EVALUATING ECONOMIC VIABILITY OF COMMUNITY TREE NURSERIES IN MASENO DIVISION, KISUMU COUNTY, KENYA

BY

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DECLARATION

I declare that this research is my original work and has not been presented by any individual for the award of certificate, diploma or degree in any other institution.

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DEDICATION

To my beloved great grand-mother the Late Dusila Abuoro Amoko of Kakwajuak, Karachuonyo-Kanam, Homa-Bay County. Her encouragement and persistent enquiry on my study progress kept me going. She insisted that nowadays unlike her days' education was the key to unlocking poverty. This energized me!

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ABSTRACT

Forests and trees are important natural resources globally. The reduction of forests and tree cover and the resulting loss of biodiversity, wildlife habitat, ecosystem integrity; increased climate variability and reduced crop yields, thus decrease in food security have become key development challenge. This trend can be reversed by promoting on-farm tree growing using quality tree seedlings. Community tree nurseries can provide this; however many are established but soon cease to operate. The reasons for such failures have not been documented. This study, premised on the theory of the firm sought mainly to evaluate the economic viability of such tree nurseries in Maseno Division, Kisumu County. The specific objectives were to: Understand the production processes; examine marketing strategies; and assess profitability. Conceptually, tree nursery profitability depends on tree seedling production processes; augmented by marketing strategies. Purposive sampling regime with a cross-sectional survey was used. A total of 54 tree nursery operators were interviewed. To triangulate the results ten closed tree nurseries; nine farmers growing trees and five key informants were interviewed. Pre-determined interview schedule was used to gather quantitative data on social demography; reasons for starting, location and size of tree nurseries; decisions on species and quantity of seedlings to produce; number of seedlings sold, given out, planted and remnants; estimated cost of production; pricing; records kept; and challenges. Qualitative data was collected through in-depth interviews and Focus Group Discussions guided by checklists. The quantitative data was analyzed and presented using descriptive statistics stating costs and benefits. The study established that 88.9% of the operators mainly use traditional production techniques resulting into high production costs. There is short market structure with product and sales orientation. A total of 53.7% of the operators are making losses, 35.2% producing below Break Even Point, and only 11.1% earn above the 52.2% average Return on Investment. Poor pricing and planning accounts for the losses as the average and marginal revenue are less than the price among those making losses. In conclusion, most of the tree nurseries are not economically viable. This can partly be overcome through training of the operators in tree nurseries as business enterprises. These findings can be valuable to tree nursery operators, policy regulators and research institutions in improving sustainable land, forest and environmental management at local, national and international levels especially Sub-Saharan region. The results can equally be used in responding to Sustainable Development Goals and climate change effects.

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ACRONYMS AND ABBREVIATIONS

ABCD- Asset Based Community Driven Development

AEZ- Agro-Ecological Zones

AFRENA- Africa Research Network Association

AfDB - Africa Development Bank

AIDS- Acquired Immune Deficiency Syndrome

ATC- Agricultural Training Centre formerly Farmers Training Centre

ASALs -Arid and Semi Arid Areas

BAT- British American Tobacco

BEA- Break-Even Analysis

BEP- Break Even Points

BPO- Business Process Off- shoring

CBA- Cost Benefit Analysis

CFAs- Community Forest Associations

CIDA - Canadian International Development Agency

CEA- Comparative Expense Analysis

CVPA - Cost-Value Profit Analysis

DANIDA -Danish International Agency

DFDR- District Focus for Rural Development

EBIT- Earnings Before Interest and Taxes

EVPA- Expense-Volume-Profit Analysis

EU- European Union

FAO- Food and Agricultural Organization

FC- Fixed Costs

FGD- Focused Group Discussion

FoF- Farmers of the Future

GDP- Gross Domestic Product

GIZ - German Technical Cooperation

GoK- Republic of Kenya

GPM- Gross Profit Margin

HIV– Human Immune Virus

ICRAF- International Centre for Research in Agroforestry (World Agroforestry Centre)

IMF- International Monetary Fund

IPCC- Intergovernmental Panel on Climate Change

IUCN- International Union on Conservation of Nature

KARLO- Kenya Agricultural and Livestock Research Organization (formerly KARI)

KEFRI- Kenya Forest Research Institute

KII- Key Informant Interviews

KNBS- Kenya National Bureau of Statistics

KES- Kenya Shillings

KFS- Kenya Forestry Services

LFCC- Low Forest Cover Country

LFA- Logical Framework Analysis

LVEMP- Lake Victoria Environment Programme

MDGs- Millennium Development Goals

M&E- Monitoring and Evaluation

MoA- Ministry of Agriculture

MSC- Most Significant Change

NASA- National Aeronautics and Space Administration

NPM- Net Profit Margin

NTFPs- Non-Timber Forest Products

PLM - Program Logic Model

PPPs- Public-Private Partnerships

RBM- Result Based Management

ROCE- Return on Capital Employed

ROE- Return on Equity

ROA- Return on Total Assets

ROI- Return on Investment

SAPs- Structural Adjustment Programme

SD- Standard Deviation

SDG- Sustainable Development Goals

SPSS- Statistical Package for Social Scientist

STI- Science, Technology and Innovation

SIDA - Swedish International Development Cooperation Agency

UNFCC- United Nations Framework Convention on Climate Change

UNDP- United Nations Development Programme

USAID - United States of America International Development Agency

VC- Variable Costs

OPERATIONAL DEFINITIONS OF TERMS

Community tree nurseries – These are tree nurseries initiated by individuals and/or groups to provide a sustained source of low cost tree seedlings purposely to grow on farming systems and public spaces while expanding the number of species. They also generate income through sale of seedlings. The operators do provide some seedlings to the neighbours for enhanced local relationships and social capital. They exclude government, research and institutional tree nurseries which engage in tree seedling production to meet specific needs.

Climate change-The changes attributed directly or indirectly to human activity that alters the composition of the global atmosphere and natural climate variability observed over comparable time periods as stated by the United Nations Framework Convention on Climate Change (GIEC, 2007).

Economic viability – Is the level by which a firm generates enough revenue to cover costs and give dividends to the shareholders or investors.

Firm - An organization which produces and/or sells products or services to consumers with the aim of making profits.

Product item- This is the single (lowest) items of a given product for example each individual tree seedling.

Product line- Is the sum of related individual product items for example a given tree species in a given tree nursery.

Product mix- A firm's total product lines for example the number of seedlings of the different tree species produced by an individual tree nursery.

Tree nursery- An area designed for tending tree seeds and/ or seedlings before out planting.

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CHAPTER ONE

INTRODUCTION

This chapter highlights the study background, problem statement, purpose and objectives of the study with the key research questions. The chapter also gives the justification, scope and limitations of the study.

1.1 Background of the study

Forests and trees are important natural resource spread across the globe. More than a billion people, often the poorest and mostly living in the tropics more so developing countries depend upon them for food, fuel and housing (Kant & Appan, 2013). Globally there is remarkable reduction in forests (vegetation cover) and worse among resource poor communities since their livelihoods are dependent on it. The challenge is aggravated by increased population growth, agricultural expansion, and over-dependence on woodfuel, accelerated deforestation and low afforestation levels. This continued loss is associated with several impacts, including loss of wildlife habitat, increased climate variability and loss of ecosystem integrity. It is further connected to reduced crop yields, and ultimately, decrease in food security.

For example, Kenya gazetted (recognized as government asset) forest reduced from over 10 percent at independence to less than 2 percent of the total land-size by 2003 (Muriuki, 2005). There has been improvement to the current 6.9 percent (GoK, 2014). So far, concerted efforts through international and national conventions, commissions and agreements have been put in place to ensure improved vegetation cover and environmental sustainability, however little impact has been observed (The National Aeronautics and Space Administration, 2012). Deforestation (indiscriminate cutting of trees and clearing of forests) though often discussed as a

major problem can easily be corrected in the tropics where tree growth is faster and most deforestation occur. To this, Moir, Vandenbosch & Scull-Carvalho (2007) attest that afforestation still remains one of the best alternatives to deforestation.

Regionally, there have been pleas to comply with the tree planting regimes and the initiation of a number of state commissions. It has been noted that by 2020, between 75 and 250 million people could be exposed to increased water stress; reduction of up to 50 percent yields from rain-fed agriculture; and compromised agricultural production, including access to food (Intergovernmental Panel on Climate Change, 2007).

In Kenya there have been many efforts to increase tree cover. For example, the annual national tree planting days in April-May; the 10 percent trees cover on individual farmland; and the Mau Forest rehabilitation. On the other hand successive governments have put ban in logging and forest excision. The Ministry of Agriculture and related Ministries' policy directions have stated that the future of trees is on farms. The Kenya Forest Service (KFS) has overstated the role of communities and community tree nurseries. However, many such are established and closed down soon after. The concern is therefore to find ways of averting this occurrence. A number of studies have been done on government or research stations on silvicultural operations (Oballa *et al* 1990 and Oballa *et al* 2010). Components of tree nurseries (Muriuki, 2005 and Nieuwenhuis and O'Connor: Unpublished); commercial tree nurseries (Muriuki, 2005) and market potentials of agroforestry seedlings (Oduol & Franzel, 2014) but not specifically on community tree nurseries or their economic viability.

Maseno division has been one of the hubs for agroforestry research in Kenya since the inception of collaborative research projects in the 1990s some which promoted tree nurseries (AFRENA 1996 ad 1997). Despite all the collaborative researches and initiation of community tree nurseries the division is fast remaining bare with limited vegetation cover. The importance of tree products and services creates an unmet demand that community tree nurseries would sustainably supply, however most of these tree nurseries start and soon close up. The reasons of which economic viability entailing production processes, marketing strategies and profitability would be important yet have not been documented.

1.1.1 Production processes

Production is turning inputs into outputs. Using given raw materials to produce what is required by the market. It involves combining the factors of production (land, labour, capital and entrepreneurship) into the desired products. The product must be able to fit in the market in terms of the variety, quality, design, features, brand, packaging, sizes, services, warranties and returns. Any production unit must consider the location, legality and other factors of production (Longenecker, Moore & Petty, 2003 and Palmer & Hartley, 1996 and Everard & Burrow, 1990). Since tree nurseries are production entities, the operators must then consider why the business and how they will sustain the process. It involves tree nursery site identification, acquisition of equipment and materials, seed bed preparation, seed sowing, pricking out, watering, weeding, root pruning, hardening off and selection of sturdy seedlings for out planting. All these are often referred to as tree nursery tending operation. These activities turn the given inputs: seeds, soil, potting containers (depending on the seedling production method- containerized or bare-root), water and labour among others into the valuable end product- tree seedlings.

1.1.2 Marketing strategies in community tree seedling production

Marketing is selling of a product or service or the activities that direct the flow of goods and services from producer to consumer (Longenecker *et al.*, 2003 and Palmer & Hartley, 1996). It comprises a whole region or area within which buyers and sellers of any commodity are present and relate to each other in such a way that only one price of a commodity prevails (Saleemi, 2007).

To small businesses of which community tree nurseries are: marketing should consist of identifying a target market; determining market potential and preparing, communicating and delivering a bundle of satisfaction to the target market. Everand & Burrow (1990) adds that marketing activities includes buying, selling, transporting, storing, financing, researching, risk taking, grading and valuing. These are delivered through production-oriented; sales-oriented or customer-oriented philosophies.

The price of a product or service specifies what the seller requires to transfer ownership or use of the product or service (Longenecker *et al.*, 2003). They illustrate that price has a direct effect on the sales revenue and quantity. Price should always be based on some basic cost behaviours. For a business to remain a float, the total cost and a profit margin need to be considered. Pricing should also consider market characteristics and the firms marketing strategy. It therefore means that in any production system one should produce with the market in mind. Know what the consumers want and what they are willing to sacrifice (price) to have it. It is none the less important to match production with markets on the one hand but also to know what level of marketing the producers are in, whether as wholesales or retailers. This is likely the point of

departure in the community tree nurseries since most of the operators produce with the aim that they will sell but not really understanding the market and marketing dynamics like which species, what quantities and by when. The traditional belief is that they will be sold out but more often than not one sees seedlings lying in these nurseries, thus increasing operation and production costs.

1.1.3 Profitability of community tree nurseries

Profit is the difference between the sales revenue and the costs of production or service delivery (Weetman, 2010 and Broadbent & Cullen, 2003). Profitability is assessed through using proven scientific formula. They enable tracking of happenings in a firm therefore monitoring and evaluating for prompt decision making. Monitoring and evaluation enables the improvement in management of outputs and outcomes while encouraging the allocation of effort and resources in the direction where the greatest impact can be achieved (IFC Advisory Services, 2004 and UNDP Evaluation Office, 2002).

Therefore realistic decisions must be made on the opportunity costs. A number of tools are available for assessing profitability but this study focused on Cost Benefit analysis (CBA) - (computing and comparing costs to benefits); Break-Even Analysis (BEA) - assessing the level of units, sales and prices that would earn profit (Break-Even Points- BEP) and Break-Even quantities (BEQ); and Return on Investment (ROI) and/or Return on Equity (ROE) - the earnings by owners or stockholders.

1.2 Statement of the problem

The importance of forests and trees in reducing global warming and supplying domestic energy among rural communities in the developing world among others cannot be understated (NASA, 2012 and Moir *et al.*, 2007). The reduction of forests and tree cover across Kenya, and the biodiversity loss that comes with it has become a key development challenge. Farm forestry is one way in which levels of tree cover can be enhanced. Yet it is unachievable without well-developed and managed tree seedling production systems providing both quality and required quantities. Earlier this used to be provided by government managed tree nurseries until the advent of Structural Adjustment Programmes (SAPs) in the 1990's liberalizing seedling production (Easterly, 2006). To sustainably fill the void in Sub-Saharan Africa more so Kenya, a number of community tree nurseries have been promoted by governments and NGO's. However, most of these tree nurseries tend to fail soon after initiation or end of support. The reasons of which economic viability would be important have not been documented. This study forays into this topical subject- the role of profitability in the performance of community tree nurseries.

1.3 Main Objective

The main objective of the study was to evaluate the economic viability of community tree nurseries in Maseno Division, Kisumu West Sub-county of Kisumu County in Kenya.

1.4 Specific Objectives

1. To understand the production processes of community tree nurseries in Maseno Division.
2. To examine the marketing strategies used by community tree nursery operators in Maseno Division.
3. To assess the profitability of community tree nurseries in Maseno Division.

1.5 Research Questions

1. What are the production processes and costs in the establishment and management of community tree nurseries?
2. What marketing strategies are used by the community tree nursery operators?
3. What are the profits realized by community tree nursery operators.

1.6 Justification of the Study

The future of trees is on farms (Moir *et al.*, 2007). This would infer that the future of tree seedling production should also be on farms. In Kenya over the years, tree seedlings' production, distribution and growing has been the responsibility of the government with limited community/ household involvement. There has since been a paradigm shift especially from the 1990s with the introduction of SAPs where line ministry employees were retrenched (Easterly, 2006) despite the growing demand due to the souring population and environmental awareness. To fill the gap, a lot of liberalization has occurred with some NGOs coming up working with community groups and the government promoting Community Forest Associations (CFAs) to produce quality and required quantities of seedlings. Lack of clear direction and planning, most of the community tree nursery operators produce below optimum levels. Yet there are overgrown seedlings in the nurseries despite the low prices and fairly good quality seedlings. There is therefore limited expansion and/or close-ups, unmet demand notwithstanding. The competitive nature of the market allowing free entry and exit the numbers keep soaring even as most of them close-down.

This study therefore set out to understand the existing planning gaps in terms of production processes and marketing strategies so as to help turn-around these ventures into economic, social and environmental benefits. The information can enhance tree seedling production since the

operators will know how best to relate production and marketing to profitability. This may be a pointer to sustainability hence contribution to achieving the Kenya Vision 2030 and meeting the Sustainable Development Goals (SDGs). The findings are valuable to the tree seedling operators, research institutions- international and local; the KFS, learning institutions and all those involved in trees and tree product value chains in ensuring sustainable supply of products.

1.7 Scope and limits of the study

The study was conducted in Maseno Division of Kisumu West Sub-county (formerly part of Kisumu District), Kisumu County. Here tree growing has been promoted by a number of institutions over the last two decades (AFRENA 1996, 1997 and 1998). This provided a good benchmark since most of the adaptive research carried out came to realize the importance of farm forestry but with wanting integration. The results may as such not be very conclusive on what is going around within community tree nurseries and has also not looked at the performance of individual product line (tree species) in the respective tree nurseries. This could have been a better pointer and decision making tool in the study field and other related fields.

CHAPTER TWO

LITERATURE REVIEW

This chapter delves to provide and review some of the available literature relating to community tree nurseries with prominence on their importance and sustainability. The chapter looks at the theoretical foundation, seedling production processes, marketing strategies and how to evaluate profitability in the community tree nursery. A summary of the conceptual framework showing the relationship between the study objectives and the key variables is also given.

2.1 Theoritical foundation of the study

Economics is a social science that studies human behaviour in relation to production, distribution and consumption of goods and services derived from scarce resources (Mudida, 2003 and Saleemi, 2007). It can also be seen as the study of choice under conditions of scarcity and how the resources are allocated among alternative uses to satisfy human wants (Hall & Lieberman, 2005 and Manfield, 1974). Begg, Fischer & Dornbusch, 1987 explain that a resource is scarce if the demand of that resource at a zero price would exceed the available supply. Therefore economics is not using or delaying the use of available resources but using the resources in a more responsive way to create wealth, reduce uncertainty and promote interdependence (Manfield, 1974).

