.95
Company book value	32.56
Leasing	16.28
Agricultural cess	0.00
Mortgage and other risk protection	2.33
Investment	20.93
Compulsory acquisitions	11.63
Others	2.33
Total	100.00



GRAPH 4.2 PURPOSE OF VALUATION
Source: Author's Survey, (2019).

From the study, it was noted that Valuers were mostly engaged to carry out timber plantation valuation for book value purposes (32.56 % of the total valuations carried). An interview with some of the Valuers revealed that, this could be higher. Nevertheless, it stands at that percentage since most entities update their book values in an annual basis, thus the services of a Valuer may only be required once a year or none at all, especially where the farm decides to do their own valuation based on historical cost. Other mostly carried out timber plantation valuation were for investment, leasing, sales and purchase purposes (20.93%, 16.28% and 13.95% respectively), these according to the respondents, have gained momentum because majority of investors are now opting to purchase or lease timber plantation farms for a specified period of time, thus the need for valuation in order to project their cash inflows and

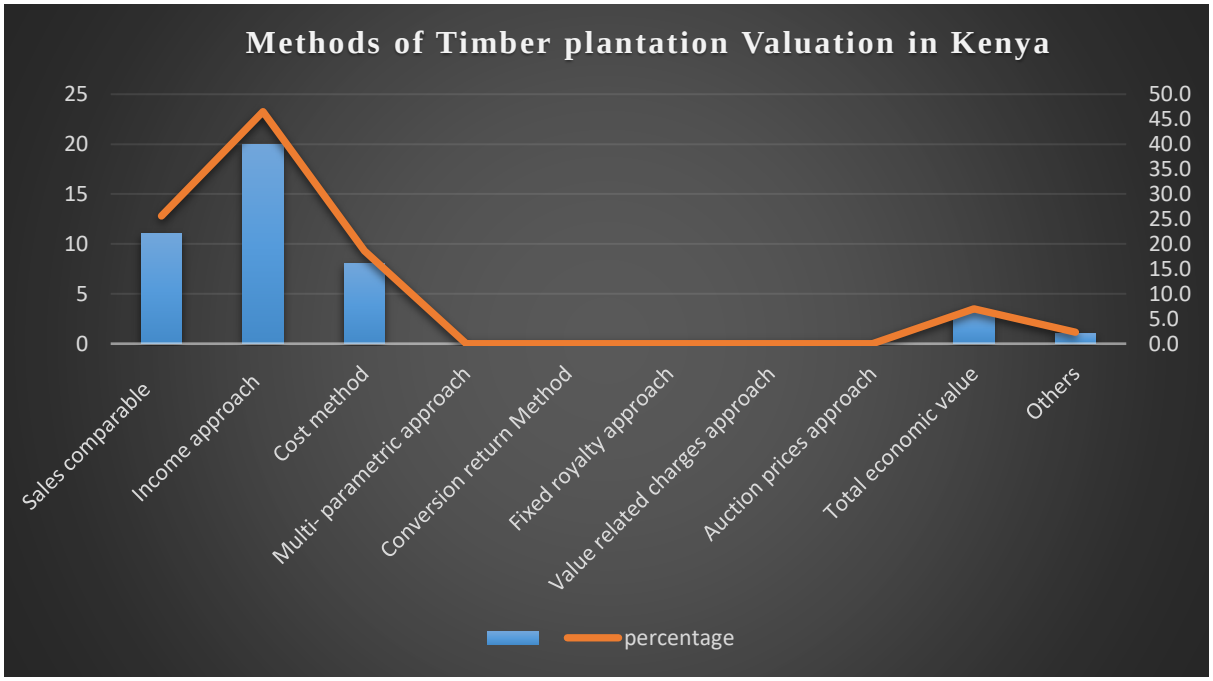
out flows. Timber valuation for loan purpose was at a low percentage (2.33%), this was due to the fact that, popular species of trees in Kenya namely blue gum and pine, take time to mature and the plantation may not have any reliable income stream to service the loans before maturity, this makes them risky for financial institutions.

Valuation for compulsory acquisition was 11.63%, Valuers projected this to rise owing to many upcoming projects as envisaged on the Big Four Agenda and Vision 2030. It was found out that many plantation owners are now engaging private Valuers to carry out valuation for compulsory acquisition especially where there is dispute of values, especially with those returned by government Valuers. Kenya Constitution (2010) and the Land Act (2012), stipulate that where land is required for a public good or in the public interest there need to be full, prompt and just compensation to the person affected. Valuers asserted that this provision of the law should be the premise for any valuation where involuntary settlement is involved. Zero percent valuation for agricultural cess purpose according to respondent, was an indication that taxation system for timber plantations is yet to be established, this could also be interpreted as government incentive to encourage tree farming. Other purposes included insurance, species value comparison and plantation benefits and rental value determination, these were found to be occasional purposes (at 2.33%). Insuring timber plantation against risks such as fire outbreak and pests is important, but it was found out that valuation for insurance purposes are normally incorporated in other purposes. Hence, rarely will a Valuer be called upon to do a valuation for insurance purpose only. Valuers further noted that, the purpose of any valuation should be clear and well stated as it will determine the valuation method adopted.

4.2.2 Valuation Approaches Adopted

TABLE 4.3 VALUATION METHODS USED TO VALUE TIMBER PLANTATION IN KENYA

Purpose of Valuation	Number	Percentage (%)
Sales comparable	8	18.60
Income approach	20	46.51
Cost method	11	25.58
Multi- parametric approach	0	0.00
Conversion return Method	0	0.0
Fixed royalty approach	0	0.0
Value related charges approach	0	0.0
Auction prices approach	0	0.0
Total economic value	3	6.98
Others	1	2.33
Total	**43**	**100**



GRAPH 4.3 VALUATION METHODS USED TO VALUE TIMBER PLANTATION IN KENYA

Source: Author's Survey, (2019).

The analysis shows that depending on the purpose of valuation, Valuers would adopt different methodologies to arrive at timber plantation values. The most popular method for valuing timber plantation as per the field survey, was income method at 46.51% followed by cost and sales comparable methods (25.58% and 18.60% respectively). Income valuation as used in timber plantation valuation is pegged on the principle of anticipation of future benefits accruing from that specific timber farm. Timber plantations are associated with the ability to generate a stream of future income and this is the point of reference and interest for most of the players or investors interested in timber farming. This therefore, makes the use of investment valuation method inevitable and most popular. Valuers further revealed that with properly kept revenue and cost data, the method is straight forward as it involves capitalizing the net income with the appropriate rate to ascertain the present worth. In addition, in connection to table 4.1, Valuers were mostly called upon to carry out timber plantation valuation for investment, leasing, sales and purchase purposes (cumulatively at 48.83%), all these purposes more often, entails projections or analysis of some revenues and cost in one way or another, this for many valuers, justified the popularity of using of the income approach.

Cost and sales methods came second and third respectively as the most common methodologies used in timber plantation valuations. Informants elaborated that unlike income approach, cost method is guided by the principle of substitution, meaning, any provident

investor will not spend amount exceeding what it takes to produce a substitute timber farm or the cost of production. The value of any timber plantation should therefore, be equivalent to the land value added to; the expenditure on establishment for land clearance and standard cultural practices expenses, and improvement such as building, plant and machinery less the accrued depreciation. The analysis further showed that this approach was dominant for valuation of timber for book purposes or financial reporting as it simply records cost of establishment and production. An interview with some of the Valuers seeking to differentiate between the historical cost and cost approaches showed slight difference, cost approach / current replacement cost consists of the compounded historical costs and it factors in the time value for money unlike the historical cost. Sales comparable on the other hand is premised on the principles of demand and supply. Valuers indicated that the method relies on available data on recent sales of timber plantations as well a vibrant timber products market. It is expected that a reasonable investor will pay a price that is equal or lower to a comparable timber plantation or timber product, a Valuers hence is tasked to convince the investor the extent of comparison that will entice the investor to pay more, equal or less than the comparable timber farm.

Total economic value approach stood at 6.98% on the valuation methodology adopted log. This method was mostly preferred for valuation for compulsory acquisition purposes because of its potential in capturing other timber plantation benefits that do not enter the market nor directly traded. Valuers argued that tree plays multiple roles besides production of tangible goods such as, logs, poles and firewood, hence the need to apply a holistic method that incorporates both market and non-market products accruing from any tree plantation. Further, the analysis showed a close similarity between total economic value and multi-parametric approach. However, unlike multi-parametric approach which is dominant mostly for valuation of urban trees, total economic method is more detailed and requires a deeper understanding and combination of Valuers knowledge in both market valuation methods namely income, cost and sales comparable and non-market methods, for example, travel cost and hedonic price model methods.

4.3 Valuation Methodologies Accuracy

4.3.1 Determination of Timber Species, Cost of Establishment, Revenue and Indirect Timber Plantation Benefits for Valuation Processes

TABLE 4.4 COMMON TIMBER VARIETIES IN THE STUDY AREAS

Varieties	Average Rotation Age (Years)	Most Popular Density Per Ha (Stem/Ha)	Popularity level (%)
Blue gum	15	2,000 (2Mx2.5M)	59
Pine	28	1,667 (2Mx3M)	38
Others	7	2,222 (2.5Mx1.8M)	3

TABLE 4.5 STANDARD PRACTICES AND AVERAGE COST OF PRODUCTION

Standard Practices	Average Cost Per Ha (Kshs.)
Seedling and seedbed management	135,000/=
Land Preparation	78,190/=
Planting	44,500/=
Weeding	66,660/=
Fertilizer application	12,500/=
Thinning and pruning	22,000/=
Pest and diseases control	27,500/=
Harvesting and transportation	76,600/=
Total Average Cultural Cost	**462,950/=**

TABLE 4.6 AVERAGE YIELD AND PRICES OF DIRECT TIMBER PLANTATION BENEFITS PER HECTARE

Plantation Products	Average Yield/Ha		Average price/unit (2018-2019 in Kshs.)
Timber Logs	Blue gum	910	2,500/=
	Pine	480	3,500/=
	Others	413	1,500/=
Firewood	472m^3		150/=
Poles	Blue gum		3,500/=
	Pine	120	4,000/=
Charcoal	178 bags		2,000/=

Source: Author's Survey, (2019).