Human wants though unlimited, competitive and at times complimentary; vary in urgency and intensity but can be fully satisfied (Saleemi, 2007). Decisions have then to be made by producers and consumers. Producers choose to allocate resources (factors of production) so as to maximize profits while satisfying the unlimited wants of the consumers. On the other hand consumers have limited income therefore must rationally have preferences (Mudida, 2009). Basically economics

seeks to fundamentally look at which goods and services to produce and in what quantities (total output); how should the goods and services be produced (capital or labour intensive) and how the goods and services will be distributed (Mudida, 2003 and Begg *et al.*, 1987). Most of the authors agree that in economic terms there must be calculations on the opportunity cost (the value of the best forgone alternative). This helps define the amount of what to produce.

A firm then has to decide what to produce using given resources and at what costs with anticipation of selling to a given market at a stated price thus making profits. A combination of goods that can be produced with constant technology and resources per unit of time, such that more of one good could be produced only by diverting resources from the other, resulting in less production of the other must be made. It shows production set for fixed input quantities and gives the maximum possible production level of one commodity for any given production level of the other, given the existing state of technology (Mudida, 2003; Saleemi, 2007; and Gowland & Paterson, 1993). The theory of the firm where resources are allocated to alternative products in anticipation of profits was used to help explain the decision making process in the community tree nurseries. This was chosen against the backdrop of other closely related economic theories like production and market. These look at only either end of the economic forces of supply and demand respectively. Theory of the firm looks at the two forces concurrently.

The production theory defines the technical relationships between the prices of the commodities and productive factors against the quantities of these commodities and productive factors. It looks at how best inputs are combined to produce output for consumption thus utility of

individuals. The production function signifies a technical relationship between the physical inputs and outputs of a firm using a given technology. It can be shown as Q = f (a,b,c,……z) where Q is the level of the output for the firm while a,b,c…..z are the various inputs or factors of production. The theory postulates fixed and variable costs in the short run while all turn to be variable costs in the long run (Boettke & Sautet, 2011, Mudida, 2009 and Samuelson & Nordhaus, 1992).

Individuals seek to improve their positions in all spheres of life thus the need for markets and markets systems. Here they can interact with one another to mutually have profitable exchange of opportunities. Market theory investigates the causal and effect chains made possible by the unique properties of human actions embodied in the act of choice among alternatives. It pays attention to how a consumer behaves and reacts to different possible patterns of alternatives availed by entrepreneurs from the hands of resource owners. Prominence is on the consumer and how he/she behaves or makes decisions (Boettke & Sautet, 2011 and Longenecker *et al.*, 2003).

2.1.1 Theory of the firm

Effective economics balances demand (quantity of a good or service which buyers are prepared to buy at a given moment and price) and supply (quantity of any commodity offered for sale at a given moment and specific price). There are hence two laws that guide a firms activities: the law of demand which states that demand changes inversely with price - the higher the price the lower the demand and vice versa; and the law of supply which is the relationship between supply and price; the higher the price the higher the supply" (Mudida, 2003, Hall & Lieberman, 2005, Saleemi, 2007, and Gowland & Paterson, 1993). The difference is the measure of economic

viability (the level by which a firm generates enough revenue to cover costs and give dividends to the shareholders or investors). This is realized when the forces of demand, supply and prices interact to have quantities of products sold at an acceptable price by the consumers who hence buy and all costs are covered and a surplus left (profit) to be shared out (Mudida, 2009).

Economists agree that normal profit is achieved at an output where the unit price (P) equals Average Revenue (AR), Average Cost (AC), Marginal Revenue (MR) and Marginal Cost (MC). It is stated as P=AR=AC=MR=MC. This defines a perfect competition market where basically there are identical products, a large number of buyers and sellers, perfect information sharing, complete certainty, free entry and exit with limited or no transaction costs. It is always hard to find such situations in the market. A firm would be earning supernormal profits when the P at given quantity is above the AC and losses when it is below the AC. The former instance would attract more firms while the latter would make some firms close down in the short run. This will stabilize the situation in the long run and reach equilibrium (Mudida, 2003, Saleemi, 2007, Hall & Lieberman, 2005, Gowland & Paterson, 1993 and Manfield, 1974).

In such a situation the equilibrium price is equal to short run marginal cost (market value of the variable inputs needed to produce the extra unit of output), so no firm can sell an extra unit at a price that covers its short run marginal cost (Plate 1). A rough measure of the consumers' gains from trade is the area under the demand curve and above the price, indicated by the light purple area (Plate 1). This area measures the consumers' surplus. A measure of the gain to the producers is the difference between their revenue and their variable cost (the producers' surplus).

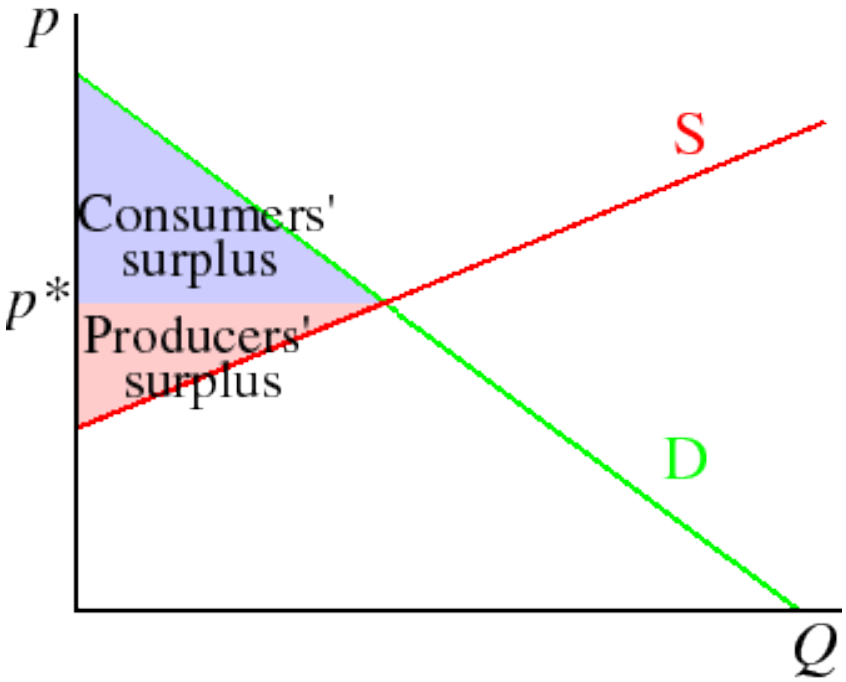

Plate- 1 Demand and Supply Curves

Source: https://www.economics.utoronto.ca/osborne/2x3/tutorial/SRCEFRM.HTM

2.1.2 Understanding tree nurseries

(i) Importance of trees

Trees provide a number of products and services: they are known to help improve soil fertility; provide shade, prevent desertification, act as windbreaks, provide fodder, timber, fruits, medicine, woodfuel and aesthetic value among others (Moir *et al.*, 2007). For example, woodfuel accounts for over 70 percent of total energy consumption in Kenya with over 80 percent of the population depending on it for their domestic energy needs. The use of woodfuel has been responsible for significant deforestation, a challenge that the government is committed to reverse through the promotion of sustainable wood resource management and efficient harvesting and end-use technology policies (IMF, 2005).

Maundu and Tengnas (2005), explain that trees form an essential part of diversified farm production for subsistence products, income and environmental resilience through soil and water conservation. Forest products such as timber and fuelwood; and non-forest timber products (NFTPs) like hive products (honey, wax, propolis, venom, pollen, brood and nector), gums, resins, essential oils, myrrh, fibers, medicines, fodder and grasses among others contribute significantly to the economies of the rural population (Mutie, 1991). This helps in the diversification of both flora and fauna thus promoting environmental resilience. Jaenicke (1999) in her introduction states that other than food, fruits, paper, pulp, wood handles and medicine, trees play an integral part in agricultural landscape with increasing important roles in income provision for rural households. Most rural communities both directly or indirectly draw their livelihoods from trees and forests hence the valuable role in economic, social and environmental development.

The New York Declaration and Bonn Challenge targets could add approximately US$ 85 billion to national and local economies and remove an additional one billion tonnes of carbon from the atmosphere each year (IUCN, 2014). The Food and Agriculture Organization (FAO) report on the energy sector that woodfuel still represents about 7 percent of the world's total primary energy consumption is a point to reckon. The report notes that 76 percent of this consumption is in developing countries, where about 77 percent of the world's population lives (Trossero, 2014). It also notes that the old problems associated with wood energy in terms of production and management of resources for fuelwood and charcoal and their use by the poorest people still remain to be overcome. Similarly, the main concern of the public and private stakeholders has

not changed meaning that the demand for wood fuels may still increase thus the demand for trees.

Equally, trees have a number of comparative advantages in farming systems as they are feasible and attractive to the poor. They are of low cost investment (capital and labour) with potential high returns. Trees provide inputs such as fodder, soil nutrients, construction materials, live fence and incomes where markets are imperfect or prices for alternative products are high. They add stability to a system productivity and income since the deep rooting systems enable trees to produce under climatic variability and can provide numerous micro-climates for crops. Trees are a durable and less-depreciating asset. Value of timber trees often rises more than proportionally with age and trees are relatively safe from disease and theft. They also sequester carbon. The demand for biomass and NTFPs will most likely increase with a possibility of expanding market and improving market access (FAO, 2003).

It can therefore be noted that in the rural areas trees may be most important for poverty alleviation since forests can be vital safety nets, helping rural people to avoid, mitigate or rise out of poverty through petty cash, savings, and hard cash. This remains unknown since the contribution of forests to poor households is largely unrecorded in national statistics and the function is unknown to many policy makers and planners because it is not well understood or explained (ibid, 2003). Chia, Somorin, Sonwa & Tiani, 2013 further states that the vulnerability of human-environmental systems is determined by exposure, sensitivity and the adaptive capacity of social-ecological systems.

(ii) Tree nursery definition and classification

A tree nursery is a site designed and managed to produce tree seedlings under favourable conditions until they are ready for out planting (Roshetko *et al.*, 2010). It brings on board the care that is required for the seed and / or seedlings. The definition may be apt in conventional forestry but may be limiting under the community tree seedling production because still one will find the farmers are producing seedlings within the same pieces of agricultural land. Evans (1982) emphasizes the difference between agriculture and forestry as the place for sowing. Evans notes that in agriculture the farmer sows seeds where his/her crop is to grow while a forester in most cases sows seeds and raises seedlings in a nursery and then transplants them elsewhere on land to be forested. Evans cites two main reasons: the failure of newly germinated tree seedlings to compete with other plants and giving them the needed care until they are sturdy enough for out planting. These are also in line with what Moir *et al.*, 2007 notes that a tree nursery nurtures young plants until sizeable enough to be moved out to the fields.

Roshteko *et al.* (2010) classify tree nurseries in terms of purposes as: institutional, project, group and individuals. They also categorize the nurseries by the reasons (objectives) for setting up; commercial orientation; quality and quantities of inputs and products; level of technology and capacity building opportunities; and level of management. They further explain that institutional tree nurseries are long-term (5-10 years) with specialized tree seedling production. These could be owned by research, government or industrial institutions. . The project tree nurseries belong basically to NGOs or development organizations taking 3-5 years and raising 10,000 to 100,000 seedlings annually and meant to fill a specific planting programme.

The community tree nurseries also known as own tree nurseries or on-farm tree nurseries have an anticipated longer life span due to collaboration often based on relationships and trust (Moir *et al.*, 2006; Wightman, 1999 and Roshetko *et al.*, 2010). These tree nurseries can produce up to 10,000 assorted tree seedlings per season and use locally available resources. They are mainly to grow trees on their farm systems, expand the number of tree species and also generate income. Arguably they are more sustainable, reliable and cost effective in afforestation programmes since they provide a sustained source of low cost seedlings to plant in public spaces (Roshetko *et al.*, 2010). However, this is never so as they start and soon after close.

Tree nurseries have also been classified as temporary (flying) and permanent (Evans, 1982). Evans alludes that temporary nurseries are located near or within planting area on flat ground where soil is workable and with regular water supply. This improves survival due to short transit time; reduced transport costs; low capital investment; and reduced disease and damage.

A classical definition would therefore be one that looks at tree nurseries as areas designed to care for seeds and seedlings until out planting. The classification also may need to be refined to appreciate the growth path for community tree nurseries. An individual or a group may start a community tree nursery but later grow it into a commercial or have it integrated as an institutional tree nursery. This notwithstanding, quantity and quality of tree seedlings remains the pillar for any tree seedling production unit.

(iii) Importance of community tree nurseries

Tree nurseries provide optimum care and attention to the young seedlings during their critical juvenile stage resulting in production of healthy and vigorous seedlings (Roshetko *et al.*, 2010,

Evans, 1982, Moir *et al.*, 2007 and Wightman, 1999). All these authors agree on the need for tree nurseries but do not offer substantial reasons for the establishment and management of community tree nurseries. For example Roshetko *et al.*, 2010 states that *"government and non-government agencies often provide modest support to enhance the development of local nurseries…These efforts strengthen local livelihood development and sustain public reforestation initiatives"*. They even give Philippines Government's annual reforestation plan of planting 50,000 ha requiring 56 to 125 million seedlings. They also elucidate the commitment of Government of Indonesia in rehabilitating 6 million hectares between 2003 and 2008 thus requiring 312 to 625 million seedlings annually. Their resolution that extensive nursery facilities will be needed to achieve the staggering seedling demand and rehabilitation of land which is in the rural can be noted. They indicate that most countries have had limited success with top-down public land restoration since objectives and resources of smallholders are usually not included in the planning process.

Further, they state that community (group and individual) nurseries help build technical and leadership capacities of group members and expand the number of species and quality of germplasm. The nurseries are believed to produce 500 to 10,000 seedlings and have longer lifespan because collaboration is often based on relationships (family and friends) and trust. Trust which is more of a social capital enhances continuity as this can reduce cheating in business (Easterly, 2006). These nurseries are often initiated to produce seedlings for planting on operators' personal farms and public lands (Roshetko *et al.*, 2010). They further state that the size, production capacity and level of sophistication varies widely from a few seedlings grown in recycled pots to well-fenced nurseries of a few hundreds to a thousand seedlings grown in

polythene bags. These nurseries may distribute seedlings within the community and occasionally cater for the needs of small-scale tree planting projects. At the local level, particularly in rural areas, group and individual nurseries are often the main source of tree seedlings and thus supporting reforestation and tree planting activities. These nurseries however due to limited technical, financial and management skills are limited in planning while this should be the first requisite in ensuring quality seedling production (Moir *et al.*, 2007).

Wightman (1999) and Jaenicke (1999) both agree that with good planning and technical support community tree nurseries can ensure genetic composition and physical quality of seedlings. This in turn improves survival, production quality and shortens the gestation (rotation or harvest) time. The genetics can be assured by collecting tree seeds from good performing mother plants while the physical- height, diameter, plant nutrition, health, root size and shape can be improved through good nursery tending operations. Both concur that tending operations like seed handling, germination and sowing; watering, pricking out, weeding, root pruning and hardening off ensures a good start for the seedlings.

A good tree nursery site where there is permanent water supply; gentle slope; good soil; security; an area accessible throughout the year with good shade; and an area free for expansion hastens tending operation (Moir *et al*, 2007 and Albrecht, 1993). These are equally wanting within the communities since finding such ideal sites are difficult. Quality germplasm and the skills of operators are also at stake. The quality of the seedlings did inform the work of Wightman (1999) and Jaenicke (1999) on coming up with practical guidelines for community and research nurseries respectively. Other than seedling production, community tree nurseries have the

potentials of generating employment and income to owners (Haque, Miah & Rashid, 2007 and Roshetko *et al.*, 2010).

To be able to realize the anticipated benefits there is need for record keeping. Everard and Burrow (1990) indicate that there should be a cash register, receipt and payment records, depreciation records, special assets record for insurance policy, fixed assets and real property, tax records and payroll records. They reiterate that business records should be accurately maintained with a convenient filing system permitting quick access and accurate storage (Karanja *et al.*, 2014).