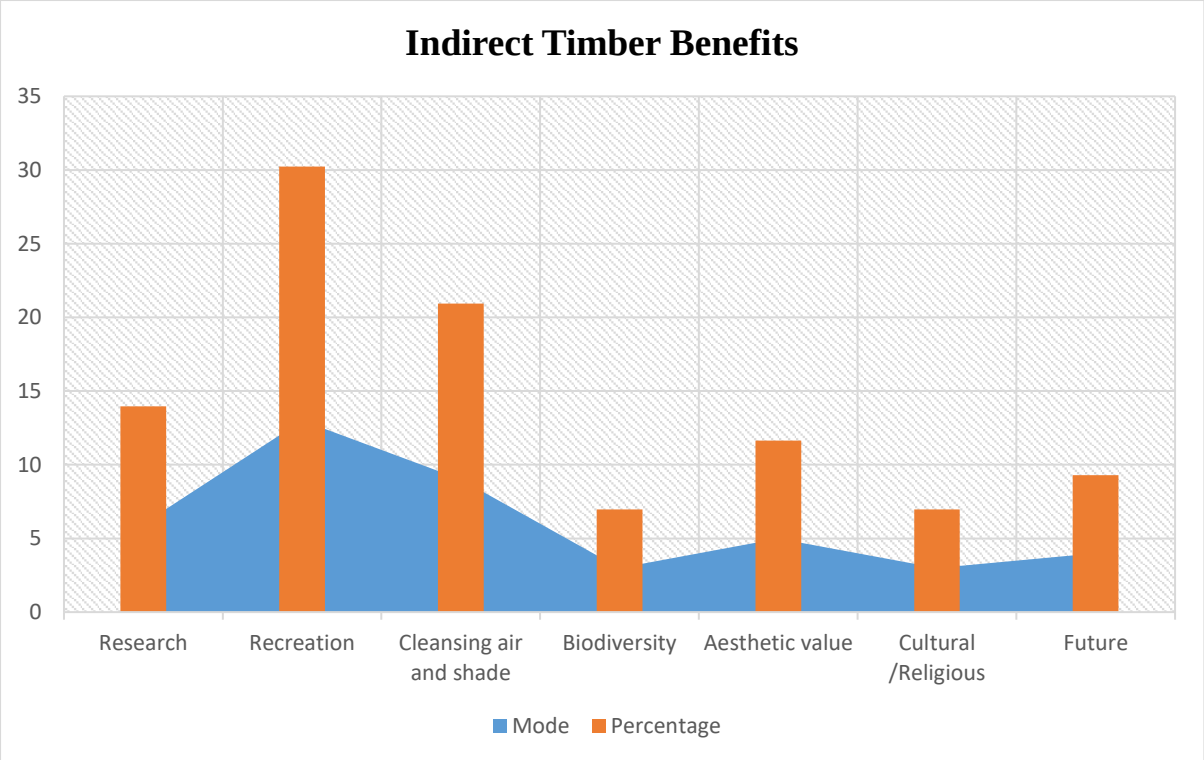
Key to achieving valuation figures that reflects the accurate economic position of a timber plantation farm, respondents insisted that one must be knowledgeable on timber species being valued in terms of rotation age, standard cultural practices, products that accrue from it, species associated cost of production and revenue. It emerged from the field survey that the most popular species in the study areas were blue gum and pine at 59% and 38% respectively. Despite of their high-water absorption rate, blue gum was still preferred to other species because of its fast growth rate and wide range of uses which are affordable ranging from timber, plywood, transmission poles, fencing posts, amongst others. Pine on the other hand, has longer rotation age and requires larger spacing of 2M x 3M to allow them grow outwards for a rotund appearance. Pine products were considered durable by farmers and therefore fetched higher prices compared to blue gum (4,000/= and 3,500/= for poles and logs respectively against 3,500/= and 2,500/= for blue gum).

Farmers noted that, adequate spacing for timber is important for their healthy and competitive growth. As found out from the survey, spacing will differ pegged on the end use of timber, for the areas of study, trees was majorly grown for production of timber logs and poles thus the spacing of 2Mx3M for pine 2Mx2.5M for blue gum, these are within the national recommended range by Kenya Forest Research Institute (KEFRI) guidelines, (2010). Other products such as charcoal and firewood were considered as additional benefits obtained from thinning activities. Also grown in the study areas though in small percentages, were; Nile tulip, Pink cedar and bastard yellowwood grown for their ornamental feature; Calliandra and Leucaena which fall under the class of fodder shrub and are mainly grown and used in the study areas for pasture or supplements for livestock feed in agro-forestry business. The study also found out that, regardless of the tree species, the field practices for timber production were standard and systematic from seedling and seedbed management to harvesting as shown in table 4.5 and the average cost of these standard cultural practices from the study areas was Kshs. 462,950/=

4.3.2 Indirect Timber Plantation Benefits

TABLE 4.7 INDIRECT TIMBER BENEFITS IN THE STUDY AREAS AND ASSOCIATED VALUE CONTRIBUTION

Indirect Benefits	Mode	Contribution to value in Percentage
Research	6	13.96
Recreation	14	32.56
Cleansing air and shade	9	20.93
Biodiversity	3	6.98
Aesthetic value	4	9.30
Cultural /Religious	3	6.98
Future	4	9.30



GRAPH 4.4 INDIRECT TIMBER BENEFITS IN THE STUDY AREAS AND ASSOCIATED VALUE CONTRIBUTION

Source: Author's Survey, (2019).

Besides economic benefits, timber plantations in the study areas also served important ecological and environmental functions and provided an important social base. Farmers asserted that a well-managed timber plantation can give a dependable source of income and subsistence items through the supply of direct and in-direct financial merchandise. Recreation and research benefits accounted for higher percentages compared to other indirect uses. The respondents attributed this to the increase in the rate of urbanisation and awareness to health precedence of a bustle lifestyle, forming a desire for outdoor recreation. Timber plantations as found out, provided an environment where it is feasible to abscond from modern stress and office researches, to interface with nature conversance. Recreation therefore, was the chief important non-timber service furnished by timber plantations. Research benefits contribution to value was at 13.96%, respondents stressed that the plantations are homes to many species besides the trees therein, the nature so created makes it a natural laboratory or research hubs for innovation, improvement and trial of new species thus earning the farmer an addition income.

Air cleansing, shade provision and biodiversity were also contributors to the non-timber benefits basket at 20.93% and 6.98% respectively. According to the respondents, trees decrease air temperature by stalling sunlight, further water evaporation from the leaf surface to form air vapour aid in eliminating heat energy from the atmosphere. Also called in the study areas as "natural air conditioner", trees help in settling out and trapping of dust and smoke from the air, they further block the unswerving heat from the sun and lower the speed of the winds that would otherwise suck the moisture. In addition, tree plantations also aid in cleansing the air by absorbing harmful gases. It also emerged that timber plantation provide homes to a wide range of other plants, animals and microorganism and the biodiversity so created have contributed to tourist attraction in the study areas. Trees also added attractiveness to the surroundings. Other indirect benefits that accrued from timber plantations from the study areas were cultural, religious and sustainability/future benefits. Few farmers (6.98%) indicated that they have dedicated some section of their forest land for worship, or performance of cultural rituals or family get together. Concerned with climate change and shrinking of water resources, some respondents (9.30%) have consequently, adopted sustainable timber plantation management, where for every tree cut, a replacement through planting of a new one is made. This was aimed at increasing timber plantation benefits, to address the society's demands in a way that conserves and keeps up forest environments for the benefit of the contemporary and the future generation

From the conceptual framework, these indirect benefits emerging from the study areas and their associated values can been summarized in table 4.8

TABLE 4.8 SUMMARY OF INDIRECT TIMBER PLANTATION BENEFITS AND THEIR CONTRIBUTION TO THE OVERALL INDIRECT VALUE

In-direct timber plantations benefits	**Benefit example from the study areas**	**Percentage**	**Ratio**
Non-Extractive Value	Recreation	13.95	5
	Research	32.56	
	Total	**46.51**	
Indirect Use Value	Cleansing air and shade	20.93	3
	Biodiversity	6.98	
	Total	**27.91**	
Non- Use Value	Cultural and Religious	9.30	2
	Aesthetic	6.98	
	Total	**16.28**	
Option value	Future	9.30	1

Source: Author's Survey, (2019).

The summary shows that each indirect benefit contribution to overall indirect value varies, and as one moves from non-extractive, to indirect use, to non-use and lastly to option use, the tangibility of the benefit and value contribution consequently reduces at a ratio of 5:3:2:1

4.3.2 Valuation Approaches for Timber Plantation

According to table 4.3, the common valuation methods for timber plantation in Kenya are; income, cost, sales comparable and total economic value. To establish accuracy, each valuation method has been worked out in the subsequent excel spread sheets in appendix 1. Values and accuracy of different fair value valuation methods as calculated in appendix 1 are as summarized in table 4.9.

TABLE 4.9 SUMMARY OF VALUES FROM THE VALUATION APPROACHES AND THEIR ACCURACY

Valuation Methods	Value Returned (Kshs.)	Accuracy
Income Method	175,650,000	$\frac{(175,650,000-164,785,000)*100\%}{164,785,000}$=6.6%
Cost Method	150,910,000	$\frac{(164,785,000-150,910,000)*100\%}{164,785,000}$=8.4%
Sales comparable	164,785,000	Benchmark

Source: Author's Survey, (2019).

According Australian Property Institute (2008), accuracy in valuation is described as the percentage error or closeness of valuation to the actual prices. That is to say, the closer the valuation is to the actual price, the more accurate it is. Any gauge of accuracy must consequently, be compared to actual sales within a reasonable period, same location and at arms-length transaction. While it's prudent to generate nil error percentage (100% accuracy), as a good practice, a value between 1%-15% is predominantly deemed to be acceptable accuracy (Australian Property Institute (2008). IVS 105 (6th April 2016), stresses that where market transactions information are available, the market approach should be the preferred valuation approach as it will return values that reflect the actual worth. Further, where applicable, sales comparables can be used as benchmark of accuracy for other methods because according to Wyatt (2007), the resulting values from using the approach are considered better because they relate to actual sales prices that reflects the current supply and demand conditions. As shown in table 4.9, income approach is more accurate than cost approach at 6.6%. However, since both resulting values are within the range of 1% to 15%, fair value valuation methods as recommended by IAS 41 (2014) were therefore accurate.

According to appendix 1, these methods focused only on the tradable timber products that enters the market such us poles, timber logs, firewood and charcoal with no consideration on non-timber benefits including but not limited to recreation, research, biodiversity, culture, air cleansing and sustainability. To attain the holistic timber value, it was found that there is need to employ a combination of both the market and non-market valuation methods such as travel cost and hedonic pricing model, this would result to total economic value (TEV). The aim of non-market valuation approach was to appraise the consumer's willing to pay or to accept compensation for receiving an undesired good or service from timber plantation. Travel cost method was favoured as it is grounded on what people actually pay and do on site instead of what they assume they would do in a theoretical circumstance. It is also relatively cheap to

employ in contrast to hedonic pricing method because people are conventionally glad to participate in on-site surveys (Ward and Beal, 2000). The value of the non-timber plantation benefit calculated using travel cost method was Kshs.73,140,000/=. The resulting total economic value is as shown.

TABLE 4.10 SUMMARY OF THE RESULTING TOTAL ECONOMIC VALUES

Valuation Methods		Value (Kshs)	Non market method (Travel Cost)	Total economic value (Market method + non-market method)	Contribution of Non-timber benefits (%)
Market method	Income approach	175,650,000/=	73,140,000/=	248,790,000/=	$\frac{73{,}140 * 100\%}{248{,}790} = 29.39\%$
	Cost approach	150,910,000/=	73,140,000/=	224,050,000/=	$\frac{73{,}140 * 100\%}{224{,}050} = 32.64\%$
	Sale comparable	164,785,000/=	73,140,000/=	237,925,000/=	$\frac{73{,}140 * 100\%}{237{,}925} = 30.74\%$

Source: Author's Survey, (2019).

From the table above, the non-timber plantation contribution to the total economic value as a percentage can be written as;

$$x = \frac{NMV * 100\%}{TEV}$$

Where x= percentage contribution by non-market benefits

TEV=is the total economic value

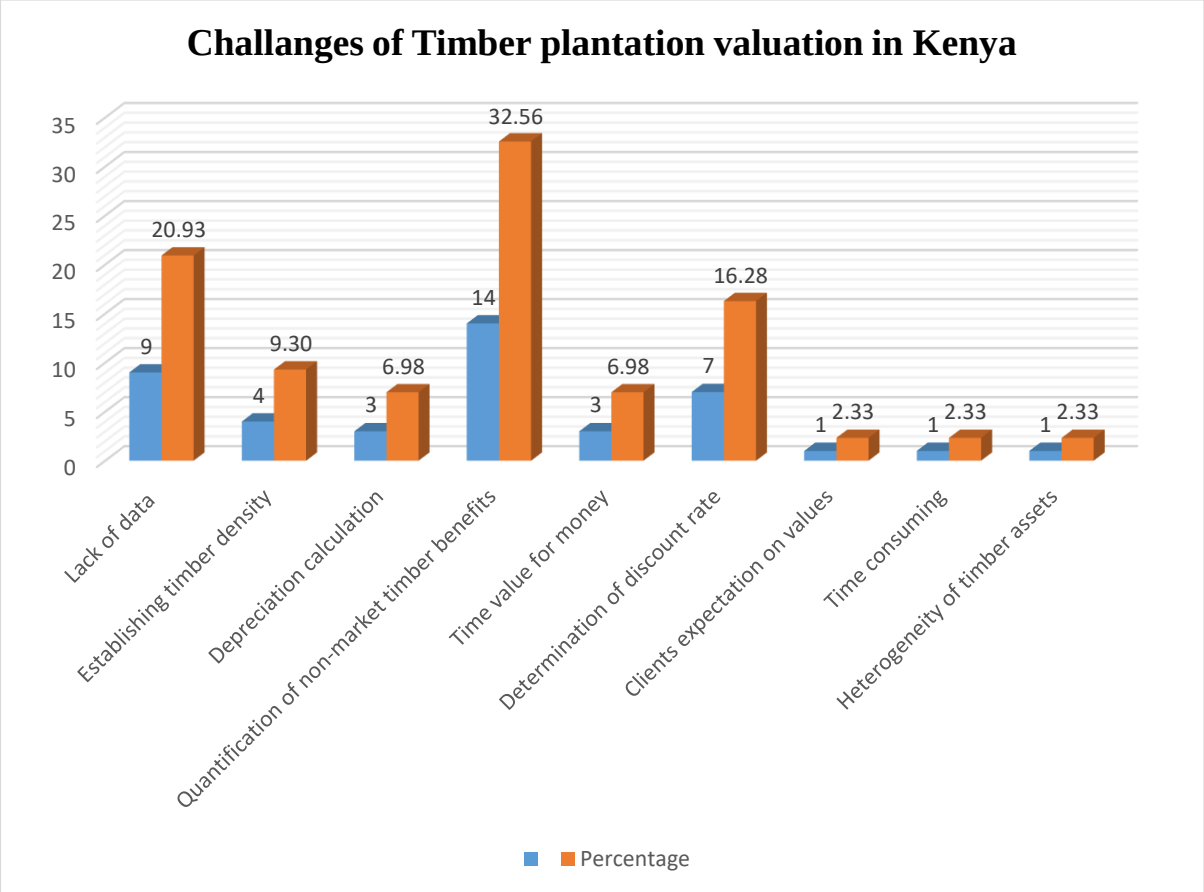
NMV =value of the non-tradable timber plantation benefits from non-market approaches

Worked out average percentage for non-timber benefits contribution to the plantation is therefore; .30.93% ((29.39%+32.64%+30.74)/3). Thus, for any value returned by the market approach, add an average of 30.93% which is the non-timber benefits contribution to the timber plantation values to get the total economic value.

4.3.3 Challenges of Timber Plantation Valuation in Kenya

TABLE 4.11 CHALLENGES OF TIMBER PLANTATION VALUATIONS IN KENYA

Challenges	Percentage
Lack of data	20.93
Establishing timber density	9.30
Depreciation calculation	6.98
Quantification of non-market timber benefits	32.56
Time value for money	6.98
Determination of discount rate	16.28
Clients expectation on values	2.33
Time consuming	2.33
Heterogeneity of timber assets	2.33
Total	**100**



GRAPH 4.5 CHALLENGES OF TIMBER PLANTATION VALUATIONS IN KENYA
Source: Author's Survey, (2019).

The greatest challenges to timber plantation valuation were quantification of non-market timber benefits and lack of data (32.56 % and 20.93% respectively). According to the informants, the understanding and knowledge on the dynamics of non-market timber benefits and how timber plantation functions is still limited, the apprehension on the connection between economics and environment is even indigent. Economics postulates one sense while the environment provides a different one and the major challenge is finding a way of making these logics compatible in order to quantify these benefits. A problem further compounded by their non-tradability. Valuers stressed that data and valuation are two inseparable items, proper valuation of timber plantation hence, depend on reliable and consistent information on the timber plantation resource. Information in this case, should be in both quantitative and qualitative incorporating physical and socio-economic components. In this sense, timber valuation and, environmental and social impact appraisals are closely related even if they are distinct in nature. Thus, without or limited information on the same, ascertaining accurate timber plantation values is major challenge. In addition, lack of information likewise on fundamental collaboration parameters and qualities makes it hard to choose the prevailing use or combination of uses that could yield the maximum social economic value for a specific timber plantation. The analysis further revealed that majority of tree farmers still rely on manual data storage which are usually subject to manipulation, theft or even misplacement, while Valuers on the other hand, though some had adopted computerized data storage, they don't readily share their data with their counterparts due to confidentiality and competition reasons.

Determination of appropriate interest rates and establishing tree density came third and fourth respectively (16.28% and 9.30%) as bottlenecks in timber plantation valuation. Informants argued that lack of uniformity in the interest rates adopted by different Valuers, was one of the utmost causes of disparities in values returned when income approach is used. They alluded this to volatility of inflation, interest and exchange rates especially in an upcoming market where small change in political environment causes a turbulence in an economy, hence forecasting these attributes of microeconomics variables with confidence is a difficult task. Common spacing for popular species of timber are 1,100 (3Mx3M) for pine and 2,222 (2.5Mx1.8M) or 2,000 (2Mx2.5M) or 1,667(2Mx3M) blue gum, but due to thinning activities and lack of systematic tree spacing guide and records, most farmers are unaware of the tree population in their respective plantation. Valuers are therefore tasked to estimate the timber density on their own. An interview with the Valuers revealed that establishing timber density is one of the crucial steps that enhances precision on the values returned, hence without an

actual data on timber density according some Valuers, will render valuation returned a mere estimate.

Time value for money and depreciation calculation also contributed to the challenges facing timber plantation valuation in Kenya at 6.98% each. Informants asserted that cost of establishing timber plantation is key to value determination as recommended by most of the valuation methods more so for cost approach. But a shilling spent on purchasing equipment or weeding may not be equivalent to a shilling today, thus straight-line addition of expenditure spent to establish the timber plantation is not appropriate. The major detriment thus, is how to take into account the change in cost or prices from the time of tree planting to the disposal period. According to them, the challenge of ascertaining attributes of time value for money will mean that the resulting values may not resemble the current market values especially when there is inflation in the economy. In addition, to arrive at the market value through cost method, depreciation allowed must be deducted for the buildings, plant and machinery, according Valuers, the depreciation assessments are often arbitrary and are difficult to derive from the market.

Other challenges according to the field survey were client's expectation on the values returned, time consumption as well as heterogeneity of timber assets. Even though these were ranked least at 2.33%, informants stressed that their impacts still have a bearing on the timely delivery of the valuation report besides contributing to the valuation conflicts especially when the client disputes the values returned. On the heterogeneity, the analysis showed that timber assets vary in terms of DBH (tree height and diameter at breast height), durability, environmental benefits contributed, marketability, colour and rotation age. Hence, one timber plantation may not be a replica of another. This according Valuers, is a major challenge when market approach is used because even if the comparable sales were available, their use would be limited. Cost approach, which is premised on estimation of the costs of improvements that is, current costs of reproducing or replacing the existing improvement or even trees can also be derailed by the heterogeneity challenge. Informants further stressed, determining the cost of replacing present improvements or timber plantation or providing suitable substitute, yet there may not be exact replicas for comparison due to changes in technology or location disparities, making cost approach impractical.