2.2 Performance of community tree nurseries

2.2.1 Production strategies and effects on performance

Production is turning inputs into outputs. Using given raw materials to produce what is required by the market. It involves combining the factors of production (land, labour, capital and entrepreneurship) into the desired products. The product must be able to fit in the market in terms of the variety, quality, design, features, brand, packaging, sizes, services, warranties and returns. Any production unit must consider the location, legality and other factors of production (Longenecker *et al.*, 2003, Palmer & Hartley, 1996 and Everard & Burrow, 1990). Since tree nurseries are production entities, the operators must then consider why the business and how they will sustain the process.

i) Factors of production in tree nurseries

Just like any business, tree seedling production requires a number of resources. Land as would be conventionally described is required in terms of space and soil that will be used for

seedling raising. The space should be sizeable enough to hold the seedlings and any infrastructure that would be needed (Evans, 1982 and Roshetko *et al.*, 2010). Tree seedling production is labour intensive thus the need for such a resource (Roshetko *et al.*, 2010 and Haque *et al.*, 2007). The capital intensity in the production process always helps in defining the type of tree nursery. This may be in terms of equipment, tools, materials and finances. Capital thus is an important factor of production in tree seedling production. All these factors must be combined in a manner that yield seedlings required by the markets (Longenecker *et al.*, 2003).

ii) Decisions in tree seedling production

The type of business always defines the type of decisions taken. Decision making in sole proprietorship is not similar to more advance businesses like partnerships and/or corporations (ibid, 2003). The level of business notwithstanding, decision making always has a bearing to the profitability of the business thus its progress.

iii) Techniques used in tree seedling production

Production techniques whether manual or mechanized always have a bearing on a business. Since there is always scarcity in the factors of production, a business would be defined with the investment in technology (Palmer & Hartley, 1996 and Everard & Burrow, 1990). The level of technology therefore defines the business strategies which occasionally influences the profitability. In the tree nursery there are the traditional tending operations, mechanized operations and value addition like grafting, rooting of cuttings, tissue culturing, air laying, cloning and seed pre-treatment (Griesbach, 1992).

2.2.2 Marketing tree seedlings in community tree nurseries

Marketing are the activities that direct the flow of goods and services from producer to consumer (Longenecker *et al.*, 2003 and Palmer & Hartley, 1996). It can also be described as the whole region or area within which buyers and sellers of any commodity are present and relate to each other in such a way that only one price of a commodity prevails (Saleemi, 2007).

i) Marketing structure

To small businesses of which community tree nurseries are: marketing consists of identifying a target market; determining market potential, preparing, communicating and delivering a bundle of satisfaction to the target market. An entrepreneur needs to understand marketing activities and how they can be used to identify a market, ascertain market potential and then transfer the idea into a product or service for potential customers (Kotler, 2000, Longeneckeer *et al.*, 2003 and Palmer & Hartley 1996). Saleemi (2007) and Gowland & Paterson (1993) classify markets according to: time (day to day, short period or long period); commodity (general, specific or grading); competition (perfect or imperfect- monopolistic competition, oligopoly, duopoly or monopoly). Gowland & Paterson (1993) highlight the need for a structure-conduct-performance approach. They indicate that a number of structural variables: number and relative size of firms; barriers to entry and exit; cost conditions; elasticity of demand for the product; role of imports and foreign markets; speed of technological change in the industry; the buyers and sellers; the turnover of customers; the capital; output ratio; and the nature of the production function should be considered. Conduct- in terms of price, output, advertising and expenditure on investment, training research and development are poignant. Performance, profitability, efficiency and record of technological innovations should also be addressed. Everand & Burrow (1990) adds that marketing activities includes buying, selling, transporting, storing, financing, researching, risk taking, grading and valuing.

ii) Marketing philosophy

Three different marketing philosophies do exist. Production-oriented philosophy is where the product is the single most important part of the business. This hinges on the belief that consumers prefer products that are widely available and inexpensive. Concentration is on efficient product or service development, low cost and mass distribution. The second is the sales-oriented where sale is the highest priority of a firm. Here the belief is that a consumer must be coaxed and coerced to buy. This orientation values aggressive selling and promotion efforts. Lastly is the customer-oriented philosophy which combines both production and marketing aspects. It is where a firm centers on the customer. The belief is that consumers favour products that offer quality performance and have innovative features than the competitors. The firm seeks to be more effective in creating, delivering and communicating with the customers in chosen markets. Everything including production and sales center around the customer and his/her needs. All marketing efforts start and end with the customer (Longenecker *et al.*, 2003, Kotler, 2000 and Palmer & Hartley, 1996).

The customer oriented philosophy seems the best bet but is always hampered by level of competition, strength in production compared to marketing skills of managers and likelihood of managers to focus on marketing efforts thus tilting to sales-orientation (Longenecker *et al.*, 2003). Building a customer oriented marketing strategy requires market research. A CBA has to be done and one needs to answer the questions: is the research really necessary, will the data obtained justify the costs and who will do the research (Longenecker *et al.*, 2003, Kotler, 2000 and Kress, 1979). Kotler, 2000 recommends a market analysis that recognizes the: New customers; dissatisfied customers; lost customers; target market awareness; target market preference; relative product and service quality. This ensures customer loyalty and fast decision

making. Kotler elucidates that the 4P's (product, price, promotion and place) of the seller should correspond with the 4C's (customer solution, cost, convenience and communication) of the consumers. Kotler again notes that marketing is a process that requires: analyzing marketing opportunities; developing marketing strategies; planning marketing progress and managing the marketing effort. These can only be filled through constructive planning, control and decision-making provided for by results from market research.

Market research helps in understanding the benefit (specific characteristics that distinguish market segments according to the benefits sought by customers) and demographic (specific characteristics that describe customers and their purchasing power) variables. From this market segmentation (un-segmented, single-segmented and multi-segmented) strategies can be done to ensure good market mix. A sales forecasting with clear total product and/or service, distribution, pricing and promotional plans can then be prepared (Longenecker *et al.*, 2003).

The price of a product or service specifies what the seller requires to transfer ownership or use of the product or service (ibid, 2003). They illustrate that price has a direct effect on the sales revenue and quantity. Price should always be based on some basic cost behaviours. For a business to remain a float, the total cost and some profit margin need to be considered. Both fixed costs (remain constant at different levels of quantity sold) and variable costs (increase with increase in quantity produced) help determine prices. The elasticity (sensitivity of price on quantity demanded) should also be measured. A pricing system where the cost-revenue relationship is understood (breakeven points) and incorporating sales forecast (adjusting

breakeven points) is feasible turn out to be the best. One may also use the markup pricing system which equally gives better returns and sustainability of the firm (ibid, 2003).

Pricing should also consider market characteristics and the firms marketing strategy. Pricing like penetration, skimming, follow-the-leader, variable and what the market will bear should be used depending on the prevailing market conditions. Such understanding in pricing provides the firms and in this case the tree nursery operators the impetus of producing with the market in mind (Longenecker *et al.,* 2003, Kotler, 2000 and Palmer & Hartley, 1996).

iii) Community tree seedlings in the market

It has been noted that there is a rapid disappearance of trees and forests towards our own self-destruction hence the dire need to grow more trees (Moir *et al.,* 2007). There has been an increasing interest in promoting tree growing in the rural areas as attested to by Bashir Jama in his forward in Maundu and Tengnas (2005). The change in Government of Kenya policy with the new Forest Sessional Paper of 2005 which identifies the role of communities in tree seedling production are indications of the growing demand for tree seedlings. The United Nations' guidance and Kenya Ministry of Agriculture policy of having at least 10 percent of one's farm under trees is a plus. The rising population has on the other hand increased the demand for tree products and NFTPs that growing of own trees is the sure way out.

Since the 1990s with SAPs, the Kenyan government did scale down its seedling production creating room for community tree nurseries through the free market and liberalization policies. The community tree nurseries however due to limited technical, financial and management skills are limited in production and marketing planning thus economic in-viability. Since the

introduction of free markets, community tree nurseries would make much revenue if they understood their markets better. As Easterly (2006) states that *"free markets work but free market reforms do not"* and that "*it is much easier to correct small mistakes than the large mistakes"* a keen look at the community market and marketing strategies would help the nursery operators. Easterly build these notions from the failures of the big push shock therapy and the SAPs. Correcting at this level would be good for responding to such challenges. It therefore means that in any production system one should produce with the market in mind. Know what the consumers want and what they are willing to sacrifice (price) to have it. It is none the less important to match production with markets on the one hand but also to know what level of marketing the producers are in, whether as wholesales or retailers. This is the point of departure in the community tree nurseries since most of the operators produce with the aim that they will sell but do not really understand the market and marketing dynamics like which species, what quantities and by when. The traditional belief is that they will be sold out but more often than not one sees seedlings lying in these nurseries, thus increasing operation and production costs.

2.2.3 Profitability in community tree nurseries

Profit is the difference between the sales and the costs of production or service delivery (Weetman, 2010 and Broadbent & Cullen, 2003). Profitability is assessed through using proven scientific formula requiring data which enable tracking of happenings in a firm for prompt decision making.

i) Record keeping

Evaluation is the objective assessment of the design, implementation and results of an on-going or recently completed business (project, program or policy). It looks at "*What has happened as a result"?* Evaluation is based on: Research and analysis covering the theoretical design, the

monitoring of interventions and assessment of the business utility. As such it requires monitoring which is the routine tracking of information about the intended outputs, outcomes and impacts. It is aimed at measuring progress towards achieving objectives. Mostly it involves checking what is happening and tracks costs and how the business is functioning (IFC Advisory Services, 2004, UNDP Evaluation Office, 2002, Gitonga, 2012 and Mulwa, 2006).

Therefore the need for the community tree nursery operators to be sure that they are on truck. A range of frameworks and systems exist for the planning and management of businesses or projects. The Result Based Monitoring (RBM) is used to assess the needs for M&E; assess current monitoring tools; adapt and/or design monitoring mechanisms then review monitoring scope or tools (UNDP Evaluation Office, 2002). The other widely used tool in community development is the Logical Framework Approach (LFA) and the underlying program logic model (PLM). The LFA helps to clarify the objectives of any project, program, or policy and improve the quality of M&E design. It aids in the identification of the expected causal links- the 'program logic' results chain of inputs, processes, outputs, outcomes, and impact (IFC Advisory Services, 2004). It leads to the identification of performance indicators at each stage in the chain, looking at the evidence needed to verify the indicators, the underlying assumptions and risks which might impede the attainment of results. Generally these generate qualitative data (Gitonga, 2012 and Mulwa, 2006).

One may also use the "Most Significant Change (MSC)" (Peters, Gonsamo and Molla, 2011). This is where changes are tracked and stories of the most important happenings are told. The MSC is a participatory tool that requires clear memories and ownership of the whole process.

M&E in this respect goes just beyond the tracking of project activities but to things that could be happening because of the project as a whole. It generates more qualitative than quantitative data.

Basing on all the enabling policies this study appraised and come up with a more feasible means for evaluating the community tree nursery so that the operators are able to make the maximum out of their investments. The tree nursery operators may go through the ten steps in participatory evaluation. The steps as postulated by Feuerstein (1986) are: Decision to use participatory evaluation, set the objectives, select an evaluation team, select method of evaluation, plan the evaluation, test the proposed evaluation methods, collect data, analysis the data, write-up a report and make decision on how to use the results. Since community tree nurseries are businesses operated by farmers who have to make choices on how best to use their factors of production, evaluation of profitability is necessary (Karanja *et al.*, 2014). Therefore realistic decisions must be made on the opportunity costs. Profitability is always measured mainly by use of Net Profit Margin (NPM), Gross Profit Margin (GPM), Comparative Expense Analysis (AEA) and profit by segment. The study used the NPM as it combines the costs and benefits; the numbers required to produce and sell; and finally the returns the investors get from their investment (Mudida, 2003 and Samwelson & William, 1992). These are calculated by use of Cost Benefit Analysis (CBA) where all costs and benefits are computed and compared. The next one is the Break-Even Analysis (BEA) where an assessment on the level of units, sales and prices that would earn profit (Break- Even Points (BEP) and Break-Even Quantities (BEQ) is performed. This is followed by Return on Investment (ROI) and/or Return on Equity (ROE) to help understand the earnings the owners or stockholders will receive.

ii) Cost Benefit Analysis

Cost Benefit Analysis (CBA) originated from a water development project in the United States. The Army Corps of Engineers were responding to a call to "prevent destructive floods" in 1879 after the Congress created Mississippi River Commission. As a reaction in 1936 the Congress passed the Flood Control Act which stated that *"the Federal Government should improve or participate in the improvement of navigable waters…. if the benefits to whomsoever they may accrue are in excess of the estimated costs."* This consummated cost-benefit analysis also known as Benefit Cost Analysis or Economic appraisal. It argues that the best course of action is that which maximizes the sum of consumers' and producers' surplus together with the surplus of any third party affected (Gowland & Paterson, 1993). Since then have the principles of CBA: common measurement unit; representation of consumers or producers valuation as revealed by their behaviour; benefits to be measured by market choices; valuation of human life among others been concretized (Watkins, Valley & Alley, n.d). The human life aspect in the CBA necessitated Nicholls, Lawlor, Neitzert and Goodspeed (2012) published a Social Return on Investment guide. The work show the connections between and among the benefits (profitability) measured more so in decision making.

For any decision making one must count the costs and the anticipated benefits. This is more critical if choices have to be made between and among a number of alternative projects. Nursery operators therefore consciously or unconsciously carry-out CBA. This gives a summary of benefits (strengths) and costs (weaknesses) meaning both positive and negative impacts are considered simultaneously (Nardini, 2009). Nardini explains that CBA appeals because of its link to welfare economies (that is, the belief that economic efficiency corresponds to a socially desirable situation); has power since market prices used in any economic evaluation, tends to be,

at least conceptually, the result of a global bargaining process between everybody for everything; and its popularity- decision makers are used to CBA to simply abandon or adopt it.

Young (1989), states that given the strong competition for the use of investment, whether these originate from external aid or internal government revenue, it is difficult to implement soil-conservation measures unless they can be justified in economic terms. The alternative means of justification is to appeal to conservation of natural resources desirable in its own right, or for the use in future generations; while a valid point of viewing this is likely to carry less weight in making decisions on allocation of development funds. CBA of soil conservation, whether on a private (farmer) or social (community) basis is essentially a matter of comparing discounted net revenue with and without conservation measures.

Both costs and benefits are likely to be affected. CBA process involves the identification of all important positive and negative impacts of a project; decide whether they are costs or benefits and if the benefits are higher than costs then the project would be moved to the next stage; assign value to the costs and benefits; aggregate the values; then plan evaluation of the anticipated impacts. Therefore even the community tree nursery operators unknowingly could be relying on CBA for their decision making.

Cost is the amount which is spent to produce or buy a commodity (Saleemi, 2000). Roshetko *et al.,* (2010) reiterates that among many other things tree nurseries may provide income generating opportunities to operators and enhance social capital. They also allude that most tree nurseries (community tree nurseries included) can be commercial and be able to sell to the community

and/or other interested parties. Work done in Bangladesh show that there was a higher net annual return for NGOs followed by private and then government with the rate of returns over full-cost longer in NGO (1.50), private 1.43 and lowest in government 1.37 (Haque *et al.*, 2007). It is believed that community tree nurseries would produce at low costs since they use locally available materials and seedlings readily available at planting sites. Tree species diversity is also promoted since most of the species are always adapted to the prevailing environmental and edaphic conditions. This was not yet documented and partly what this study sought to address.

Community tree nurseries should be using locally available resources (land, labour, capital and entrepreneurship). For example the amount of potting media (substrate) depends on the size of bag used. A good potting media is light in weight to facilitate transport yet hold seedlings firmly. It should not shrink nor swell in a manner that can course seedling damage. The media should be of good water drainage capacity; well aerated; contain necessary nutrients for seedling growth and development; does not contain weed seeds; low in toxic salts and harmful micro-organisms. It can also be sterilized without changing the characteristics; and the quality is consistent from year to year (Wightman, 1999). Evans (1982), states that nursery soil should be workable, of good texture and free draining, with pH 5.5-7.0 for broad leaved species and pH 4.5-6.0 for conifers. Soils well drained with mix of sand and loam and high in humus and nutrients are preferred (Moir *et al.*, 2007). Since it is difficult to find all these within the communities one can always correct by mixing parts as: clay soils-one soil, two sand and 2 compost; loamy soils-equal parts of soil, sand an compost; and sandy soils- one soil, zero sand and one compost (Wightman, 1999). CBA is calculated as: Cost Benefit = Total Revenue less Total Costs (Expenses plus Taxes plus Interests) this is denoted as: CBA= TR-TC (E-T-I)

iii) Break Even Analysis (BEA)

A person starting a new business often asks, *"At what level of sales will my company make a profit?"* This is equally so even with established companies which have suffered through some rough years. The discussion of BEA referred to by several names: break-even point (BEP), break-even formula, break-even point formula, break-even model, cost-volume-profit analysis (CVPA), or expense-volume-profit analysis (EVPA) will provide a thought process that may help to answer the question and give insight as to how profits change as sales increase or decrease. Frankly, predicting a precise amount of sales or profits is nearly impossible due to a firm's many products (with varying degrees of profitability), the many customers (with varying demands for service) and the interaction between price, promotion and the number of units sold. These and other factors complicate BEA (Gitman, 2006 and Longenecker *et al.*, 2003).

BEA is a technique used to determine the level of operations necessary to cover all costs; and evaluate profitability associated with various levels of sales (Gitman, 2006, Weetman, 2010, Horngren, Sundem, Stratton, Burgstahler & Schatzberg, 2009, Broadbent & Cullen, 2003 and Longenecker *et al.*, 2003). The analysis takes care of both Break-Even Quantity/ Volume (BEQ) and BEP. Quantity looks at the number of products in a production line that will ensure recovery of all the costs. On the other hand BEP concentrates at the point of sale to recover costs at prevailing prices (Gitman, 2006 and Longenecker *et al.*, 2003 and Weetman, 2010). BEP is the least (minimum) number of units a producer should strive to produce so as to be able to have sales revenue equal to costs of production. Longenecker *et al.* (2003) and Gitman (2006) confer that it is difficult for a business to flourish if there is no understanding of the BEP. The

calculation helps the firm to know what units and at what prices they would meet the sales revenue.