Another challenge that emanated from the survey is that, timber plantation valuation is a tedious process since a Valuer has to capture detailed information ranging from revenue data, historical cost information, rate of return, time and expenditure on each of the cultural activity, issuance of questionnaires to determine willingness to pay or accept amongst others. These

according to Valuers, require a lot of time and dedication and despite of all the efforts, the exercise may be futile in cases where the client disputes the figures returned. It was noted that environmental assets, timber plantations included, are very emotive and divisive subjects with different stakeholders having their own opinion on how benefits should be quantified or captured, some even viewed benefits that accrued from timber plantations as priceless. Matching these expectations is therefore a dire task. Some clients as found out, would go an extra mile to manipulate the information on cost of production or any relevant revenue, just to get values that conform to their expectation.

CHAPTER FIVE
CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

The research was seeking to evaluate methods employed in the valuation of timber plantations in Kenya. The research was aimed in achieving the following;

1. To identify timber plantation valuation methods in Kenya.
2. To evaluate their accuracy in determining timber plantation values
3. To identify challenges and constrictions of timber valuation in Kenya
4. To recommend appropriate mechanisms to enhance timber plantation valuation

The chapter presents a summary of findings, conclusions of the study and recommendation.

5.1 Research findings summary

Four (4) valuation methods were found to be used in the valuation of timber plantation in Kenya, namely; cost, income, sale comparable and total economic value. The major determining factors for choosing either of the method were the purpose of valuation as well as data availability. Income approach was the most dominant method used in timber plantations valuation because timber farms are associated with the ability to generate a stream of future income and with properly kept revenue and cost data, the method is straight forward as it involves capitalizing the net income with the appropriate rate to ascertain the present worth. The major challenge of this method was how to determine appropriate discount rate.

Sales comparable as found out from the study, is premised on the principles of demand and supply while its accuracy is pegged on availability of recent sales data and vibrant timber products and timber farm market. It is probable that a reasonable investor will pay a price that is equal or lower to a comparable timber plantation or timber product. Resulting value from sale comparable therefore, should be able to convince the investor the extent of comparison that will entice the investor to pay more, equal or less than the comparable timber farm. The major detriment to this approach was the heterogeneity of timber products and limited recent sales data. Cost approach on the other hand was found to be guided by the principle of substitution, that is, any prudent investor is not expected pay more than what it takes to produce a substitute timber farm or the cost of production. To value timber plantation, the method proceeds by summing up land value to the expenditures on establishment and improvement less the accrued depreciation. The fundamental weakness of the approach as found out, was

that, cost generally did not equal value and it also failed to acknowledge investors' entrepreneurial intentions.

Lastly, the method employed to value timber plantation was total economic value method. The method as found out, emerged as a response to the perception that the above fair value valuation methods habitually viewed the value of the plantation solely on raw materials and physical products generated for consumption, trade and commercial profits. It was argued that this persistently led to under-valuation of timber plantation goods and services resulting to economic suboptimal outcome and, in the worst case, loss to environmental cover. Total economic value as such, is a hybrid valuation method that takes into account full range of characteristics within timber plantation as an integrated system. The method proceeds by first valuing the physical products that enter the market using the market approaches namely income, cost or sales comparable. The resulting value from either of the adopted market approaches are then added the indirect timber plantation values obtained using non-market methods such as travel cost or hedonic price model which generally measure values in terms of what resource users or society at large are willing to pay or accept for the commodity. Quantification of non-market timber benefits, the understanding and knowledge on the dynamics of non-market timber benefits were found to be the greatest limitation to this approach. Moreover, the apprehension on the connection between economics and environment was also found to be poor. It is worth noting that the method was thumped up for its ability in measuring and comparing the various benefits of timber plantations making it a reliable valuation method and a powerful tool to encourage wise use and management of resources.

While efforts were devoted to achieve accuracy in timber plantation valuation, the study revealed that the extent of accuracy should be subject to the actual sales within a reasonable period, same location and at arms-length transaction, and the further the valuation departs from the actual sales, the less accurate it becomes. Using sale comparable as the benchmark as it replicates actual sales, the other two fair valuation methods namely income and cost approaches were found to be accurate since the resulting values fell within the allowable 1%-15% acceptable accuracy levels as recommended by Australian Property Institute (2008). Despite of these methods meeting the accuracy test, they however only captured the tangible tradable timber products with no consideration on non-timber benefits. To attain the holistic timber value, the study found need to employ a combination of both the market and non-market valuation methods this would result to total economic value (TEV) which aims to incorporate both the direct and indirect timber plantation values. Timber plantations were found to offer an extensive range of goods and services, which were grouped into direct use benefits and indirect

use benefits. The value contribution of the indirect timber plantation benefits was further grouped into 4 classes namely; Non-Extractive Value, Indirect Use Value, Non- Use Value and Option value. The study found out that the value contributed by each of these classes are not uniform and as one move from the former to later, less tangible the non-timber benefits becomes and the value contribution also reduces consequently at a ratio of 5:3:2:1.

Quantification of non-timber benefits and lack of adequate data were the greatest challenges to timber plantations valuation. That difficult task of quantifying these indirect benefits was further compounded by the lack of knowledge on the role played by timber plantation in the ecosystems and on their impact on the social-economic stability and sustainability. Valuation for any purpose was dependent on the availability of reliable information, lack of which would jeopardize the accuracy of the values returned, majority of the farmers still relied on manual data storage which can be subject to manipulation, theft and misplacement. Determination of appropriate interest rates and establishing tree density were also found to be hindrances to timber plantation valuation. Lack of uniformity in the interest rates adopted by different Valuers, was one of the utmost causes of variation in values returned when income approach is used. Poor records on tree density, would mean that a Valuer is expected to calculate the total number of trees in a particular farm, and this could be a tedious process especially where spacing standards are not uniform or where some section of the farm are inaccessible. Establishing timber density as revealed by the study, was one of the crucial steps that enhances precision on the values returned, hence without an actual data on timber density, values returned will be regarded as a mere estimate.

Timber plantations valuations were also hindered by time value factor and difficulty in determining depreciation. A shilling spent in the past in purchasing equipment or weeding may not be equivalent to a shilling today, thus straight-line addition of expenditure spent to establish the timber plantation is not appropriate, the major detriment thus is how to take into account the change in cost or prices (due to general inflation for example). In addition, to arrive at the market value through cost method, depreciation allowed must be deducted for the buildings, plant and machinery. However, depreciation assessments as found out, are often arbitrary and are difficult to derive from the market. Other challenges were client's expectation on the values returned, time consumption as well as heterogeneity of timber assets. All these were found to have a bearing on the timely delivery of the valuation report besides contributing to the valuation conflicts especially when the client disputes the values returned. Timber assets are not homogeneous; thus, one timber plantation may not be a replica of another, these limited the use of sale comparable and cost method which entails comparing like for like or replacing

present improvements or timber plantation or providing suitable substitute, yet there may not be exact replicas. Timber plantation valuation also require detailed information ranging from market data to willingness to pay or accept amongst others, this could be a tedious process and exercise in futile in cases where the client disputes the figures returned. Moreover, the research revealed that environmental subject is very emotive and different stakeholders would have their own opinion on how benefits should be quantified or captured, some even view the benefits that accrue from timber plantations as priceless; matching these expectations is therefore a dire task. Client in some occasions would go an extra mile to manipulate the information just to get values that conform to their expectation.

5.2 Assessment of the research propositions

The study propositions were;

i. Fair valuation methodologies are widely used by Valuers to value timber plantation in Kenya.
ii. Fair valuation methodologies are accurate and they capture the timber plantation values entirely.

Through the findings of the study, it has been established that fair valuation methods namely income, cost and sales comparables are the most popular approaches used to value timber plantations in Kenya, cumulatively accounting for 90.69% of the valuation methods adopted in Kenya. Further, the research established that these methods are accurate since the resulting values had an accuracy range of 6.6% to 8.4% and are within the acceptable accuracy range of 1% to 15%. These methods however, only considered the direct benefits of timber that were traded in the market, and ignored the non-timber benefits which was found to have a significant contribution to timber plantation value of about of 30.93%.

5.3 Conclusion

In conclusion, despite all the concerns and challenges associated with each of the valuation methodology, one is able to state, without equivocation, that there are two major categories of valuation methods used to assess the values of timber plantations in Kenya. These are, market also known as fair valuation methods or direct methods, and non-market methods also referred to as indirect approaches. The direct methods use the information provided by the markets in relation to physical timber plantation products and the category includes; the cost, income and comparable approaches. Indirect methods on the other hand, are used for timber

plantation products that are neither tangible nor tradable in the commercial market and are premised on people willingness to pay or accept. This category includes the non-market valuation methods such as travel cost and hedonic pricing model. Selection of a method in either of the categories solely pegged on the reason for valuation. But whichever method selected, the usefulness and accuracy of results depend on how well it is applied, information available, Valuer's skills, judgment, and practical experience.

Though the direct methods return values that are within the recommended accuracy margins especially for tradable timber products, they are not wholistic as far as non-tradable timber plantation product are concerned. A wholistic method is therefore, Total economic value method which is a hybrid methodology that combines both the direct and indirect methods and is able capture all timber benefits whether physical on non-physical (as clearly illustrated in the valuation process in data analysis). It is worth noting that Valuation is not a remedy to handle all timber plantation associated problems. As such, even if estimated values are higher, there is no assurance that forest will be preserved or preferred to other competing land uses. An all-inclusive valuation methodology however, can be a constructive technique that provides crucial guide and information to all the decision makers.

Finally, though value is defined as worth, desirability or utility, the work of the Valuer by virtue of his/her training, deals only with that concept of value in exchange or utility existing between the asset to be valued and other related properties or environmental utilities. In the light of this, we can argue that, Valuers may not wholly quantify all that is considered to contribute to value, but the methods help Valuers support professional judgment by factual and sound reasoning.

5.4 Research recommendation

The following are the recommendations so as enhance timber plantation valuation in regard to finding.

1. **Emphasis on the use of total economic value**

An of appropriate and accurate valuation techniques for any given timber farm needs both judgement, skills and experience. It is imperative that the valuation assess the cost, time taken to collect, process, analyse and present results, funds and human resources available. If for any reason any important attribute for successful valuation cannot be put up due to cost, skills needed or other reasons, the entire exercise may be curtailed. To capture all the timber plantation benefits, the emphasis is to come up with the total economic value (TEV). Though

not classified as a valuation method, its calculation is considered reliable, wholistic and appealing since it takes in account all round timber plantation benefits by conceptually aggregating (i) total use value (TUV) and (ii) total non-use value (TNV). All factors held constant, for timber plantation offering both the direct and indirect benefits, total non-use value (TNV) will account for an average of 30.93%. Total economic value therefore is the value obtained from the market approach added to the percentage contribution by indirect benefits (i.e. 30.93%).

2. Use of adjusted risk factor

Timber plantations are subject to a wide range of risks, from climatic threats such as droughts, to fire threats, pest and diseases infestation, inflation, to change in governmental policies amongst other. These uncertainties may have an impact on future returns thus must be accounted for in the valuation especially when income approach is used. One method to incorporate these risks which will also help in discount rate determination is to use an adjusted discount rate that reflects the added risk of timber plantation above the risk free discount rate, starting with the recently introduced risk free infrastructure bond at 12.2%, rate for 364 days T-bills which is 9.371% and β_{stock} for companies dealing in similar products in the security exchange, thus minimum risk rate of 14.8% per annum is recommended for timber valuation.

3. Creation of database management system (DBMS)

This is prearranged data stored and retrieved electronically from a computer system. Availability of data was one of the major challenges of timber plantation valuation, majority of the farmers still relied on manual data storage which could be subject to theft or manipulation. Some Valuers had also had not fully computerized their information system. Database management system ensures data stored is accurate and can easily be retrieved and cross-referenced. Database system created for timber plantation should include at least the following information; land size, varieties of trees grown, dates of each of the standard practices, tree spacing adopted, cost associated, projected yields, revenue accruing and values retuned if any. DBMSs provide various functions that allow valuation to be hastened as it enables quick data definition, data updating, retrieval and administration.

4. Need for civic education and networking

The Institution of Surveyors of Kenya (ISK) should do civic education and include timber plantation assets valuation in their Continuous Professional Development (CPD) programmes, in order to update Valuers on the changing trends in forest sectors and their respective valuations. Valuers need to be exposed and educated through seminars or workshops on environment and ecosystem valuations so as to sharpen their skills to achieve diversification and shift from already dominated land and building valuations. These programmes shall enable them to be conversant with; tree species, their rotation ages, tree pest and diseases, standard practices for each species, tree products amongst others. All which will enhance their ability in carrying out a valuation from an informed point of reference.

5. Need for due diligence in valuation

Valuation through this research has revealed not to be an exact science but it serves to narrow down too many imponderables where it is humanly possible to do so. Hence, even if the client's expectation on the value may not conform to the values given by the Valuer, the respective Valuer should stand by the values so long the valuation methodology adopted is justifiable. Valuers should provide explicit analysis clearly identifying and documenting all assumptions, documenting facts and supporting data necessary to achieve valid and reliable values. Use of sophisticated tools such as graphs, aerial photographs, GIS maps and coordinates for report presentation is recommended. To account for deprecation, a Valuer must be familiarized by the life span and allowed rate of diminution for each class of asset. Valuation of timber plantation should thus follow five steps summarized as follows;

Step 1 Instructions - source of the instructions and date instructions. Depict from the instruction terms of reference and the purpose of the valuation.

Step 2 Identification – use map and Google earth to locate the timber farm. Gather information about characteristics of the timber farm for ease of valuation

Step 3 Timber plantation inspection- check for boundaries, trees grown, ages, any pest or disease infestation, developments that support the farm, access roads within the farm, identify both timber and non-timber benefits of the plantation.

Step 4 Market data collection and valuation analysis- market data necessary for timber plantation valuation are; actual purchase/sale price for timber products, money spent on

the plantation, number of visitors at the plantation, cost of production and other expenditure, expected yield and rate of return. State the valuation methodology adopted and clearly state the limiting condition and assumptions made.

Step 5 Report writing and presentation- The valuation report writing is the final step in the valuation process. The report is the product through which the output of the valuation process is relayed to client. The report should be in a logical and readable manner since it is what the Valuer sells to the clients as the finished evidence of the result of the investigation, research and analysis. The final component of the report is an expression of the value opinion by the Valuer and a signature of the Valuer responsible for the value conclusion. Attachments on the report such as copy of the official title search certificate, coloured photographs of the plantation and any other useful documentation are recommendable.

5.5 Area of further research

Further research should be done in the following areas;

1. The applicability of hedonic pricing model in determining timber plantations values
2. Critical comparison of multi-parametric approach and total economic value in timber plantations valuation.
3. Investigation on the non-use of arbitrary methods in timber plantation valuation in Kenya.

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APPENDIX 2: COVER LETTER TO THE QUESTIONNAIRES

UNIVERSITY OF NAIROBI

COLLEGE OF ARCH.AND ENG.
SCHOOL OF BUILT ENVIRONMENT
DEPT.OF REAL ESTATE AND CONSTRUCTION MANAGEMENT
MASTERS OF ARTS IN VALUATION AND PROPERTY MANAGEMENT

Dear Sir/Madam,

RE: FIELD SURVEY QUESTIONNAIRE, 2018/2019.

Attached is a questionnaire to aid in a research conducted by Elisha Ochieng Ojijo, a student at the University of Nairobi. The topic of the study is **Valuation of Timber Plantation, a Case Study of Elburgon, Kaptumo and Sitoi Tea Estate**.

Kindly fill in the blank spaces provided after every question or where appropriate, tick in the bracket provided.

Your assistance and cooperation will highly be appreciated.
Yours sincerely,

Elisha Ochieng Ojijo.
***Declaration*: The information given in the questionnaires as well as your identity shall be treated with utmost confidentiality and shall be used only for this research and not for any purpose.**

APPENDIX 3: QUESTIONNAIRES

UNIVERSITY OF NAIROBI

Questionnaire Administered to Valuers

Preamble

My name is **Elisha Ochieng Ojijo**, a final year student at The University of Nairobi pursuing Masters of Arts in valuation and property management. I would like to request for assistance in data collection for my research project entitled; **Valuation of Timber and Timber Products in Kenya-Case Study of Elburgon, Kaptumo and Sitoi Tea Estate.**

(Kindly answer by ticking the appropriate option (if provided), also fill or provide written answer/comment for the open-ended questions appropriately and accurately. All information will be treated with strict confidence. Thank you in advance for your co-operation.

Section A; General Information

Instruction; kindly tick within the bracket

1. Details of the Valuer
   i) What is the name of your organization? (Optional)

……..

……

……

ii). Qualifications

a) MISK Yes ( ) No ( )
b) RV Yes ( ) No ( )
c) GMISK Yes ( ) No ( )
d) Others (specify)……..

iii) Professional experience/Years of practice.....

Section B; Critical Examination of Timber valuation Methods

2 a) Have you ever carried out timber plantation valuation?

Yes ( ) No ( )

b). if yes, where was the location of the plantation?

……..
……
……

3) What are the most common purposes of timber plantation valuation (rank them from 1-8. 1 being the least common and 8 being the most common purpose)

a) Sales and purchases ( )
b) Company book value ( )
c) Leasing ( )
d) Agricultural cess ( )
e) Mortgage and other risk protection ( )
f) Investment ( )
g) Compulsory acquisitions ( )
h) Others

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

4). What valuation method did you use to carry out the valuation for each of the above Purposes?

a) Sales comparable ( )
b) Income approach ( )
c) Cost method ( )
d) Multi- parametric approach ( )
e) Conversion return Method ( )
f) Fixed royalty approach ( )
g) Value related charges approach ( )
h) Auction prices approach ( )
i) Total economic value ( )
j) Others

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

5) Give reason(s) and shortcoming(s) for adopting a particular method for each purpose

a) Sales comparison approach

i). Reason(s)

……

……

ii) Shortcoming (s) of this approach

……

……

b) Income approach

i) Reason(s)

……

……

ii) Shortcoming (s) of this approach

……

……

c) Cost approach

i). Reason(s)

……

……

ii) Shortcoming (s) of this approach

……

……

d) Multi- parametric approach

i). Reason(s)

……

……

……

ii) Shortcoming (s) of this approach

……

……

e) Conversion return Method approach

i). Reason(s)

……

……

ii) Shortcoming (s) of this approach

……

……

f) Fixed royalty approach

i). Reason(s)

……

……

ii) Shortcoming (s) of this approach

……

……

g) Value related charges approach

i). Reason(s)

……

……

ii) Shortcoming (s) of this approach

……

……

h) Auction prices approach

i). Reason(s)

……

……

ii) Shortcoming (s) of this approach

……

……

i) Total economic value

i). Reason(s)

……

……

ii) Shortcoming (s) of this approach

……

……

j) Others

i). Reason(s)

……

……

ii) Shortcoming (s) of this approach

……

……

6) Comment on the accuracy of each of these methods in valuing timber plantation.

a) Sales comparison approach

……

……

b) Income approach

……

……

c) Cost approach

……

……

d) Multi- parametric approach

……

……

e) Conversion return Method

……

……

f) Fixed royalty approach

……

……

g) Value related charges approach

……

……

h) Auction prices approach

……

……

i) Total economic value approach

……

……

j) Others

……

……

7 a) In the valuation, did you capture the benefits that are not traded in the market?

Yes ( ) No ( )

b). if yes, how did you incorporate these benefits?

……..
……
……

b). if no, give reason(s) for your answer?

……..
……
……

Section C; Challenges of Timber Plantation Valuation

8) What are the challenges faced in Timber plantation valuation?

……
……
……

9 a). In general, how can these challenges be mitigated?

……
……
……

b). In your opinion what can be done by valuers to address these constraints?

……
……
……

10) What mechanisms would you recommend to be adopted to enhance to Timber plantation valuation?