BEA has some noticeable limitations: it assumes that cost and revenue behaviour patterns are known and that change can be represented by a straight line ($y = a+bx$) where $\boldsymbol{y}$ is the total cost; $\boldsymbol{a}$ is variable cost per unit; $\boldsymbol{b}$ is total fixed cost and $\boldsymbol{x}$ is the price per unit cost. It may also not be feasible to precisely split costs into variable and fixed. It assumes that fixed costs remain constant over the volume range and that the input and output volumes are the same with no build-up stock or work-in-progress. Another assumption is that there can always be one product at a time; and that cost behaviour depends entirely on volume (Weetman, 2010).

Break-even quantity is calculated for single products as:

$$Q_b = \frac{FC}{P-V}$$

Where Q_b = number of units manufactured and sold
FC = Total Fixed Cost
V = Variable cost per unit
P = Selling price per unit

The break-even point is calculated as:

$$PQ_b = \frac{P\,(FC)}{P-V}$$

Where Q_b = number of units manufactured and sold
FC = Total Fixed Cost
V = Variable cost per unit
P = Selling price per unit

These formulae could not be used since the tree nurseries are many and also have multiple production lines in terms of tree species. The following was then used as adopted from Gitman (Gitman, 2006).

$$S = \frac{FC}{1-VC\%}$$

Where S=Sales (Quantity of sales)
1 (or 100%) = Contribution margin
VC% = Total variable operating cost as a percentage of total sales

It is assumed that the firms' product mix remains the same at all levels of sales (Gitman, 2006 and Weetman, 2010). Critically, this is equivalent to the total cost of production.

iv) Return on Investment/ Return on Equity

Investors are interested in knowing a firm's financial performance- profitability. Any investor starts by asking *"At what point will I be able to draw a fair salary from my company?"*. Managers use return on investment (ROI) also known as Return on Total Assets (ROA) or Return on Capital Employed (ROCE). ROI measures owners' equity while Return on Equity (ROE) measures stockholders' equity which is the excess of assets over the liabilities. ROE measures the returns earned on the common stockholders' investment in the firm (Horngren *et al*, 2009, Gitman, 2006 and Longenecker *et al.,* 2003). As stated ROI is used in sole proprietorship and partnerships while the ROE is used in corporations (Horngren *et al.*, 2009). They both measure the overall effectiveness in generating profits from the available assets which may also include an element of investment in working capital (Broadbent & Cullen, 2003). ROI measures paid-in capital (ownership claim arising from funds paid in by the owners) plus retained earnings (income or profit from the business at that time) less the ownership claim arising from investment of previous profits.

ROI helps firms understand how to finance whether to use debts or equity (Gitman, 2006 and Longenecker *et al.*, 2003). It is widely used and understood by managers and preferred since it offers inter-sectoral and divisional comparisons; focuses on both assets and profits; allows for a comprehensive measure and reflection of all decisions; and concentrates on projects making best use of resources (Broadbent & Cullen, 2003 and Horngren *et al.*, 2009).

Otherwise it could be limited since it is a ration thus decisions may not be apt thus sub-optimization of decisions. Agreement should be made on what to use if it is profits, total assets or otherwise. Therefore, the higher the firm's ROI and ROE the better for investors and owners respectively.

ROI should be measured over the same period of time because income is a flow of resources over a period of time. It facilitates the comparison of a units' performance with that of other segments within the company or with similar units outside the company (Horngren *et al.*, 2009). Simply put it is the economic profit (residual income) or after tax operating income less capital charge (cost of capital multiplied by the amount of investment) or income (net profit divided by invested capital). Cost of capital is what the firm must pay to acquire more capital whether or not it actually has to immediately acquire more capital. ROI can be increased by increasing returns on sales by reducing expenses or increasing capital turnover by decreasing investment. Horngren *et al.*, (2009) notes that much care should be taken while using ROI as profitability metric since least profitable divisions have the incentive to invest in new projects than most profitable even if the project would still earn the company. Knowing the nature of tree nurseries, ROI was used.

Berzkalne and Zelgalve (2014) while comparing industry performance in Latvia found out that in 2012, the ROE for agriculture companies was almost 12 percent, for food production companies almost 5 percent and for retail companies the ratio was close to 17 percent. They also note that unlike the other companies, the agriculture companies' ROE remained stable. They however attribute this to the enabling government policies and subsidies. It would be good still to bare this in mind since tree seedling production can be considered an agricultural activity as much as it is

a forest activity. There have been new insights in ROI and ROE. Nicholls *et al.,* (2012) acknowledges that there is increasing recognition in the need for better ways to account for social, economic and environmental value that result from our activities. This has necessitated the understanding and managing of the broader value in the public and private sectors. Kijewska (2016) also proposes a departure from the DuPont three level model integrating productivity, profitability and leverage to the operational, financial and tax effect.

ROI calculations would then progress as:

(i) Gross profit margin: This measures the percent of sales in Kenya Shillings (KES) remaining after paying for goods. The higher the gross profit margin the better (Gitman, 2006). It is calculated as:

$$\text{Gross profit margin} = \frac{\text{Sales} - \text{Cost of goods sold}}{\text{Sales}}$$

(ii) Operating Profit margin: Represents the percentage of each KES remaining after all costs and expenses other than interest, taxes and preferred stock dividends are deducted (ibid, 2006). At times it is referred to as the earnings before interest and taxes (EBIT). It shows how well a firm is managing the income statement. It is affected by sales volume, sales price, cost of goods sold and operating expenses (Longenecker *et al.*, 2003). It is calculated as:

$$\text{Operating profit margin} = \frac{\text{Operating profits}}{\text{Sales}}$$

(iii) Total assets turnover represents how well a business is utilizing the available assets in generating sales. It is computed as:

$$\text{Total assets turnover} = \frac{\text{Sales}}{\text{Total assets}}$$

(iv) ROI shows the rate of return on the total money invested by owners and other interested parties in the firm. ROI is calculated as:

$$\frac{\text{Earnings available for common stockholders}}{\text{Total Assets}}$$

Or

$$\frac{\text{Income}}{\text{Invested capital}}$$

Or

$$\frac{\text{Income}}{\text{Revenue}} \times \frac{\text{Revenue}}{\text{Invested capital}}$$

Or Return on sales x capital turnover

2.4 Legal and Policy Framework

The Agenda 21, Kyoto Protocol and emerging conventions have been in full support of environmental protection. Trees support a number of industries- the wood and non-wood industries. The SDGs and MDGs have added to the voice. In Kenya, the then Forest Department now KFS has over ages tried to improve vegetation cover in line with the then Forest Act CAP 385 and through the District Focus for Rural Development (DFRD) which only provided for tree growing within the plantation system. The department produced seedlings and distributed and/or sold at considerably subsidized rates more so during annual national tree planting days in April and May.

This is in line with what has been happening elsewhere that government nurseries do not sell seedlings but only give out after meeting the planned objectives (Roshetko *et al.*, 2010). The system did not achieve much since most of the seedlings ended up not planted. The local communities' attitude that trees regenerate naturally did more harm. Currently, The Sessional

Paper No.9 of 2005 on Forest Policy and the Forest Act, 2005 do stipulate the need to involve communities in reforestation. The MoA in line with UN guidance did also enact a policy that requires at least 10 percent of one's land to be under trees. The importance of forestry is clearly spelt in the current Constitution of Kenya, 2010 (GoK, 2010): *"the state shall work to achieve and maintain a tree cover of at least 10 percent of the land of Kenya"* (Article 69 (b)). This make tree growing a more concern of every Kenyan citizen.

2.5 Interventions so far

The Kenya: Poverty Reduction Strategy Paper, 2005 states that in the 1980s, the Kenyan economy performed below its potential, with low economic and employment growth and a decline in productivity. Consequently, per capita income remained constant till 1982 and prices declined from US$271 in 1990 to US$239 in 2002. It further asserts that the number of people openly unemployed stood at over 2 million or 14.6 per cent of the labour force, with the youth accounting for 45 percent of the total. The majority of the unemployed, though educated, do not have necessary skills. In addition, the number of the working poor is staggering comprising primarily subsistence farmers, female-headed households and slum dwellers. Disguised unemployment is also a serious problem, especially in the public sector. Moreover, the incidence of HIV/AIDS has increased, thereby imposing an increasing social and economic burden. The paper states that the factors underlying the weak economic performance and high incidence of poverty include the persistence of pervasive governance failures, the slow pace of economic reforms, low savings and investment, intermittent shortages and high costs of power, and poor physical and telecommunications infrastructure.

The rising population has increased the demand for tree products and services yet as the population grows more trees are indiscriminately cut down to create space for settlement and/or agricultural production. Policies like the Kenya Forest Act CAP 385 promoted tree growing in plantations most of which have been harvested but not replanted or worse excised. For example East Africa had an estimated 14 percent tree cover 50 years ago but now only 2 percent while Kenya's 17 percent at independence was estimated at platter l.7 percent in 2007 (Moir *et al.*, 2007). However in the last five years it improved to 6.1 percent (GoK, 2014).

In the recent past tree seedlings have been produced by communities a departure from earlier years when production was under central government tree nurseries. Conversely, current Kenyan government Sessional Paper No.9 of 2005 on Forest Policy and Forest Act, 2005 stresses the need for sustainability by involving communities, private sector and all other relevant stakeholders in forest management. The need to register CFAs is equally an important aspect of the improvement noticed over the last few years. Good development of forest products and industries may also lead to reduced unemployment rate which most countries are struggling with. This may also help achieve the Kenya Vision 2030.

Sustainability has become a major concern and agroforestry systems have been preferred with much investment for research (Nair, 2009). To realize the SDGs, environmental conservation and protection provides a secure platform. Sustainability here would mean meeting the needs of the present without compromising the ability of future generations to meet their own needs (Ballin, 2002). This infers that sustainability is a prerequisite for continuity. What we do today should enhance what we have tomorrow. Conventional forestry did not consider this factor in the

management process hence leading to the current forest status. The sustainable forest policy envisages to: contribute to poverty reduction; sustainable land use; promote private sector, communities and other stakeholders involvement in the management process; promote farm forestry; promote dryland forestry; promote forest extension; and promote forest research, training and education to ensure a vibrant forest sector as contained in the Sessional Paper No.9 of 2005 (GoK, 2005).

The paper appreciates the increasing tree cover on farms more so in the densely populated high potential areas. This demonstrates that rural communities and individual farmers have basic skills and willingness to improve their land management practices through tree growing for their own benefit. The biggest hurdle however is how best to promote commercial forestry, improve farm forestry management and enhance efficient utilization and marketing of forest products. The paper highlights the government's enactment of policy guidelines on: the need to ensure that forest and trees on private lands are established and managed using sound business principles and according to landowners' priorities. Land owners should be supported through appropriate incentives including partnerships to have sufficient land under tree cover. They are encouraged and supported to sustainably manage natural and riverine forests in the farmlands particularly for water and soil conservation. There should be an enabling environment for processing, pricing and marketing of farm forest products.

Adequate information, education and training on conservation, management and tree planting should be provided. There is need for improvement of planting materials to improve quality and shorten tree growing rotation. These policies seek to encourage sustainable forest and tree

management ensuring that indigenous forests; farm forestry; forest plantations; dryland forestry; and local authority forests are managed for both optimum and maximum production and utilization. Since then community tree nurseries have been established though with unprecedented challenges. All these are envisaged but no calculations have been done to understand the driving factors in community tree seedling production and tree growing.

Millennium Development Villages Project (MVP) in Yala division has also been doing the same since 2006. This was to propagate the agreements reached by political leaders from around the world enshrined in the eight MDGs as: eradicate extreme poverty; achieve universal primary school enrolment; promote gender equality and empower women; reduce child mortality; improve maternal health; combat HIV/AIDS, malaria and other diseases; ensure environmental sustainability; and develop a global partnership for development (Easterly, 2006). The "*a big big push forward*" theory by Tony Blair has been gaining popularity. The notion was carried forward by the "Make Poverty History" in Africa during the G8 Summit in Scotland in July 2005. Jeffrey Sach's idea that poverty can be ended if the poor were liberated from the "poverty trap" where-poor health, poor education and poor infrastructure reinforce one another is yet to be realized (Chambers, 1983). This formed the pivot for the MDGs whose impact is yet to be realized though he reiterates that success in ending poverty will be much easier than it appears. This notwithstanding his critics sense that big plans will always fail to reach the beautiful goal (Easterly, 2006). The impacts of the project and the MDGs are yet to be realized.

The study still notes that Aid agencies cannot end world poverty, but they can do many useful things to meet the desperate needs of the poor and give new opportunities. It is these

opportunities if well nurtured that may lead to development and liberation out of poverty. This would echo William Duggan quoting Leonardo da Vinci "*As you cannot do what you want/ want what you do"*. Wanting what one does goes a long way in the liberation process. Tree growing is one such an opportunity that if the ones doing it did it with passion and had the required quality and quantity seedlings then the environmental and economic liberation may be achieved and once this is done then the others may be as well be obtained. Bob Geldof's belief that *"something must be done; anything must be done, whether it works or not*" reinforces the new development paradigm where the poor need to do everything at their disposal to achieve development and sustainability. The current SDGs may provide the much needed energy for propelling gains by the MDGs.

The need for community participation partly informs the thinking of the Asset Based Community Driven Development (ABCD) and in the words of one of the proponents Moses Coady '*We desire above all that they will discover and develop their own capacities for creation…They will usher in the new day by attending to the blessings of the old. They will use what they have to secure what they have not'* (Coady, 1939 and Mathie & Cunninghum, 2008). People should be facilitated to achieve their own destinies. What is needed is facilitation since no man can develop the other. Knowing the economic returns that can be realized from the community tree nurseries would help the nursery operators and subsequent communities appreciate tree growing then be part of the solution to the global environmental degradation and climate change.

Most of the ideas above are reflected in the Kenya Vision 2030 which is the country's development blueprint with much emphasis on the 2008 to 2020. It aims at making Kenya a

newly industrialized, “middle income country providing high quality life for all its citizens by the year 2030” based on three development “pillars”- economic, social and political. The economic pillar aims at providing prosperity of all Kenyans through an economic development programme aimed at achieving an average Gross Domestic Product (GDP) growth rate of 10 percent per annum over the next 25 years. The social pillar seeks to *build “a just and cohesive society with social equity in a clean and secure environment”*. The political pillar aims at realizing a democratic political system founded on issue-based politics that respects the rule of law, and protects the rights and freedoms of every individual in the Kenyan society (Kenya Vision 2030, 2007).

Kenyans’ aim of living in a clean, secure and sustainable environment by 2030 can be achieved through: increasing forest cover and lessening environment-related diseases. Specific strategies will involve: promoting environmental conservation; improving pollution and waste management through design and application of economic incentives; and commissioning of Public-Private Partnerships (PPPs) for improved efficiency in water and sanitation delivery (GoK, 2007). In meeting the SDGs the country seeks to economically improve tourism; increase value in agriculture; better and more inclusive wholesale and retail trade sector; manufacturing for the regional market; business process off shoring (BPO); and financial services. Socially, there should be improvement in education and training; the health sector; water and sanitation; the environment; housing and urbanization; gender, youth and vulnerable groups; equity and poverty elimination; and science, technology and innovation (STI).

Politically, the guiding principles should be: constitutional supremacy; sovereignty of the people; equity of citizens; national values, goals and ideology; the Bill of Rights; a viable political party system; Public participation in governance; Separation of powers and Decentralization. Rule of law; electoral and political process; transparency and accountability; public administration and service delivery; security, and peace-building and conflict management form the ingredients thereof (GoK, 2007).

Quality from the tree growing perspective would therefore mean a few good trees (superior survival and growth) than many poor ones. The adage saying that a poor quality tree will always be a poor quality tree even if planted on a well-prepared, good site still holds to date. Good survival and fast growth allows a tree to out-compete weeds and reduce the initial labour costs. This enables a farmer to harvest wood or tree products sooner, increasing the return on farmer's investment (Wightman, 1999). It requires consideration of both the genetic and physical quality. He notes that the genetic composition can be improved through good seed collection and handling procedures while the physical quality can be improved through good tree nursery management and tending operations. Quality Eucalyptus species seedling production has been noted as one way of ensuring seedling and tree product quality (Oballa *et al.*, 2010).

2.6 The Gap

There is a lot already done in ensuring quality tree seedling production. The importance and long life span of community tree nurseries stemming from the social capital are mentioned (Roshetko *et al.*, 2010). This notwithstanding one cannot be definite on how long they would continue and what would be the precursors to failure and how they could be overcome. It is also important to

know what would be the growth paths for such tree nurseries- can they transform into private entities and/ or institutions. What other businesses would the operators go for? Can the communities understand where to move to in good time? What and how should the operators and communities monitor and evaluate in their tree growing activities? Is it planned versus achieved outcomes? What role can planning play in the process hence measure of economic viability to reduce cessations?

2.7 Conceptual Framework of the Study

Figure 1 shows the identified variables and indicators that result into performance and how they interact. These are in line with the environmental challenges which have resulted from indiscriminate tree cutting, inadequate tree seedlings and poor quality tree seedlings. Understanding and carrying out effective planning would therefore ensure economic viability thus sustainability.