……
……
……

THANK YOU FOR YOUR COOPERATION

APPENDIX 4: QUESTIONNAIRES

UNIVERSITY OF NAIROBI

Questionnaire Administered to Tree farmers

Preamble

My name is **Elisha Ochieng Ojijo**, a final year student at The University of Nairobi pursuing Masters of Arts in valuation and property management. I would like to request for assistance in data collection for my research project entitled; **Valuation of Timber and Timber Products in Kenya-Case Study of Elburgon, Kaptumo and Sitoi Tea Estate.**

(Kindly answer by ticking the appropriate option (if provided), also fill or provide written answer/comment for the open ended questions appropriately and accurately. All information will be treated with strict confidence. Thank you in advance for your co-operation.

Section A; General Information

Instruction; kindly tick within the bracket

1. Details of the farmer/farm

i) What is the name of your timber farm/plantation? (Optional)

……..

ii). What is the size of your timber plantation?……

iii) How long have you owned/operated the timber plantation? ……

2. (i) What variety(ies) of tree do you grow in your farm?

……

(ii)Why have you chosen that variety (ies)?

……..

……..

iii) What is the specification (s) of the above variety (ies)?

……..

……..

iv) Any other comment on the variety ....…….

Section B; Critical Examination of Timber Plantation Standard Cultural Practices and Production Cost, Revenue and Values

3. (i) What are the general standard cultural practices associated with timber plantation establishment?

.....

.....

.....

.....

.....

.....

.....

.....

(ii) How much did you spend in each of the above cultural activities?

.....

.....

.....

.....

.....

.....

.....

(iii) Comment on any other additional expenditure besides the standard activities expenditure

.....

.....

.....

3.(i) What is the average yield of timber products per hectare?

.....

.....

(ii) What is the selling price of the above timber product?

.....

.....

4. i) Besides the physical timber plantation products, what other benefits does timber plantation generate?

.....

.....

.....

.....

ii) Comment on the above benefits?

.....

.....

.....

.....

5.i) Have you ever engaged a valuer to carry out a valuation of your farm?

Yes ( ) No ( )

(ii). If No, why?

.....

.....

.....

(ii). What were the challenges of the valuation process?

.....

.....

.....

.....

.....

(iii). what would you recommend to curb the above challenges in your opinion?

.....

.....

.....

.....

THANK YOU FOR YOUR COOPERATION

APPENDIX 5: QUESTIONNAIRES

UNIVERSITY OF NAIROBI

Questionnaire Administered to Plantation Visitors

Preamble

My name is **Elisha Ochieng Ojijo**, a final year student at The University of Nairobi pursuing Masters of Arts in valuation and property management. I would like to request for assistance in data collection for my research project entitled; **Valuation of Timber and Timber Products in Kenya-Case Study of Elburgon, Kaptumo and Sitoi Tea Estate.**

(Kindly answer by ticking the appropriate option (if provided), also fill or provide written answer/comment for the open ended questions appropriately and accurately. All information will be treated with strict confidence. Thank you in advance for your co-operation.

Instruction; kindly tick within the bracket

1. Details of the visitor
   i) Residence ( )
   i) Non- residence ( )

   iii).Age of the visitor
   1-10 years ( )
   11-20 years ( )
   21-35 years ( )
   Above 35 years please specify**.....**

   iv). What is your approximate monthly income (in Kshs.)?
   Below 10,000/= ( )
   10,001-30,000/= ( )
   30,001-50,000/= ( )
   Above 50,000/= please specify **.....**

2. i) Where is your residence?

.....

(ii) How far is your residence to the timber plantation?

0-15 Kms ( )
15-30 Kms ( )
31-45 Kms ( )
Above 45 Kms please specify .....

3. i) What means of transport did you use to travel to the timber plantation?

.....

(ii) How far is your residence to the timber plantation?

0-10 Kms ( )
11-20 Kms ( )
21-30 Kms ( )
Above 30 Kms please Specify.....

(iii) How much did you spend to travel (in Kshs.)?

0-100 ( )
101-200 ( )
201-300 ( )
Above 300 please specify .....

4. What is the reason(s) for visiting the timber plantation?

.....

.....

.....

5. How many times do you visit the plantation in a year?

.....

6. How long do you stay in the plantation?

.....

7. How much do you spend on the plantation (in Kshs.)?

0-200 ( )
201-400 ( )
401-500 ( )
Above 500 please specify ….....

8. Any other comment?

.....

.....

.....

THANK YOU FOR YOUR COOPERATION

APPENDIX 6: INTERVIEW SCHEDULE TO VALUERS

Section A; General Information

1. Details of the Valuer
   ii). Qualifications
   iii) Professional experience/Years of practice

Section B; Critical Examination of Timber valuation Methods

2 a) Have you ever carried out timber plantation valuation? Yes ( ) No ( )
b). if yes, where was the location of the plantation?

3 What are the most common purposes of timber plantation valuation (rank them from 1-8. 1 being the least common and 8 being the most common purpose)

Sales and purchases	( )
Company book value	( )
Leasing	( )
Agricultural cess	( )
Mortgage and other risk protection	( )
Investment	( )
Compulsory acquisitions	( )
Others (specify)	

4). What valuation method did you use to carry out the valuation for each of the above Purposes?

Sales comparable	( )
Income approach	( )
Cost method	( )
Multi- parametric approach	( )
Conversion return Method	( )
Fixed royalty approach	( )
Value related charges approach	( )
Auction prices approach	( )
Total economic value	( )
Others (specify	

5) Give reason(s) and shortcoming(s) for adopting a particular method for each purpose

6) Comment on the reliability of each of these methods in valuing timber plantation.

7) In the valuation, how did you capture the benefits that are not traded in the market?

Section C; Challenges of Timber Plantation Valuation

8) What are the challenges faced in Timber plantation valuation?

9). In your opinion what can be done by valuers to address these constraints?

10) What mechanisms would you recommend to be adopted to enhance Timber plantation valuation?

APPENDIX 7: INTERVIEW SCHEDULE FOR TIMBER FARMERS

1. Details of the farm
   i) What is the name of your farm? (Optional)
   ii). What is the size of the farm?

2.i) What variety (s) of trees do you grow?
ii) What are the specifications of the above variety (ies)?

iii) Comment on the above specifications

Section B; Critical Examination of Timber Plantation Cultural Practices and Production Cost and Revenue

3.(i) What are the general standard cultural practices associated with timber plantation establishment?

(ii) How much did you spend in each of the above cultural activities?

(iii) Comment on any other additional expenditure besides the cultural activities expenditure

4.(i) What is the average yield of timber plantation products per hectare?

(ii) How much do they sell for?

5. i) Besides the physical timber plantation products, what other benefits does timber plantation generate?

ii) Comment on the above benefits?

6i) Have you ever engaged a Valuer to carry out a valuation of your farm?

Yes ( ) No ( )

(ii). If No, why?
(ii). What were the challenges of the valuation process?
(iii). What would you recommend to curb the above challenges in your opinion?

7. What is the average selling price of a hectare of land in the neighbourhood? with and without trees

THANK YOU FOR YOUR COOPERATION

APPENDIX 1

TIMBER PLANTATION VALUATION METHODS

Consider the following example of one of the sampled farmer having 148.7Ha of land of tree plantation

Farm specification

1. size of the farm(Ha)	148.7	
2. Tree species	Blue gum, pine and calliandra	
3.Plantation Blocks	Trees are set within 5 blocks of varying ages	
	Block 1: Blue gum 10 years old	
	Block 2: Pine 12 years old	
	Block 3: Calliandra 4 years old	
	Block 4: Blue gum 8 years old	
	Block 5: Pine 23 years old	
5.Block sizes (Ha):	Block 1	35.8
	Block 2	21.4
	Block 3	7
	Block 4	32.5
	Block 5	21.4
	Total	**118.1**
6.Roads,Path and Central Park		30.6

From the Field Survey the researcher established as follows;

a) Thinning Schedule

Pine Age	Thinning / resulting density		Blue Gum Age	Thinning / resulting density	
0		1,667	0		2,000
17	1st	1,100	5	1st	1,600
20	2nd	950	8	2nd	1,400
23	3rd	750	12	3rd	1,300
26	4th	600	15	Harvesting	
28	Harvesting				

b) Varieties grown and specification

Common Varieties	Average Rotation Age	Average Maturity Height	Most Popular Density Per Ha (Stem/Ha)
Blue gum	15	45	2,000 (2Mx2.5M)
Pine/ cypress	28	30	1,667 (2Mx3M)
Others	7	15	1,212 (2.5Mx3.3M)

c) Standard cultural practices and average costs

Standard Practices	Average Cost Per Ha (Kshs.)
Seedling and seedbed manage	135,000
Land Preparation	78,190
Planting	44,500
Weeding	66,660
Fertilizer application	12,500
Thinning and pruning	22,000
Pest and diseases control	27,500
Harvesting and transportation	76,600
Total Average Cost	**462,950**

d) Prices and Yield of Direct timber Plantation Benefits per Hectare

Plantation Products	Average Yield/Ha		Average price/unit (2018-2019 in Kshs.)
Timber Logs	Blue Gum	910	2,500/=
	Pine	480	3,500/=
	Others	413	1,500/=
Firewood	$472m^3$		150/=
Poles	Blue Gum	260	3,500/=
	Pine	120	4,000/=
Charcoal	178 bags		2,000/=

Income Valuation Proceeds as follows

Step 1. Assumptions Made

1. Data used reflect typical or representative of the study areas
2. Management, timber plantation characteristics, standard practices and all the prices are typical
3. The valuation takes into account the expected future timber plantation benefits, extraction, expected revenues, and specific operation costs.
4. All the costs and revenues have been projected at the current prices.
5. All factors at ceteris paribus, the adopted Risk Rate have captured all risk associated with timber plantation
6. The entire plantation will reach their respective maturity rotation age

Step 2. Determination of Discount Rate

Timber Plantations are subject to a wide variety of risks that should be accounted for in the value analysis. One method to include risk into discount cash flows value analysis is to use an adjusted discount rate that reflects the added risk of a the plantation, over and above the risk free discount rate. Starting with the recently

introduced risk free Infrastructure Bond at 12.2 percent per annum and rate for 364 days T-bills which is 9.371%

Other methods of coming up with the approriate rate according to (Carlson,2007) Include;

1. Opportunity cost of money
2. Capital + risk premium
3. Captial Price Model
4. Weighted average cost of capital

For most agricultural entities, Carlson (2007), further recommends the following formula

$$R = RFR + \beta_{stock} (R_{market} - RFR)$$

Where;

R is the the required rate of return, or expected return

RFR is the risk free rate

βstock is the beta of the stock

R_{market} is the return of the market as a whole

(R_{market} - RFR) is the market risk premium, or the return above the risk-free rate to accommodate additional unsystematic risk

(http://www.investopedia.com/articles)

Guided by the above formula, the dertmined discount rate proceed as below;

i) Determining RFR

Risk free rate in Kenya can be equated to infrastructure bond which is at 12.2 percent or the rate for 364 days T-bills which is 9.371% (centralbank.go.ke)

ii) Determining β

According to Magni (2013), if the company/entity is not publicly traded, you can gauge its performance with similar companies.