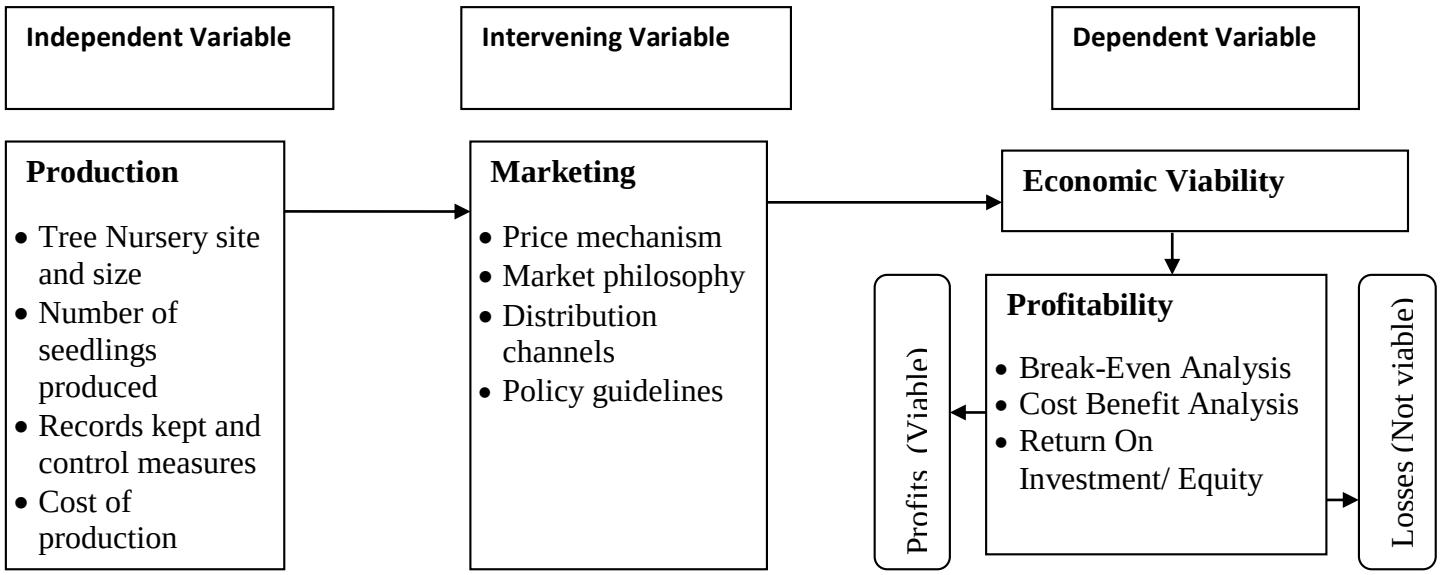

Figure 2- 1 Operational Conceptual framework

Source: Author.

CHAPTER THREE

METHODOLOGY

Information on the study area and the methods used in conducting the study are herein enlisted. It outlines the study area; research design; the study population and sample size; data collection methods, analysis and presentation; and the ethical considerations.

3.1 Study Area

3.1.1 Geographic and biophysical characterization

Maseno Division is in Kisumu West Sub-County, Kisumu County in Nyanza Province, Kenya. The division is located within 0^0 10' 0" South and 34^0 36' 0" East. It boarders Seme sub-county to the west and Kisumu Central to the East; Winam and Lake Victoria to the south and Emuhaya sub-county of Vihiga County, Western Province to the North. The division has 2 locations (North-West Kisumu and West Kisumu) with 9 sub-locations (Figure 3-1). The division has an estimated 91.6 Km^2 land area with almost 80 percent arable land (GoK, 2009). There are cultural and social sites like Kit Mikai which a tourist site and connected to the Western Kenya Tourist circuit. Earlier the division consisted of the current Maseno and Kombewa divisions. Concerted tree growing efforts have been in place for more than two decades (AFRENA, 1996; 1997 and 1998). The area lies along the Equator and in Agro-ecological zones (AEZ) 3-4. It receives an average annual rainfall between 1500-1800m. The pattern is bimodal with peaks in March-May and September-November (ibid, 2009).

ADMINISTRATIVE BOUNDARY OF MASENO DIVISION

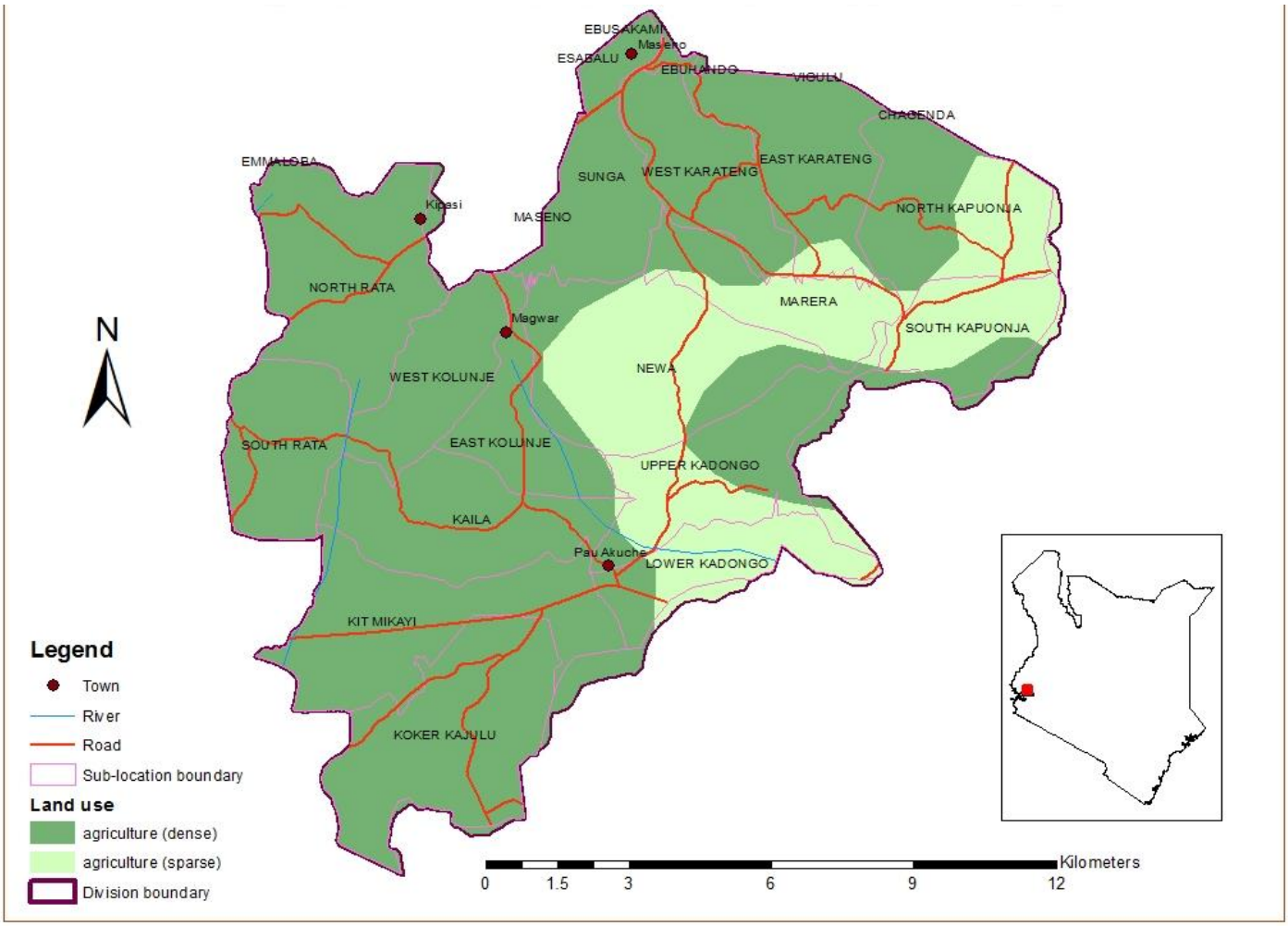

Figure 3- 1 Administrative boundary of Maseno Division

Source: Google Earth

3.1.2 Demographic information

Maseno Division The area has an estimated population of 46,102 with 48 percent to 52 percent males and females (Kenya National Bureau of Statics, 2009).

3.1.3 Social and economic descriptions

The area is predominantly Luo but with other tribes in the urban and government institutions like Maseno University, Maseno National School, Maseno Veterinary farm, Maseno

Agricultural Centre and Kenya Forestry Research Institute (KEFRI). About 65 percent of the population lives below abject poverty line depending on substance agriculture, livestock keeping and fishing (GoK, 2009).

3.2 Research method

The study employed cross-sectional survey research method (Appendix 1). To verify the data collected, one Focus Group Discussion (FGDs) per location, five key informant interviews (KII) and observations were also conducted among identified stakeholders using a check-list (Appendix 2, 3 and 4).

3.3 Research Design and Sampling Techniques

Research design specifies the approaches that are used for collecting and analyzing data (Kothari, 2004, Mugenda & Mugenda, 2008 and Collins *et al.*, 2000). It provides a logical arrangement for the collection, analysis and interpretation of data in a manner that aims at achieving the research purpose. The study employed a purposive sampling regime with all available tree nurseries reached. A list of the tree nurseries within the division was received from the KFS- Maseno station and others reached in the field using the snow balling technique.

3.4 Study population, sample frame and components

A total of 54 operational community tree nurseries were visited and owners/operators interviewed (Table 3-1). This was far higher than the 14 listed by the KFS but helped reach out the others. Two FGDs comprising two operators chosen during chief's baraza, one from each of the sub-locations (except Upper Kadongo where only one existed so Lower Kadongo

had three) were interviewed. The North West Kisumu FGD was conducted in Marera Chief's camp while the West Kisumu one was conducted at Ulalo Primary School. Nine farmers (one from each sub-location) selected during the FGDs were interviewed. A total of 21 tree nurseries operators who had closed down were reached but only ten interviewed as they were ones willing to share their experiences.

The Forester, Maseno Forest Station and the tree nursery attendant; Maseno University farm manager; Kenya Forestry Research Institute (KEFRI) tree nursery attendant; Probation Officer- Maseno; and the Ministry of Agriculture- Extension Officer- Maseno were also interviewed. Information from relevant literature were also used and acknowledged as such.

Table 3- 1 Interviewee location

Location	Sub-location	Number of Respondents	Percentage
North West Kisumu	West Karaten'g	15	27.8
	East Karaten'g	4	7.4
	Marera	10	18.5
	Sunga	3	5.6
Sub-total		**32**	**59.3**
West Kisumu	Lower Kadongo	8	14.8
	Upper Kadongo	1	1.9
	North Kapuonja	4	7.4
	South Kapuonja	2	3.7
	Newa	7	13.0
Sub-total		**22**	**40.7**
Total		**54**	**100**

Source: Field Data

3.5 Unit of analysis and sample size

The tree nurseries were analyzed individually. This was to improve understanding on operations and comparisons within the tree seedling production arena. At the time of the study the exchange rate was 1 US$= KES 101.07.

3.6 Study Processes

After the development of the data collection tools the study was undertaken in three phases: pre-interview schedule pre-test and training of the enumerators; field data collection, cleaning and preliminary analysis; and FGDs and key informants interviews.

3.7 Data Collection Methods

Quantitative data was gathered from all 54 community tree nurseries. The tree nurseries were visited, the operators or owners interviewed using the attached interview schedule (Appendix 1). Qualitative data was gathered through two FGDs conducted using the check-list (Appendix 2). Further five key informants and nine farmers were interviewed using check-list (Appendix 2 and 3). Ten community tree nursery owners who had closed down were interviewed using check-list (Appendix 4).

3.8 Data Analysis and Presentation

The data was input and analyzed using Statistical Package for Social Scientists (SPSS) and MS Excel. Frequencies, percentages and averages were used to compare different nursery performances. Results from the FGDs and key informants are also incorporated. CBA was calculated taking in all costs and benefits to know where the production and marketing levels are. Break-Even Points and RoI were established. The information has been presented in narrative, tables, bar charts, pie-charts, graphs and photos (plates).

3.9 Reliability and Validity of Instruments

3.9.1 Reliability

Reliability is the degree to which a scale or measurement technique yields consistent results or scores upon repeated application (Kothari, 2004; Mugenda and Mugenda, 2008 and Collins *et al*, 2000 and Winer, 1962). Reliability identifies the stability or consistency of research results

(Kress 1979). Inter coder reliability using the Kalpha formula (KALPHA=1- (observed disagreement)/ Expected disagreement) which measures variable reliability using SPSS was employed. KALPHA of 0.67 to 0.97 were reported among the variable. This was realized during pre-test on 5 tree nursery operators in Emabungo Ward, Emuhaya Sub-county of Vihiga County in Western Province. The results show the reliability of the tool.

3.9.2 Validity

Validity is the degree to which a scale measures what is supposed or claims to measure. Construct validity (focusing on what is being measured) and concerned with the nature of reality and the nature of properties being measured was use. It focused on the characteristics to be reflected by the pre-determined questionnaires on the tree nursery. To strengthen the validity, FGDs and key informant interviews were conducted (Collins *et al*, 2000 and Kress 1979).

The research was conducted with two graduate assistants who were selected on the basis of knowledge on land use and tree species. This offered an opportunity to clarify to the respondents the difficult questions and to cross-check any misinterpretation.

3.10 Ethical Considerations

The researcher went out with candid objectivity (no predetermined answers were expected). The purpose of the research was honestly and transparently explained to the respondents. Their consent was obtained with freedom given to answer or not answer any question as would be deemed. Privacy and confidentiality of the data was also assured. Permission to conduct the research was obtained from Maseno University.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

This chapter details the findings of the study. The results are on: the tree seedling production processes (ownership, location and combining factors of production); marketing strategies (marketing concepts, pricing, competitors, consumers); evaluating profit margins- (CBA, BEA, ROI and ROE) of tree nurseries. These in effect help in understanding the costs and revenue streams which have a direct bearing in the economic viability of the community tree nurseries.

4.1 Community tree seedling production strategies

Production processes involves turning inputs into the products that are required by the consumers (Longenecker *et al.*, 2003). A tree nursery is a site designed and managed to produce tree seedlings under favourable conditions until they are ready for out planting (Roshetko *et al.*, 2010). Tree seedling production therefore is a process and enlists a number of activities: tree nursery site selection and preparation; potting; purchase of materials, equipment and tools; seed sowing; pricking out; and hardening off among other tending operations. At each level there are cost implications. The costs could be implicit or explicit. The economic viability of a tree nursery is dependent on how these activities are managed so as to match the returns. In tree seedling production a number of inputs are required thus the need for planning and organizing. These are seen at the onset by the reasons considered while establishing a tree nursery (commercial or otherwise); its location; size and the type (species) of seedlings produced. These invariably determines the quantity and even quality of seedlings produced in a given tree nursery which will inform the costs and returns resulting in economic viability.

4.1.1 Understanding the community tree nursery operators

(i) Demographic characterization of the producers

There were a total of 54 tree nursery operators in the division (Table 3-1). It was observed that 41 (75.9 percent) and 13 (24.1 percent) of the operators were male and female respectively. The study observed that among the respondents 87.1 percent were the owners and the remaining consisted of Brothers (5.6 percent), Daughters (3.7 percent), Spouses (1.9 percent) and sons (1.9 percent).

During FGDs it was realized that 59.3 percent had been in operation for three years and below; 17.8 percent for between four to nine years; and 11.1 percent for 10 years and above. Results from those who had closed shop indicated about 80 percent had been in the business for three years and below. The results show that most operators could be venture in the business as a short-term investment only to realize that it is long-term investment.

Most (79.6 percent) of the respondents were in the active labour age group of 18-55 years (Table 4-1). 23 (42.6 percent) of the tree nursery operators had secondary school education and above (Figure 4-1). It was also noted that only 2 (3.7 percent) had no formal education. These negated the belief that tree nursery is only for the uneducated. Roshetko *et al* (2010) notion that community tree nurseries thrive on social capital was equally dispelled. The results indicate that social capital work best for groups when there is no financial grant. These results are almost similar to the findings from Lower Nyando river basin by Oduol and Franzel (2014) that 75 percent of the tree nurseries were individually operated. They reported that on average, the operators are 39 years old and 68 percent are male and that majority (75 percent) attained up to primary school level of education while about 12.5 percent have secondary and college education.