Using this guide, the researcher looked at the the β for Kakuzi, Williamson Tea Co.Ltd and Sasini which are 0.56, 0.65 and 0.73 respectively(live.mystock.co.ke) this averages at;

(0.51+0.69+0.67)/3

0.62

iii) Determining R_{market}

The return of the market as a whole in the year ended 2018 according to NSE Press Breafing January (2019), is 13.5%

Thus restructuring the formula

R=12.2%+0.62(13.5%-9.371%)

0.147606

Say **R=14.8%**

		1) INCOME VALUATION METHOD						
		Block 1 Valuation						
	1	**10 Years old Blue gum in Block 1**						
		These are yet to be harvested, 5 years remaining to maturity.						
		Since the trees are almost mature, it was obtained from the interview that the losses						
		expected through diseases, pest or any other risk should be minimal, approximately 10%						
		and also recurrent expenditure (RE)such as wages and salaries for the plantation is 5%						
		Expected average timber log yield for blue gum per Ha					910	
		Current log price for blue gum					2,500	
		Revenue from timber logs sales per Ha					2,275,000	
		Expected average poles per Ha					260	
		Current price for untreated blue gum poles					3,500	
		Revenue from poles sales per Ha					910,000	
		Total Revenue					**3,185,000**	
		Less losses @ 10% + 5% of RE					2,707,250	
		Less cost of production (from standard practices)					462,950	
		Total expected revenue from 1 Ha of Block 1					2,244,300	
		Total value from Block 1(Call it A)					**80,345,940**	
		This the value in five years time, defer it/ discount it to						
		get the value now (as at the time of valuation) using the formular below						
			$PV = A(1+r)^{-n}$					
			Where;					
			PV is the present value					
			r is the interest rate					
			n is the time					
			Hence the value of the blue gum as at now					
			A in our case		80,345,940			
			r (as determined above)		14,8%			
			n (is the remaining period)		5			
			Hence the present value of blue gum in Block 1				80,345,940(1+14.8%)^-5	
								40,295,309
		Block 2 Valuation						
	3	**12 Years old pine in Block 2 Pine**						
		These are yet to be harvested, 16 years remaining to maturity.						
		Since the trees are almost half to maturity age, it was obtained from the interview that the						
		loss expected through diseases, pest or any other risk should be minimal, approximately 15%						

		Expected average timber logs yield for pine per Ha		480	
		Current log price for pine		3,500	
		Revenue from timber logs sales per Ha		1,680,000	
		Expected average poles per Ha		120	
		Current price for untreated pine poles		4,000	
		Revenue from poles sales per Ha		480,000	
		Total Revenue		**2,160,000**	
		Less losses @ 15% + 5% of RE		1,728,000	
		Less cost of production (from standard practices)		462,950	
		Total expected revenue from 1 Ha of Block 2		1,265,050	
		Total value from Block 2(Call it A)		**27,072,070**	
		This the value in five years time, defer it/ discount it to			
		get the value now (as at the time of valuation) using the formular below			
		PV= $A(1+r)^{\wedge}-n$			
		Where;			
		PV is the present value			
		r is the interest rate			
		n is the time			
		Hence the value of the blue gum as at now			
		A in our case	27,072,070		
		r (as determined above)	14,8%		
		n (is the remaining period)	16		
		Hence the present value of pine in Block 2		27,072,070(1+14.8%)^-16	
					2,974,755
		Block 3 Valuation			
	2	**4 Years old (Block 3 Calliandra)**			
		These are yet to be harvested, 3 years remaining to maturity.			
		Since the trees are almost half to maturity age, it was obtained from the interview that the			
		loss expected through diseases, pest or any other risk should be minimal, approximately 15%			
		Expected average timber logs yield for Calliandra per Ha		413	
		Current log prices for Calliandra		1,500	
		Revenue from timber logs sales per Ha		**619,500**	
		Less losses @ 15% + 5% of RE		495,600	
		Less cost of production (from standard practices)		462,950	
		Total expected revenue from 1 Ha of Block 2		32,650	
		Total value from Block 3(Call it A)		**698,710**	
		This the value in five years time, defer it/ discount it to			
		get the value now (as at the time of valuation) using the formular below			
		PV= $A(1+r)^{\wedge}-n$			
		Where;			
		PV is the present value			

			r is the interest rate				
			n is the time				
			Hence the value of the blue gum as at now				
			A in our case		698,710		
			r (as determined above)		14,8%		
			n (is the remaining period)		3		
			Hence the present value of calliandra in Block 3			698,710(1+14.8%)^-3	
							461,818
		Block 4 Valuation					
	1	**8 Years old (Block 4 Blue gum)**					
		These are yet to be harvested, 7 years remaining to maturity.					
		Since the trees are almost half to maturity age, it was obtained from the interview that the					
		loss expected through diseases, pest or any other risk should be minimal, approximately 15%					
		Determining density or total stem number (Density/Ha x total Ha)					65,000
		Less 10% losses (say for diseases, pests etc.)					6,500
							58,500
		Expected average timber log yield for blue gum per Ha				910	
		Current log price from blue gum				2,500	
		Revenue from timber logs sale per Ha				2,275,000	
		Expected average poles per Ha				260	
		Current price for untreated blue gum poles				3,500	
		Revenue from poles sale per Ha				910,000	
		Total Revenue				**3,185,000**	
		Less losses @ 15% + 5% of RE				2,548,000	
		Less cost of production (from standard practices)				462,950	
		Total expected revenue from 1 Ha of Block 1				2,085,050	
		Total value from Block 1(Call it A)				**67,764,125**	
		This the value in five years time, defer it/ discount it to					
		get the value as at the time of valuation using the formula					
			PV= $A(1+r)^{\wedge}-n$				
			Where;				
			PV is the present value				
			r is the interest rate				
			n is the time				
			Hence the value of the blue gum as at now				
			A in our case		67,764,125		
			r (as determined above)		14,8%		
			n (is the remaining period)		7		
			Hence the present value of blue gum in Block 4			67,764,125(1+14.8%)^-7	
							25,787,344

		Block 5 Valuation						
	3	**23 Years old (Block 5 Pine)**						
		These are yet to be harvested, 5 years remaining to maturity.						
		Since the trees are almost mature, it was obtained from the interview that the loss						
		expected through diseases, pest or any other risk should be minimal, approximately 10%						
		Determining density or total stem number (Density/Ha x total Ha)						23,540
		Less 10% losses (say for diseases, pests etc.)						2,354
								21,186
		Expected average timber log yield for pine per Ha					480	
		Current log price from pine					3,500	
		Revenue from timber logs sale per Ha					1,680,000	
		Expected average poles per Ha					120	
		Current price for untreated pine poles					4,000	
		Revenue from poles sale per Ha					480,000	
		Total Revenue					**2,160,000**	
		Less losses @ 10% + 5% of RE					1,836,000	
		Less cost of production (from standard practices)					462,950	
		Total expected revenue from 1 Ha of Block 1					1,373,050	
		Total value from Block 1(Call it A)					**29,383,270**	
		This the value in five years time, defer it/ discount it to						
		get the value as at the time of valuation using the formula						
			$PV = A(1+r)^{-n}$					
			Where;					
			PV is the present value					
			r is the interest rate					
			n is the time					
			Hence the value of the blue gum as at now					
			A in our case			29,383,270		
			r (as determined above)			14,8%		
			n (is the remaining period)			5		
			Hence the present value of pine in Block 5				29,383,270(1+14.8%)^-5	
								14,736,376

		Revenue from Firewood and Charcoal					
		From the survey, firewood and charcoal are harvested and burnt after every 3 years					
		and the last harvest or burning was 2016					
		Year	Total Ha	Firewood	Charcoal	Total Revenue	PV= $A(1+r)^{-n}$
		2016-2019	118.1	8,361,480	42,043,600	50,405,080	43,906,864
		2020-2023	118.1	8,361,480	42,043,600	50,405,080	29,020,625
		2024-2027	111.1	7,865,880	39,551,600	47,417,480	15,718,220
		2028-2031	21.4	1,515,120	7,618,400	9,133,520	1,743,153
		2032-2035	21.4	1,515,120	7,618,400	9,133,520	1,003,617
				Total DCF from Charcoal and firewood			**91,392,479**
					TOTAL VALUE		**175,648,082**
						Say	**175,650,000**
					or	**1,181,237**	**Per Hectare**

	2) COMPARABLE VALUATION METHOD					
	Comparable One					
	LR.Number.	1141/R				
	Location	Sitoi -Murera Junction within the study area				
	Size	87.75	Hectare			
	Development	Recently planted with blue gum and pine				
	Sold to EPK	96,500,000	in July 2018			
	Analysis	1,099,715	Per Ha			
	Comparable Two					
	LR.Number.	9285/3				
	Location	Sitoi -Nandi Road within the study area				
	Size	132.4	Hectare			
	Development	planted with nearly half age blue gum and pine				
	Sold to EPK	180,000,000	in March 2018			
	Analysis	1,359,517	Per Ha			
	Comparable Three					
	LR.Number.	11286	Tarakwet Farm			
	Location	Njoro -Nandi Road within the study area				
	Size	138.47	Hectare			
	Development	planted with mature blue gum				
	Sold to Timsales Ltd.	225,000,000	in September 2018			
	Analysis	1,624,901	Per Ha			
	Comparable Four					
	LR.Number.	8543	Mutimo Farm			
	Location	Njoro -Nandi Road within the study area				
	Size	49.47	Hectare			
	Development	planted with mature blue gum				
	Sold to Timsales Ltd.	79,250,000	in September 2018			
	Analysis	1,601,981	Per Ha			
	From the Questionnaires, most farmers indicated tree farms are selling for at an average range					
	of Kshs.1,100,000/= to 1,600,000/= per Hectare depending on the ages of the trees, that is,					
	farms with younger trees will fetch lower prices and vice versa.					
	Vacant parcels within the study area on the other hand are selling at an average range of					
	Kshs.200,000/= to 350,000/= per Hectare depending on the distance from the road and					
	availabilty of water resources					
	EPK recently purchased 53 hectare vacant land for Ksh 18.55M this analyses at 350,000/=					
	per hectare					

According to Fannie Mae Guideline (2019), a minimum of 3 comparable sales are appropriate to make decision on sales comparison approach. Further, IVS 105.20.3(d) (7th April 2016), opines that a valuer may also consider additional information on sales based on hearsays, especially where there is limited sale records, since such may give indicative figures

The selection of comparables require judgment and the valuer is allowed to make adjustment depending on the qualitative and quantitative factors being compared (IVS 105.20.6)

Based on the above comparables and depending on the age of the trees, the minimum selling price of one hactare trees farm is Kshs. 1,099,715/= while the maximum is Kshs.1,624,901/=.