Table 4- 1 Age and Relation of Interviewees

Age	Frequency	Percentage
Under 18 years	3	5.6
18-35 years	17	31.5
36-55 years	26	48.1
56-60 years	4	7.4
60 years and above	4	7.4
Total	**54**	**100**
Relation		
Brother	3	5.6
Owner	47	87.0
Spouse	1	1.9
Daughter	2	3.6
Son	1	1.9
Total	**54**	**100**

Source: Field data

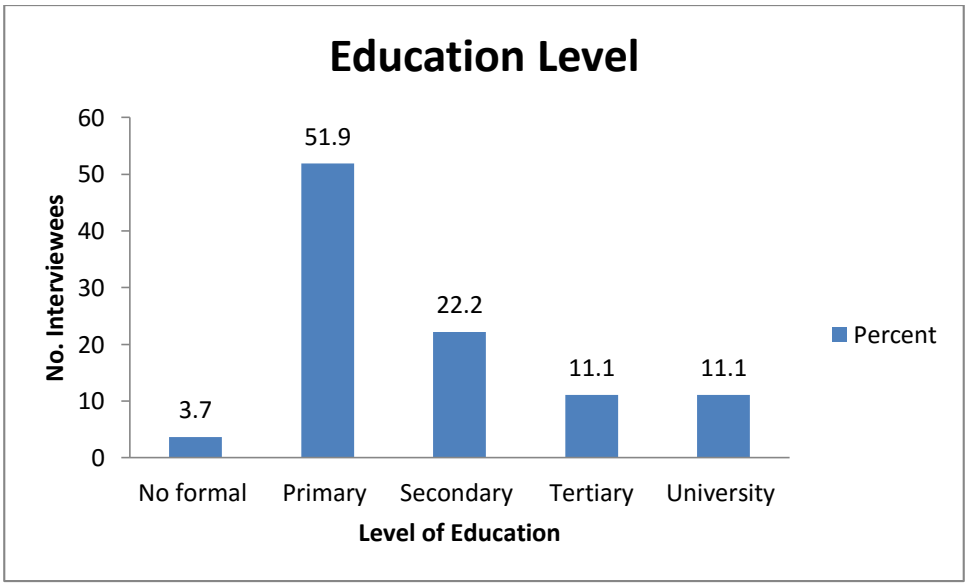

Figure 4- 1 Respondents' level of education

Source: Field data

ii) Community tree nursery ownership

Business ownership defines the level of decisions in both production and marketing matters (Longenecker *et al.*, 2003). The study observed that 50 (92.6 percent) of the tree nurseries are individual owned and act as the main household source of income (Figure 4-2). It was not

possible to get group membership information since most of those found were reluctant to divulge information about the groups. They were skeptic due to some funding earlier given by the LVEMP II.

The FGDs and key informant interviews confirmed the existence of the project in Ngo'w village. A number of tree nurseries were started by the LVEMP II since each member was to have his/her own tree nursery to compliment the group nursery. The project provided the members with equipment and materials to boost production. The group tree nursery was located within Maseno KFS Station. The group performed dismally and the grant could not be accounted for. This was partly a pointer to why project nurseries do not weather storms. One of the members noted that poor leadership and lack of commitment were the major challenges. Another noted the location of the nursery (almost five kilometers) from the village to have been the key hindrance. Most of the members did not want to discuss the group tree nursery. Further follow up revealed that the group nurseries were started as group but later remained as individuals since most of the group members were not active after end of project funding. This revealed the nuisance and mistrust in group tree nurseries. It was difficult to measure production, marketing and revenues obtained.

Since most of the tree nurseries are individually owned, it is therefore suffice to state that economic viability plays a vital role in their sustainability since decision making power relies on a few people giving thrust to connection power over the other power bases (Toseland & Rivas, 1998 and Mulwa, 2002). The decision making process can be well defined and posterity achieved unlike groups and institutions.

(iii) Financing

All businesses require some financing. The source of finance is incumbent upon the owner as it determines the level of ownership, sacrifice and benefits that accrue. It was noted that all the tree nursery operators interviewed depend on on-farm sales; own savings; formal and informal groups contributions and subscriptions; and friends and relatives to finance the tree nursery operations. Only 1 (1.9 percent) naively indicated loan as a source of funds for the business but could not explain the loan source. It can therefore be deduced that all use their own generated resources to fund the ventures. This therefore makes economic viability of the ventures a major factor to consider for continuity. Financing is vital though limiting for small-holder farmers in Kisumu County.

This conforms to what has been noticed in the county. High cost of in-puts, weak markets, diseases (both livestock and crops) and lack of credit are some of the impediments to agricultural development in Kisumu West as contained in the Kisumu West District Development Plan 2008-2012 (GoK, 2009). These have also been noted in the entire Kisumu County with lack of credit facilities having high prominence. It has been reported that despite the established network of banks and financial institutions lack of collateral and high interest rates have made it difficult for smallholder farmers and business entrepreneurs to access funds which inhibits business expansion (GoK, 2013; Thorlarkson, 2011; and Thorlakson and Neufeldt, 2012).

This is also noticed in the under-investment in forestry which Kant and Appan (2013) assert as the central issue facing forestry since earnings from existing forests are undervalued therefore not competitive with other services. The market mostly recognizes timber and a few non-timber

products not considering the other goods and services offered. Value of seedlings and the costs are equally not taken care of. This could be improved both locally and internationally to overturn a number of believes on forestry.

This is also in line with observations in Sub-Saharan Africa that small family farms dominate. Poverty is concentrated in those areas and therefore dependence on their household labour which is occasionally idle would boost incomes. In 2004 family farms contained over 92 percent of the world's 1.1 billion "dollar poor" consuming less than one US dollar worth of a world average consumption bundle, per person per day (Lipton, 2005). It can be noted that to achieve this there is need for thorough improvement in management and ability to look at the nurseries as business ventures.

Roshetko *et al.*, (2010) perceives that if tree nurseries were well managed then the community livelihoods and well- being would be improved. They see community tree nurseries as thriving on social capital. The authors allude that the community tree nurseries would provide answers to the poverty situation while responding to environmental management and conservation issues. This would likely happen if the community were operating at economic levels. It has however been noted that even the involvement of other actors mostly the NGOs in project set ups do not really give much to the economic viability of the ventures (Oduol and Franzel, 2014).

Further, financing is impeded by lack of proper planning which is still in line with the findings of (ibid, 2014). They noted that though financing is identified as critical for the production and marketing of tree seedlings, there is limited access to business services like credit facilities, rural

advisory services, market information, and transport. Most of the operators rely on their own resources which are by and large limiting. This is evident in Fig 4-2 that shows that on-farm and tree nurseries contribute to over 77.8 of the operators' income. Notably tree nursery is their main (38.9 percent) source of income. It is even seen as an additional income source to those in formal employment.

It can be deduced that tree nursery is life line of most of the operators. Once production is ascertained, marketing would therefore be important in ensuring that the ventures are profitable. If the operators are able to produce tree seedlings, there is need for buyers. This is what would sustain the tree nurseries. They can then look at how to reduce production costs while maximizing sales.

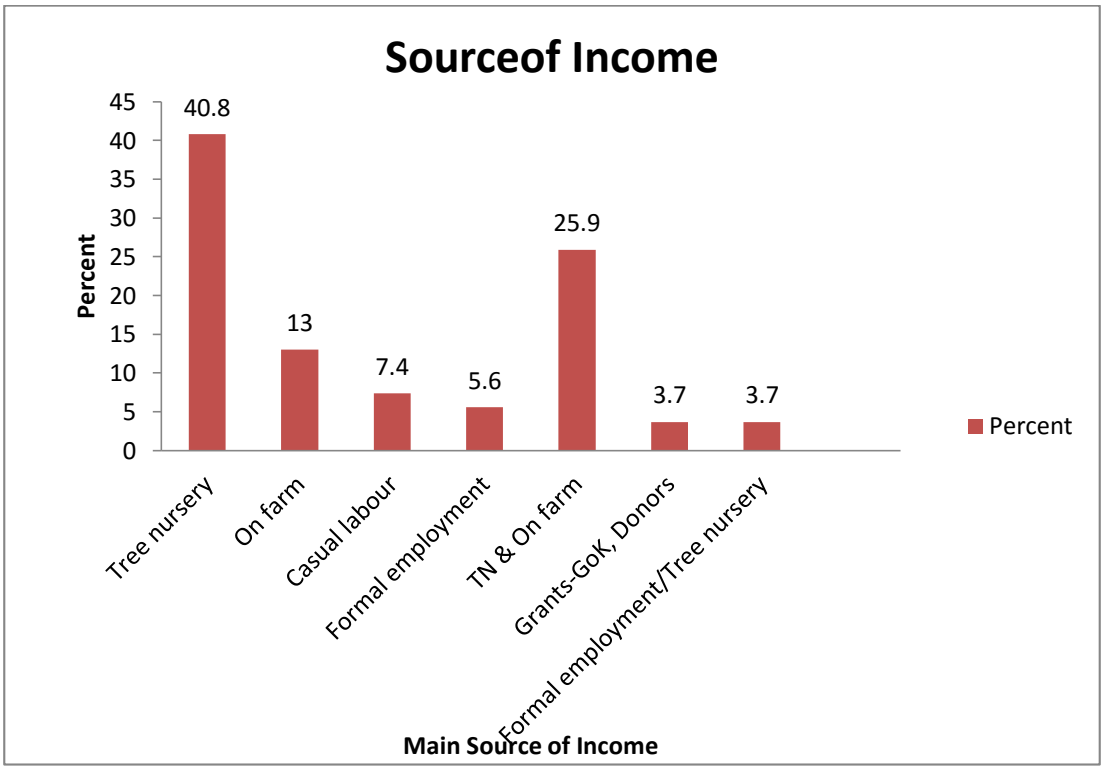

Figure 4- 2 Respondents sources of income

Source: Field Data

4.1.2 Reasons for establishing community tree nurseries

Tree nurseries provide optimum care and attention to the young seedlings during their critical juvenile stage resulting in production of healthy and vigorous seedlings (Roshetko *et al.*, 2010, Evans, 1982, Moir *et al.*, 2007 and Wightman, 1999). Since tree growing is a long term investment, the quality of the seedling (root shoot ratio, leaf colour and sturdiness) is important in any seedling production unit. Commonly the quantity (number of seedlings available for planting at a given time) varies and is a drive to tree nursery establishment.

The above authors retort that community tree nurseries are believed to be established to fill the quantity and quality void rather than for income. Roshetko *et al., (*2010) attests that group nurseries are established to build technical and leadership capacities of group members, expand the number of species and provide quality germplasm. This study revealed that 51 (94.4 percent) of the operators stated income as a reason for establishing their tree nurseries compared to 44 (81.5 percent) and 28 (51.8 percent) for quality seedlings and quantity (required numbers) at planting respectively (Table 4-3). On ranking 53.7 percent mentioned income as the first reason to consider. This shows that community tree nurseries would be an investment therefore the need for good planning and management.

Wightman (1999) highlights that *"A nursery manager's most important goal is to produce quality tree seedlings….A poor quality tree seedling will always be a poor quality tree even if planted on well-prepared good site"*. Evans (1982) also notes that most forest nurseries produce seedlings for specified programmes thus the need for required species at the right time, of the right size, sturdiness and in sufficient numbers. Evans consents to the fact that ambient growing

conditions and reduced competition in the nursery provides good start for the tree seedlings. Since most small-holder family farms are operating units in which most labour and enterprise come from the family, which puts much of its working time into the farm. The tree nurseries would harness such labour while providing the much needed income.

These explanations are more from the producer's perspective and not consumers. This was confirmed from the FGDs and key informants. Most of those planting trees indicated the need for quality seedlings and willingness to pay any prices though when probed further they were unable to consider the cost of production. Their pricing were arbitrary. What is important is the assurance that the seedlings will grow and provide the intended end use. One tree farmer said that *"since tree planting is a long-term investment, I would rather pay a higher price for quality seedling while sure that I will get the right quality product when time comes".* The demand for quality from the buyers is congruent with the reason for establishing tree nurseries by the operators. This partly explains why the tree nursery operators are not able to sustain the production process. Quality required but no commensurate sacrifice on price.

Any business needs to consider the needs of the consumers. This would therefore mean that if the operators were able to produce quality seedlings then the demand may be met at a reasonable price. Since Kenya is still internationally considered a Low Forest Cover Country (LFCC) as it has less than 10 percent of its total land area under forest, this would act a boon. Since income is important to the tree nursery operators, the closing down of community nurseries could be attributed to the inadequate match between the costs and revenue yet there is unmet demand for tree seedlings. The gap that community tree nurseries would fill but it is like the economic factors mostly revenue from sales does not match.

Table 4- 2 Reasons for establishing tree nurseries

Reasons	Rank						Total	
	1st	Percent	2nd	Percent	3rd	Percent	All who gave the reason	Percent
Seedling availability (quality)	19	35.2	14	25.9	11	20.4	44	81.5
Seedling accessibility (quantity)	6	11.1	14	25.9	8	14.8	28	51.8
Income generation	29	53.7	19	35.2	3	5.6	51	94.4
None	0	0	7	13.7	32	59.5		
Total	54	100	54	100	54	100		

Source: Field Data

4.1.3 Factors considered while locating community tree nursery

Business location has a direct link to the business economic performance. According to Longenecker *et al. (*2003) the product individual item (tree seedlings), product line (number of seedlings per given tree species) and the product mix (number of tree seedlings per species in per tree nursery) hence product mix consistency (similarity of the product lines) depends on the location of a tree nursery. The location determines the cost of production in terms of material (potting media, tree seed, labour, water) availability. Therefore considerations must be made on a number of issues in terms of seedling growth and management. Permanent (constant) water supply; a gentle slope; good potting soil (media); seedling security; accessibility during all the year; area free for expansion and shade are prerequisites (Evans, 1982, Roshetko *et al.,* 2010, Moir *et al.,* 2007 and Oballa *et al.,* 1990).

It is estimated that a thousand tree seedlings on average requires 20 litres of water. Gradient affects the maintenance cost. Very steep sites would result into losses as seedlings can be washed away during heavy down pour. Too flat areas would also encourage water logging then diseases to the seedlings (Evans, 1982). Potting soil is required for each and every tree seedling therefore proximity reduces cost of production. Loss in terms of theft and/or damage by pests also in decreasing production cost (Moir *et al.*, 2007).

Accessibility reduces related production costs like transport and even customers. Any business has growth prospects therefore an area free for expansion would help reduce cost of shifting and even management (Longenecker *et al.*, 2003). Shade is a must in the nursery and will always help in increasing losses especially at pricking out (Moir, et al., 2007, Jaenicke, 1999 and Wightman, 1999).

All the mentioned factors have implications in the overall cost of production. The study revealed that availability of water reigned high but with same scores as security (27.8 percent) as number one priority (Table 4-3). The cumulative numbers revealed that water and potting soil were important as 72.2 percent of the 54 respondents mentioning them. Security was not far off (70.4 percent). The study revealed market as an additional factor considered even though mentioned by only one operator. It is good to put it in consideration especially when income is the main reason for establishing the tree nursery. A follow up during FGD and in-depth interview revealed that most of the operators did not consider market because they are able to sell what they produce so long as they are of good quality and at the right time. Timing is therefore an issue to reckon in community tree seedling production since most of the operators rely on weather conditions for

production and marketing. The other reasons like gentle slope, accessibility, area free for expansion and shade were equally considered.

These results could be attributed to the area's bimodal rainfall with climax in April and May; and the awareness on the importance of tree growing. During FGDs it was reported that every person would wish to plant a tree regardless of where and how he/she obtains it. The KII show that most of the operators only consider water, security and soil mainly because where they are scarcity of water, theft and sandy soils make it difficult to access these commodities and services. However decisions have to be made on which one to trade off. *"One would rather establish his/her tree nursery within the homestead even he/she has to walk long distance to fetch water"* retorted one of the key informants meaning to her security is a main issue. They also noted that potting soil is always a challenge as they have to buy. The other reasons were not very prominent since the land holdings in the area are still relatively large. Accessibility was not a big issue for both the producers and the buyers. Most of the tree nurseries are within homesteads or within the farms. On the other hand most of the buyers are community members who can access the nurseries on foot.

From these findings it suffices to note that even though water and soil were the major factors while locating the community tree nurseries, most of the nurseries lack in these two components thus the high production costs.

Table 4- 3 Factors considered while locating a tree nursery site

Reasons	Rank 1st	2nd	3rd	4th	5th	6th	7th	Total on factors
Permanent water source	15 (27.8%)	13 (24.1%)	4 (7.4%)	6 (11.1%)	1 (1.9%)	0 (0.0%)	0 (0.0%)	39 (72.2%)
Gentle slope	2 (3.7%)	4 (7.4%	6 (11.1%)	6 (11.1%)	1 (1.9%)	1 (1.9%)	2 (3.7%)	22 (40.7%)
Potting soil	8 (14.8%)	10 (18.5%)	14 (25.9%)	3 (5.6%)	2 (3.7%)	2 (3.7%)	0 (0.0%)	39 (72.2%)
Security	15 (27.8%)	8 (14.8%)	10 (18.5%)	2 (3.7%)	3 (5.6%)	0 (0.0%)	0 (0.0%)	38 (70.4%)
Accessibility	7 (13.0%)	12 (22.2%)	5 (9.3%)	7 (13.0%	4 (7.4%)	0 (0.0%)	0 (0.0%)	35 (64.8%)
Area free for expansion	4 (7.4%)	4 (7.4%)	2 (3.7%)	6 (11.1%)	8 (14.8%)	2 (3.7%)	0 (0.0%)	26 (48.1%)
Shade	3 (5.6%)	0 (0.0%)	5 (9.3%)	3 (5.6%)	1 (1.9%)	6 (11.1%)	1 (1.9%)	19 (35.2%)
Market	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (1.9%)	0 (0.0%)	1 (1.9%)
None	0 (0.0%)	3 (5.6%)	8 (14.8%)	21 (38.9%)	34 (63.0%)	42 (77.8%)	51 (94.4%)	
Total	**54 (100.0%)**	**54 (100.0%)**	**54 (100.0%)**	**54 (100.0%)**	**54 (100.0%)**	**54 (100.0%)**	**54 (100.0%)**	

Source: Field Data

4.1.4 Sizes of tree nurseries

The size of a tree nursery will determine the number of seedlings an operator can produce. Operational costs also depend on the size of the tree nursery. The larger the tree nursery the higher the likelihood of mechanization which reduces production cost. Individual nursery area is mainly determined by level of annual seedling production, method of raising the seedlings and nursery life of the seedlings (Evans, 1982). Evans alludes that a total area for producing an estimated annual of one million seedlings including shade, access tracks and storage is about 4 ha where nursery life of plant is more than one year. He indicates 1.5-2ha where it is between four months and one year and 0.5-1ha where it is less than four months and several crops are grown in one year. His last description befits the operators interviewed. Most 39 (65 percent) of the tree nurseries are of 10m x 10m (0.001ha) (Figure 4-3). This means that effectively these nurseries have the capacity of producing 20,000-40,000 assorted tree seedlings. This may also be dictated by the sizes of the containers. Otherwise this is in tandem with Roshetko *et al.*, (2010) estimate of up to 10,000 seedlings per season. Obala *et al., (*1990), also stipulate that a 10m x 10m is required to raise 10,000 seedlings per year in standard containers. This should be enough to take care of access paths and shade.