Using sales comparable method, the value of the timber plantation is as follows;

Step.1. For ease of comparison, classify the timber plantation into three classes namely; young, tender and mature

Blue Gum (Age)	**Ranking**	**Pine (Age)**	**Ranking**	**Calliandra**	**Ranking**
0-5	Young	0-9	Young	0-2	Young
6 -10.	Tender	10-19.	Tender	3-5.	Tender
11-15.	Mature	20-28.	Mature	6-7.	Mature

Step.2. Decide on value to return for each class; According to the comparable sales, price range (rounded off for ease of calculation) for tree farms is Kshs. 1,100,00/= while the maximum is Kshs. 1,600,000/=. based on the tree ages. the value can therefore be deduced as follows;

Ranking	**Value Per Ha**	
Young	1,100,000	
Tender	1,350,000	(Average of the minimum and maximum)
Mature	1,600,000	

Block 1,2,3,4&5 respectively	**Remarks**	**Hectare**	**Value from comparable method**	
			Value/Ha	**Total**
Blue gum 10 years old	Tender	35.8	1,350,000	48,330,000
Pine 12 years old	Tender	21.4	1,350,000	28,890,000
Calliandra 4 years old	Tender	7	1,350,000	9,450,000
Blue gum 8 years old	Tender	32.5	1,350,000	43,875,000
Pine 23 years old	Mature	21.4	1,600,000	34,240,000
	Total	**118.1**		**164,785,000**
		or	**1,108,171**	**per Hectare**

COST VALUATION

Notes

1 The development comprises log and poles preservation houses, container offices, seed store, pesticide and insecticide room, labour houses, timber sheds, park canteen, pit latrines, ablution block, timber shed and gate houses.

2 Siteworks include Borehole, fence, concrete yard, roads and plastic and steel tanks

3 Most of the developments and equipment are approximately 5 years old save for the new labour blocks which are new

4 Developments are well maintained and are in good condition

5 The replacement cost have been obtained from the farms books of account, current sale prices in the market and IQSK building construction costs handbook August 2017-July 2018,

6 Different assets have different useful lifespan as shown

Asset Class	useful lifespan (Years)
Siteworks- roads, yards and fences	15
Farm buildings and stores	20
Residential units	27-28
Automobiles and loose assets	5
Water transportation and equipment	10

Source IRS, (2018)

7 Depreciated replacement cost was obtained through

a) Double declining balance depreciation method was used over straight line method because most of the assets are used consistently over their useful life and their diminution of value vary overtime, thus depreciating them at constant rate does not make sense

Improvements

	Area Sq.ft.	**R.C (Kshs)**	**R.C.V (Kshs)**	**D.R.C. (Kshs)**	**D.R.C.V (Kshs)**
7 x Logs preservation houses	14,784	1,100	16,262,400	450	6,659,601
2 x poles preservation houses	2,230	1,100	2,453,000	450	1,004,526
Office - 3 x 40' container	each @	300,000	900,000	165,000	495,000
4x 20' container	each @	250,000	1,000,000	137,500	550,000
Seeds store	336	1,800	604,800	737	247,672
Pesticides and insecticides room	215	1,000	215,000	410	88,045
Dripping Shed	4,230	800	3,384,000	328	1,385,790
2x Timber Sheds	29,484	800	23,587,200	328	9,659,253
Park canteen	415	2,000	830,000	819	339,885
2x Gate houses	436	1,800	784,800	737	321,384
Ablution block	336	1,800	604,800	737	247,672
Manager's House	1,817	2,500	4,542,500	774	1,406,540
Social Hall	538	2,000	1,076,000	819	440,622
4 x labour blocks	12,844	2,500	32,110,000	774	9,942,540
2 x new labour blocks	4,622	2,500	11,555,000	2,500	11,555,000
3 x pit latrines	80	1,800	144,000	737	58,970
	199,414		**100,053,500**		**44,402,500**

	Add Siteworks					
	Bore hole 200M deep	250	8,000	2,000,000	4,088	1,022,000
	Chain link and barbed wire fencing in metres run	1,486	2,779	4,129,594	1,420	2,110,120
	Concrete yards and roads	10,837	650	7,044,050	332	3,597,884
	Raised steel tank in litres	100,000	57	5,710,000	29	2,918,000
	Plastic water tank in litres	20,000	17	340,000	9	173,800
						9,821,804
	Add Machinery and equipment (salvage value according to the books of accounts)					
	A tractor with a disc plough and trailer			3,000,000		650,000
	8No. chain saw with 18" 20 " 22" 24"bar wood cutting machine ,72cc			253,200		20,000
						670,000
				Total		**54,894,304**
	Add Professional fees @ 10 %					5,489,430
						60,383,735
	Add cost of establishment					54,674,395
						115,058,130
	Add Land as follows					
	First 36.8 Ha along the road @ 350,000 per Ha					12,880,000
	Next 100 Ha @ 200,000 per Ha					20,000,000
	Residue 11.9 Ha sloping to the stream 250,000 per Ha					2,975,000
						35,855,000
				Total Value		**150,913,130**
				Say		**150,910,000**
				or	**1,014,862**	**Per Hectare**

	TRAVEL COST METHOD					
	Travel Characteristics		**Mean(Sum/n)**			
	Mean Travel time Round trip (Hours)		3.5			
	Mean Time Spent at the park (Hours)		6.0			
	Average Round Travel distance (Km)		140			
	User Characteristic		**Mean (sum/n)**			
	Age		36			
	Income		40,000			
	User Expenditure					
		Round trip Fare/Transport Cost (Tc)	Number	Amount/km	Total travel cost	
		Public	33	3.5	116	
		Private	18	69.65	1,254	
		Total	51		1,369	
					Mean(Sum/n)	**26.85**
		Average Round Travel distance as shown above				140.00
			Total Round trip travel cost (Trtc)			**3,758.59**
	NB:According to Rotary 2017 & 2018, Automobile Reimbursement Rates					
	for Kenya is Kshs.69.65 per Km					
	According to the updated 2018 Kenya Surface Transport rates per Route, the company					
	charges an average of Kshs.3.5/-/Km for passengers and 21.45/- /Km for cargo					
		Entrance Fees(Ef)	Number	Gate	total fees	
		Adults	45	150	6,750	
		Children	6	100	600	
			51		7,350	
					Mean (Sum/n)	**144.12**
						Avarage sum
		Food (F)			On the Plantation	438
					Round trip on the journey	425
					Total	**863**

		Accomodation (A)			On the estate for 2 respondents	31,000
					Neighbouring Hotel for 3 respondents	16,500
					Total	47,500
					Mean(sum/n)	**931.37**
	NB: From the survey only 5 of respondents sought accomodation					
		Mean number of days stayed at the park				
		No.of days	**No.of Respondents**	**Total sum of days**		
		2	5	10		
		1	46	46		
			51	56	**Mean(sum/n)**	**1.1**
		Activity characteristic				**Mean(Sum/n)**
					Activity expense (Ae)	**358**
					Average activity time (mins)	30
					Average no.visits/year	9
		Opportunity Cost (Oc)				
		Assumption				
		1.Instead of working to earn a wage rate, the respondent have forgone work for recreation				
		2. The wage rate will be applied to the mean number of days stayed at the park				
		NB: Average Wage rate per day according to AFDB September 2016 in USD				
			USD	Kshs.		
		Low Class	3.65	370		
		Middle class	15.30	1,553		
		upper	98.50	9,998		
		As per the questionnaires on the level of income the following was obtained				
			Number	Wage rate	total	
		Low class	1	370	370	
		Middle class	47	1,553	72,989	
		Upper class	3	9,998	29,993	
		Total	51		103,352	
					Mean(sum/n)	**2,027**
			Mean no.of days at the park as given above			1.1
					Total Oc	**2,225**

		Conservation Cost(Cc)				
		Amongst the respondents only a few were aware of the wildlife				
		and plantation conservation for the future thus little contribution to that course				
				Mean conservation cost(Cs)		**55**
	Total Non Market benefit Value of the plantation (TNMVp) for the sample visitors					
	can be estimated by the following formulae respectively;					
	TNMVp =WTPix λ x n		Equation 1			
	and					
	TNMVp =WTPix λ x N		Equation 2			
	Where					
	WTPi=mean visitor willingness to pay per one day of a visit					
	λ=mean number of days stay in the park					
	n=sample size					
	N=Park estimated number of visitor per year (Zella and Ngunyali,2016)					
	WTPi	8,335	(Trtc+Ef+F+A+Ae+Oc+Cc) as calculated above			
	λ	1.1				
	The Total Economic Value for all sampled visitors for one average length day of stay					
	in the Plantation as represented by equation 1 will be;					
	TNMV for Sample vistors	466,775.3				
	Say	**450,000**				
	N=Park estimated number of visitor per year?					
	According to EPK Survey 2017, there were a total of 7,912 visits at the park in the year					
	2017 and this was projected to increase by 1% in 2018					
	This thus translates to a projected total visit of 7,991 in 2018					
	The Total Non Market Value with the estimated visitors of 7,991					
	in the plantation as represented by equation 2 will be;					
		73,137,287				
	Say	**73,140,000**				

Different Images from the Study Areas






Multi-Functionality of a Tree in one Image