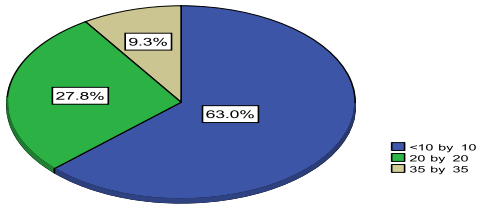

Figure 4- 3 Tree nursery sizes

Source: Field Data

4.1.5 Production techniques

It was observed that all the tree nursery operators employ traditional techniques. They use local materials with limited training and value addition. Despite the levels of education, ownership and financing, the techniques employed did not show any high level technologies like root trainer containers, soil sterilization equipment, watering pumps and spraying machines among others (Roshetko *et al.*, 2010 and Evans,1982).

Longenecker *et al.*, (2003) asserts that most businesses thrive on the depth of the product line and wider product mix. In the tree nursery set up, the higher the tree species and the higher the number of tree seedlings per given species would determine the viability of the ventures. The study revealed that only 10 (18.5 percent) of the tree nursery operators are doing value addition thus increasing the product line and mix. Seven are raising flowers from cuttings, two grafting mangoes while one is raising bamboo from cuttings (Plate 2 and 3). These show opportunities for diversification in the tree nursery activities. Comparatively these are the ones earning most in the business venture (Figure 4-11 and 4-12).

Plate- 1 Grafted Mango seedlings

Plate- 2 Bamboo seedlings in a tree nursery

4.1.6 Training and its impacts

Training is vital in the performance of any task. As it is, only 29 (53.7 percent) of the tree nursery operators interviewed indicated having had training on tree nursery establishment and management. The trainings were received mostly from NGO's and research organizations within and outside the division. There was indifference on the need for further trainings as most of those interviewed remained non-committal on the importance of the trainings. It was not possible to capture the nature of trainings and content as most of those trained only indicated tree nursery establishment and management. The FGDs revealed that most of the trainings were hands-on and took three days. Much covered was on production processes and not running the tree nurseries as businesses. Key informants interviewed lamented the poor organization and training delivery techniques. One of them said *"the trainings were organized to help spend donor money but not to empower the trainees"*. Further follow up with the trained operators revealed that there was a hand-out syndrome in the community that the trainees do not attach much to the trainings. The triangulation brought to book the value of trainings and the need to have the trainees own the process.

Muriuki (2005) attests to the inadequacy of the content of training courses undertaken for tree nursery operators in tree seed collection and handling. Short training sessions, subjects handled including general agroforestry, tree nursery operations, tree management for seed production and seed harvesting made it difficult to ensure quality tree seed production and procurement. The composition of trainees (tree nursery operators basically farmers) with co-opted extension staff in the 1980s far affected the training results and adoption.

These results therefore indicate the need to understand what content to give to what trainees and for how long. This also partly explains why the role of NGOs in developing the forestry sector is still low (Oduol and Franzel, 2014). Participation should therefore be sought at all levels while designing such projects. Otherwise a lot will be done with a lot of resources but minimum impact.

4.1. 7 Species produced and reasons for their production

Tree seedlings are the product items in a tree nursery while species form the product line. Most buyers come knowing the species of tree they require and even the numbers of seedlings. It therefore means that for meaningful business venture the tree nursery operators should produce tree species in demand within the area and the neigbourhood. The economic viability would depend on the species, numbers produced and sold. Much has been done in terms of tree nursery site selection, size and number of seedlings to produce but not on which tree species to produce. Depending on the reason for establishing the tree nursery one is always guided by the prevailing weather conditions, expected end use and the technology to be used among many considerations (Roshetko, 2010). For example if one is in the Arid and Semi-Arid Areas (ASALs) the species

selection will be dictated by climatic conditions and the AEZ in terms of rainfall, evapo-transpiration, soils, temperatures and humidity among others. This makes each planting site unique and requiring corresponding species and provenance (Milimo, Kimondo & Chikamai, 1990).

Community tree nursery operators must be privy to such factors as they select which species to produce since this will determine the sales. As can be noted from this study (Figure 4-4), most of the operators produce exotic tree species. Eucalyptus species tops the list (83.3 percent) followed by *Grevillea robusta* (64.8 percent), Casuarina species (22.5 percent) and *Dovyalis caffra* (17.2 percent). *Markhamia lutea* an indigenous tree species comes fifth after flowers. A total of 31 different species were reported (28 tree species, one vine, one bamboo and a number of flowers). Different tree nurseries produced different species with diversity ranging from 1-10. A number of flower species were in the tree nurseries but were lumped together.

The study observed that as much as the tree nursery operators are in business, cumulatively 86.1 percent did not know why they raise seedlings of the given species. The remaining indicated their choice to be dependent on uses: tolerance to diseases, pest and drought and seed availability (Figure 4-5 and Appendix 6). Among the uses timber reigned highest (39 percent), followed by fruit trees and agroforestry at 18.9 and 15.5 percent respectively. This could be explaining why most tree nurseries were growing *Eucalyptus species, Grevillea robusta* and *Casuarina species* thus matching the report by Oduol and Franzel (2014) in the Nyando Basin. There were eleven timber species; six fruit tree species; three for aesthetic value; three medicinal trees; three fodder

trees; two fuelwood tree species; and one species for fencing. The flowers are mainly for aesthetic value while bamboo is for soil conservation.

These results confirm the preference for exotic to indigenous tree species. Eucalyptus species is reportedly the most occurring species strengthening its position as the widely cultivated forest trees in the world. These findings show the likelihood of overdependence on one species which could be having ripple effects on environmental management. Farmers confirmed their preference for the two species (*Eucalyptus species* and *Grevillea robusta)*. Most of them like these species due to the products and potentially fast growth. There was a notion among the farmers that indigenous species are slow growing and that is why they are shying away from growing them. This notwithstanding socio-cultural values are still attached to some of the indigenous species thus their continued planting.

The results here agree with the other reports that Kenya has an estimated 100,000 ha of Eucalyptus species comprising 15, 000 ha in gazetted forests; 35,000 on private owned land by large companies; 50,000 ha on individual farmers' land and local authorities (Oballa *et al.*, 2010). Despite being introduced for woodfuel supply for the Kenya-Uganda railway in 1902, Eucalyptus is now grown for timber, plywood, transmission poles, pulp, building materials, fencing posts, rail (fittos), windbreak, ornamental and environmental enhancement (ibid, 2010).

The results conform to the findings of a survey in Murang'a district (Nieuwenhuis and O'Connor-unpublished) which reported an almost similar trend with heavy reliance in the region on a single exotic tree species, *Grevillea robusta*. Although this species fulfills many functions, such as supply of fuelwood, timber, fodder, shade and mulch (Harwood, 1992), reliance on one

species is dangerous. An example of damage caused by pathogens was seen when *Leucaena leucocephala* and *Cupressus lusitanica* were attacked throughout Kenya in the early 1990s and the entire crop destroyed at nursery and plantation ((Nieuwenhuis and O'Connor-unpublished).

The listed uses agreed with those highlighted by Maundu and Tengnas (2005) and Milimo *et al. (*1990). The categorization is a clear indication that the operators understand the uses of the species (though disturbing because only 13.9 percent responded) they are raising even though differentiations could not be easily made on agroforestry and the other uses. The FGDs and in-depth interviews showed that all trees have agroforestry potential. It was also noted that since most men were interviewed than women, no wonder the fuelwood issue did not come up strongly as compared to timber. One of the women said *"Men always think construction. That is where we test their strength. They also love money that comes readily from timber. My strength is in the kitchen. How I wished I was in the interview. All the same we still get fuelwood when they cut trees for timber. We need trees for our day to day living."*

Despite the production of likely preferred tree species, there is always a mismatch between the demand and supply. Most of the operators indicated seasonal and annual variations in demand. This has resulted in the operators occasionally having too much or too few of given species. Since production is not synchronized there is economic loss either way. Understanding and predicting the production is vital for economic viability in the seedling production process.

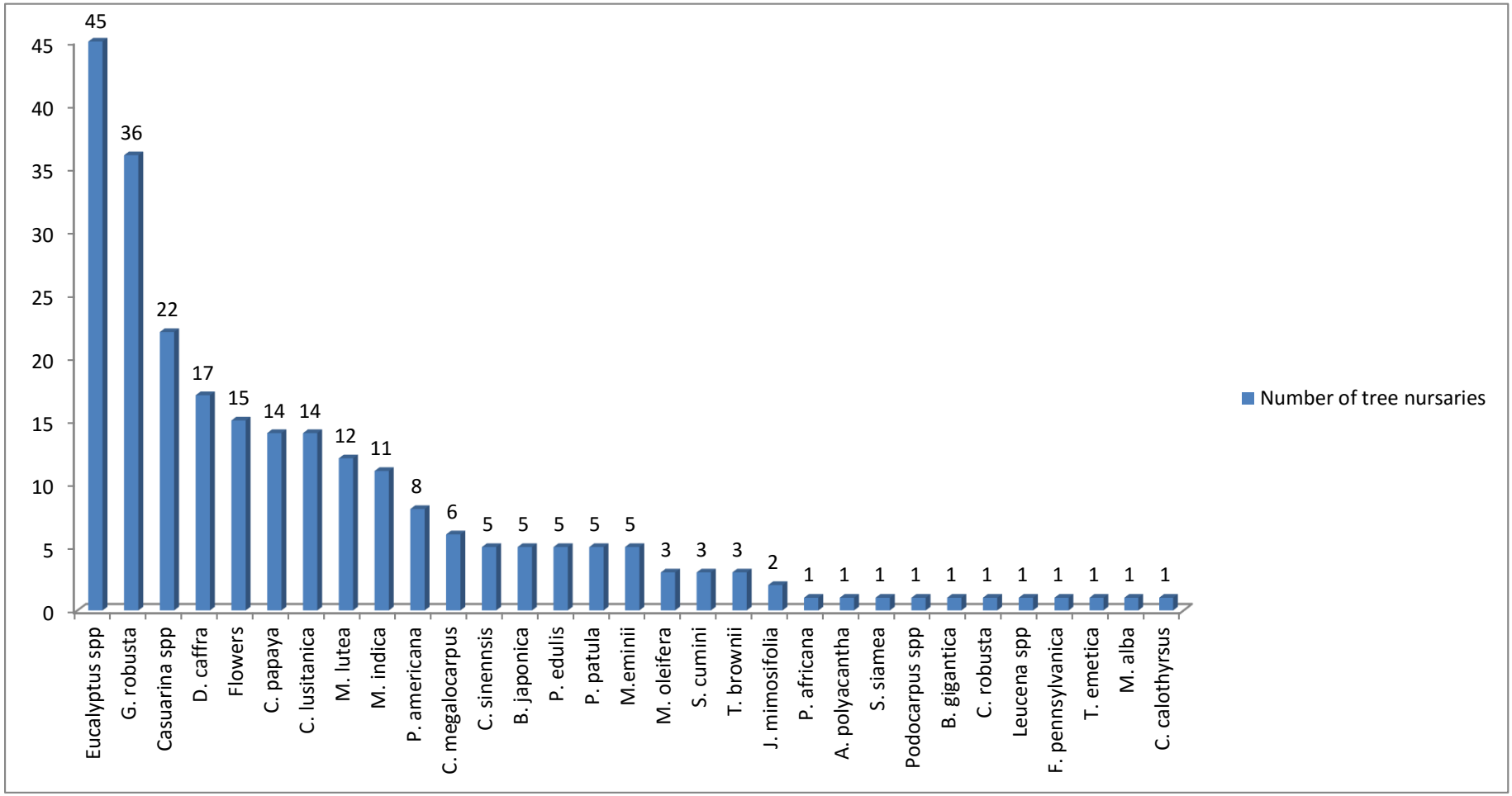

Figure 4- 4 Number of tree nurseries producing given tree species

Source: Field Data

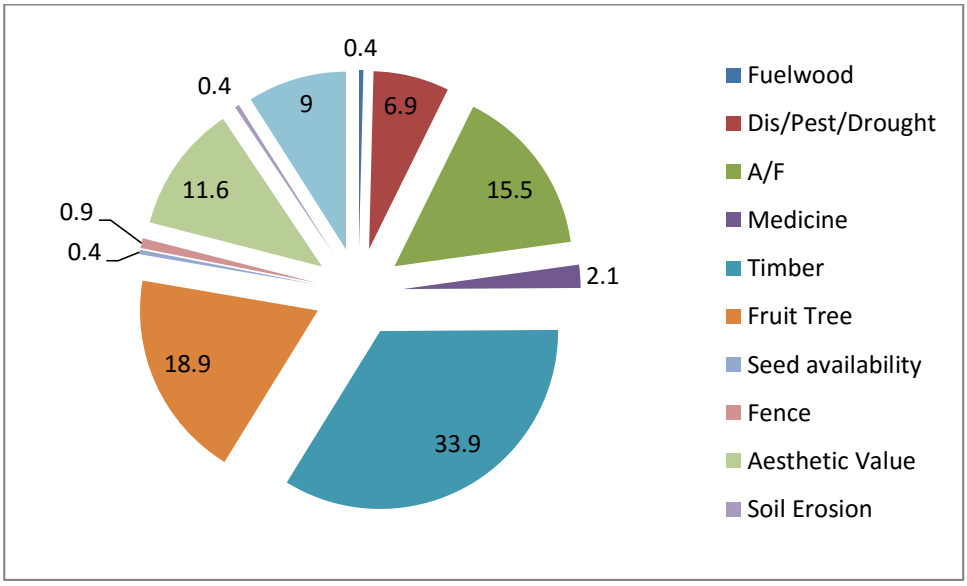

Figure 4- 5 Tree nursery reasons for raising given species

Source: Field Data

4.1.8 Tree seedlings' production costs

Cost is the amount which is spent to produce or buy a commodity (Saleemi, 2000). They are the expenditures incurred to earn income. Every production process must incur costs. These could be in acquisition of both fixed and current assets thus fixed and current (variable or recurrent) costs respectively. It is also prudent to understand the BEP so as to allow concentration to making savings from various cost lines. From this point, CBA can also be done to ensure all costs accrue some benefits in the production line.

i) Fixed costs

Fixed assets are the assets that can be used for more than one season or year. Their cost is independent of the number of seedlings produced. The following assets were mentioned by the operators: shade (16.7 percent), watering cans (50 percent), watering containers (55.6 percent),

spades (64.8 percent), jembes (88.9 percent), pangas (74.1 percent), sowing beds (14.8 percent) and pruning knives (14.8 percent) (Figure 4-6). There were a number of variations in the costs depending on the sizes and qualities purchased. For example the water containers were so varied; operators' had ten, twenty, one hundred and one thousand litre containers. This made price comparisons challenging between and among the items. This notwithstanding, data and information from FGDs, key informants and prices from nearby shops were consolidated to arrive at the total fixed cost per tree nursery (Appendix 4-7).

There could have been mix up in computation since some of the items are used in the farm, given by NGOs or handed over by parents. This is in tandem with the findings of Oduol & Franzel (2004) that fixed costs are always difficult to compute. It was observed that the fixed costs constitute only on average seven percent of the total cost.

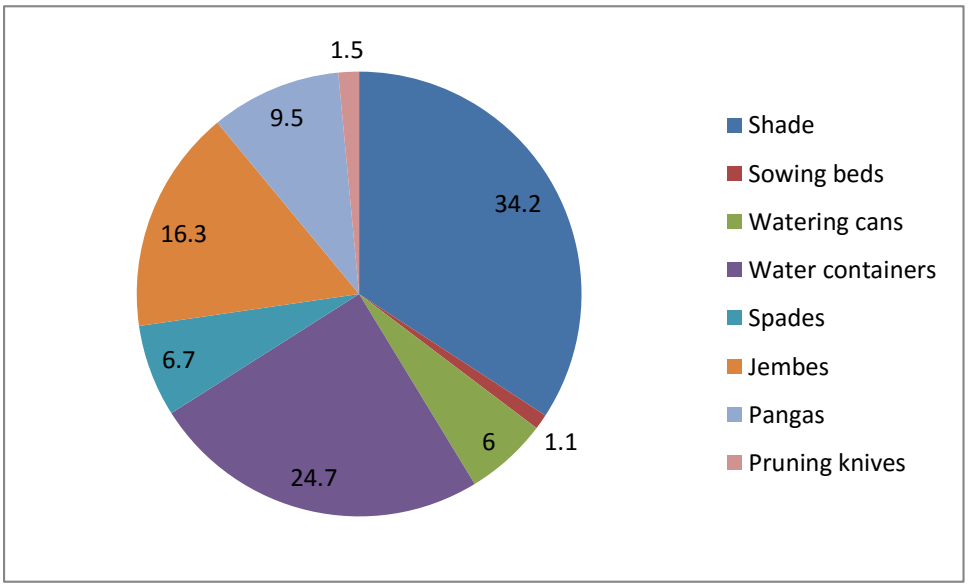

Figure 4- 6 Fixed costs

Source: Field Data

ii) Variable costs

Variable costs are costs that vary with production level (Longenecker *et al.*, 2003). These included potting media, potting bags, water, labour, land rent and seeds. Different potting media (substrate) were observed in the nurseries. This depended on the available soil within the nursery. Most of the nurseries excavated soil from within the nursery area. This is not sustainable since soon they will start excavating the top soil from the farms which may drastically affect production of other crops. Only five (9.5 percent) operators were using farm yard manure. In depth discussions revealed that most of the operators do not consider the opportunity costs. To help improve the health and growth rate of the seedlings a good potting media that is light in weight to facilitate transport yet hold seedlings firmly; does not shrink nor swell in a manner that can cause seedling damage; good water drainage capacity; well aerated; contains necessary nutrients for seedling growth and development; does not contain weed seeds; low in toxic salts and harmful micro-organisms; can be sterilized without changing the characteristics; and the quality is consistent from year to year need to be obtained was lacking (Wightman, 1999).

Evans (1982), states that nursery soil should be workable, of good texture and free draining, with pH 5.5-7.0 for broad leaves species and pH 4.5-6.0 for conifers. Soils well drained with mix of sand and loam and high in humus and nutrients are preferred (Moir *et al.*, 2007). Since it is difficult to find all these within the community tree nursery sites, one can always correct by mixing parts as: clay soils-one soil, two sand and two compost; loamy soils- equal parts of soil, sand an compost; and sandy soils- one soil, zero sand and one compost (Wightman, 1999).

All the tree nurseries produce seedlings in containers. No bare-root seedling production an indication that they are producing with transportation in mind. Potting bags are in different sizes.

It was observed that there are 2'', 3'', 4'', 6'' and 12''. The quality of the bags also differs remarkably. The size of bag used depends on the size of seed and how long the seedlings will be staying in the nursery. For example big seeds like *Mangifera indica* (mango) and *Persia americana* (avocado) are sown in 6" x 6" bags unlike the small ones like Eucalyptus and Casuarina species which also take shorter time in the nursery, the 2" and 3" are used. Occasionally space available also influence the type of bag used (Evans, 1982).

Water – This is the main stay of any tree nursery. Oballa *et al.*, 1990 estimated that in the dryland 10,000 seedlings require 300 litres of water per day. A farmers' manual developed for Western Kenya farmers estimated 20 litres for 1,000 seedlings a day. Care should be taken not to under or over water seedlings as each extreme has its effect. Within the area a 20 litres of water in a container costs KES 5 except in the urban centers like Maseno Township where the same quantity goes for between KES 15-20 depending on distance from water source. On average one seedling requires 3 litres of water for the four to six months it will take in the nursery assuming rains in between.

The study realized that most (85.2 percent) of the tree nursery operators use family labour in their seedling production. Generally, within the area casual workers are paid KES 200 per day with mostly own savings or profit. It was noted that the operators who hire labour pay by task. They pay KES 200 for pricking out 1,000 seedlings and KES 100 for filling 500 bags.

Land rent is not an issue since most of the operators are within their own lands except the 3 (5.6 percent) in Maseno Township who are required to pay rates to the Town Council.

Good quality seed is a key factor in the establishment, survival and productivity of trees. Most afforestation programmes have failed due to in-availability of seed (Evans, 1982). Since tree growing is a long term investment it is therefore prudent to plan to have quality and enough quantity of seed in good time. It was found out that only 10 percent are purchasing seed from authorized dealers, the remaining do own collections. This is similar to results by Nieuwenhuis and O'Connor (Unpublished) where all *Grevillea robusta* seed used in the nurseries were locally collected. These results are in tandem with what was found out by Muriuki (2005) that tree nursery operators reported procuring seeds from both formal and informal sources. The formal sources constituted only 16 percent and included the Forest Department (now KFS) of the Ministry of Environment and Natural Resources, KEFRI, MoA and a number of NGOs. Informal sources included self-collection (57 percent), purchase from seed dealers (24 percent) and seed exchanges with other nursery operators (3 percent) (Figure 4-7).

The current seed source is likely to lead to inbreeding, resulting from a gradual decline in the genetic base. Local seed collection posses a great challenge to the quality of seedlings being sown. The operators indicated that the main reason is that seed from the authorized dealers' are not very viable while their cost is very high. It was also observed that the operators have limited planning skills and do not understand tree seed production calendars. They depend on fell trees. The formulae highlighted by Evans (1982) as the size of annual planting programme; intended number of seedlings; estimated survival after planting and estimated plantable seedlings per kilogram of seed need to be adapted while planning seed acquisition and handling. This combined with what Maundu and Tengnas (2005) gave as would be guide on the amount of seeds required and avoid wastages. Nursery operators reported procurement of seeds from both

formal and informal sources. The formal sources included the Forest Department of the Ministry of Environment and Natural Resources (FD), KEFRI, MoA and various NGOs.

The seedling production costs are high compared to the commercial tree nurseries (Roshetko *et al.*, 2010). Since most (94.4 percent) of the operators are producing with incomes in mind, there needs to be much on planning and management. Conversely most customers want quality seedlings and of given quantities, a blend that should be got.

The study also discovered that there is a lot of seedling wastage during and after production. It was not possible to really quantify the numbers lost at pricking-out since most of the operators replace the dead seedlings and only consider the numbers ready for planting and/or sale to have been produced. It was observed that this though not documented is pushing production costs up since the labour is always paid by number of seedlings pricked out not the numbers that survive. The other loss comes due to the number of seedlings that remain unsold or unplanted. These remnants escalate production costs since they have to be continually tended. The study found out that the remnants constitute 12.6 percent while those lost through pest and diseases account for 16.5 percent. From this it was evident that only 70.9 percent of the 744,076 seedlings produced are sold and/or planted. There were also piles of filled pots which were either unused or seedlings dried-up never reaching the market despite polythene, media and labour costs.

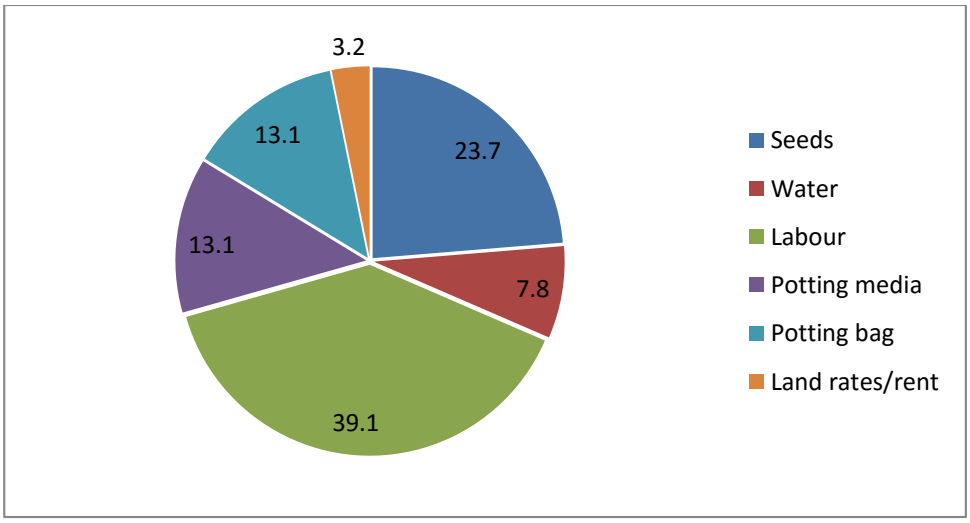

Figure 4- 7 Variable Costs
Source: Field Data

Plate- 3 Over-grown seedlings in a tree nursery
Source: Field Data

Plate- 4 Wastages in the tree nursery

Source: Field Data

4.1.9 Challenges in tree seedling production

Community tree seedling production has been riddled with a number of challenges. As indicated in Table 4-4 water remains a key challenge with 57.4 percent mentioning it. Oballa *et al* (1990) estimated 300 litres of water per day for 10,000 seedlings in the dryland and 20 litres per day for 1,000 seedlings in Western Kenya. It is in line with the earlier results (Table 4-2) that 72.2 percent of the tree nursery operators mentioned as prerequisite to locating a tree nursery. The results conform to studies elsewhere by Nieuwenhuis and O'Connor (unpublished) findings in Muranga that water supply was a limiting factor in over one third of nurseries, regardless of the nursery size, the location or AEZ.

Pest and diseases have also been noted by 42.5 percent. Tree seedlings suffer from a number of pest ranging from sucking to cutting. A number of diseases like damping-off and wilting do

occur. This is why every tree production book or manual must endevour to provide pest and diseases solution. The results here are in line with the findings of Oduol & Franzel (20140 in Nyando basin where pesticides had to be included in the cost of production.

Seed forms an integral part of seedling production. Availability, viability, purity and price are factors to consider (Muriuki, 2005). Oduol & Franzel (2014) also include them while costing for seedling production. Nieuwenhuis & O'Connor (unpublished) also note that there is danger in supplying of *Grevillea robusta* seed from one source. Since most of the tree nursery operators produce almost homogeneous products, competition due to free entry and interference by other actors may be real (Oduol & Franzel, 2014) but it also to a degree explains why most of the producers close-shop. They come with high expectations then realize the demand and supply dynamics. Labour, insecurity and cost of potting bags illustrate the high variable cost in this finding and the part they play in Nyando Basin (ibid, 2014). Even though most of the labour is family occasionally the operators have to hire.

The other challenges like infertile soil and inadequate knowledge are inconsequential since the heavy presence of other actors. This notwithstanding the missing of market and poor pricing raise questions of the prevailing contrast between what the buyers consider challenge and what actually is making the operators close the business. The operators mention income as the main reason for starting the tree nurseries yet fail to mention marketing. The absence may partially have informed the findings of Oduol & Franzel (2014) that the margins would be negative should fixed costs be included, other actors be locked out and business be left to the forces of demand and supply despite the good prices offered by neighbours.

Table 4- 4 Challenges in community tree seedling production

Reasons	No	Yes
Inadequate water	23 (42.6%)	31 (57.4%)
Pest and diseases	31 (57.4%)	23 (42.5%)
Expensive labour	47 (87.0%)	7 (13.0%)
High seed prices	40 (74.1%)	14 (25.9%)
Long seed procurement procedures	53 (98.1%)	1 (1.9%)
Infertile soil	51 (94.4%)	3 (5.6%)
Competitors	40 (74.1%)	14 (25.9%)
Insecurity	47 (87.0%)	7 (13.0%)
Inadequate knowledge	54 (100.0%)	0 (0.0%)
Cost of potting bags	47 (87.0%)	7 (13.0%)

Further, the tree nursery operators understand the seedling production processes. They are able to establish the tree nurseries in the right places thus reducing operational costs but water and soil are still the main constraints despite being the main items required in any tree nursery. This therefore makes running the tree nurseries expensive as most of the operators have to buy water and potting soil. This notwithstanding they still have to struggle with the low prices offered at the community or household level (Appendix 4-8).

4.2 Tree seedling marketing system

Market means a place where one can present his/her products to potential customers. This can be in the open place, building and even electric system for e-commerce. To small businesses like the community tree nurseries it is the process by which products (tree seedlings) are presented to the customers at a price. Understanding the marketing systems used by community tree nursery operators in Maseno division would help respond to the economic viability of the tree nurseries.

The market structure, price mechanisms; and business financing have been assessed

.

4.2.1 Market structure

A market structure consists of how products are availed to the consumers from the producers. The structure could consist of the producer, wholesaler, retailer and consumer. It has been noted that the longer the chain the higher profitable the business (Longenecker *et al.*, 2003). One therefore should be able to understand the products required by the consumers; what quantities; what qualities; the existing market players (competitors) and what the gaps could be (ibid, 2003). This helps in structuring the business in terms of product, pricing, place and promotion which all inevitability define the market structure. The study discovered that the tree nursery operators do not carry-out any market research. They rely on their intelligence and past experience in deciding the tree species and number of seedlings to produce.

It was also noted that all the respondents use the product and/or sales orientation philosophies. This is where one relies on the goods and products he/she has produced or the amount he/she or others have sold to tap the market. Production and sales strategies supersede marketing (ibid, 2003). The limited marketing skills and focus on products and sales impede customer-orientation philosophy which lays emphasis on the customer. It seeks to understand who the customer is or likely to be, what would they need in terms of quality and quantity; where and at what given intervals. It also looks at the target population to assess the potential customers then what segment of the market can be controlled. It was observed that all the operators are selling directly to the consumers (end-users- people who go planting) though with exceptions of the fruit trees which are occasionally sold to NGOs who then distribute to farmers.

Longenecker *et al.,* (2003) defines product mix as the number of goods a firm can present to a market. It comprises the total product lines (sum of related individual product items). For example in the tree seedling production business this is the total number of seedlings of the different tree species availed in the market. The product line would therefore be the given tree species in a given tree nursery while the product item is the individual tree seedling in the tree nursery. This helps show how a market is structured and how the customers would benefit from such structuring. The better organized the product mix the better the market thus the economic viability.

It was observed that the tree nursery operators produce multiple products-tree species (Figure 4-4 and 4-5 above) but not so much differentiated in terms of use. This reduces the potential that would come with the product lines. For example if they were able to present the different tree species in terms of timber, fruit tree, medicinal and fuelwood among others then much interest would be aroused from the customers as was noted with tree nurseries dealing only in fruit trees. There is also lack of specialization which affects sales.

On one hand the tree nurseries are organized as units yet at times operating as a network though not organized as such. In one of the FGDs the operators agreed that they always sell for other operators or refer customers. This happens regularly which could be construed as good business practice but in essence there is lack of understanding of the market structures. It was noted that all the operators sell to buyers who come visiting their tree nurseries. Only a few (11.1 percent) transport seedlings to nearby markets.

The operators are unable to do sales forecasting and understand the customers partly due to no market research. Pricing and the number of seedlings leftover after every season were evident. Planning would strengthen the market structures and make the operators be more realistic of the prevailing demand for given tree species. This can even make them understand the customers and be able to predict the market share they could target. Good market structures would enhance the existing notion among the operators seeing likely competitors as complementary.

4.2.2 Pricing mechanisms

The price of a product or service specifies what the seller requires to transfer ownership or use of the product or service to the buyer (Longenecker *et al*, 2003). The study found out that the tree nursery operators depend on seedling size in determining their prices. This was followed by the species and the number of seedlings bought (Table 4-5). It was also noted that cost of production is not a factor since only 20 (37.1 percent) of the operators considered it while only 2 (3.7 percent) stated it as a first reason. It was observed that pricing is one of the key challenges in marketing tree seedlings. The need for cash makes some of the operators charge very low prices that they were even unwilling to state. Conversely some charge so high prices that prohibit sale. Seedlings are sold for between KES 5 to KES 200 depending on the size and use. Fruit trees especially grafted mangoes fetched the highest prices.

There were no seasonal variations since most sales were during the rainy season. The farmers were comfortable with the prevailing prices as they are slightly below the established commercial tree nurseries in towns and cities like Kisumu. A number of previous season's seedlings could be seen overgrown in the nursery (Plate 4). The operators are still maintaining

them but this was increasing operational costs. Piles of filled pots in which seedlings dried up were general phenomena in the tree nurseries (Plate 5). Other than cost it is also an environmental concern since the waste materials litter the nursery and there are no clear waste disposal guidelines. They could also harbor disease pathogens and rodents in the tree nursery. It was not clear who pays for such loses. In most businesses such losses are passed to the customers in prices.

Table 4- 5 Reasons considered while pricing

Pricing reason	Rank								Total
	1st	2nd	3rd	4th	5th	6th	7th	8th	
Species	8 (14.8%)	8 (14.8%)	5 (9.3%)	2 (3.7%)	2 (3.7%)	3 (5.6%)	2 (3.7%)	1 (1.9%)	31 (57.4%)
Size of seedlings	19 (35.2%)	10 (18.5%)	4 (7.4%)	1 (1.9%)	2 (3.7%)	1 (1.9%)	0 (0.0%)	0 (0.0%)	37 (68.5%)
Prevailing demand	2 (3.7%)	3 (5.6%)	2 (3.7%)	3 (5.6%)	0 (0.0%)	1 (1.9%)	0 (0.0%)	0 (0.0%)	11 (20.4%)
Cost of production	2 (3.7%)	6 (11.1%)	6 (11.1%)	4 (7.4%)	1 (1.9%)	0 (0.0%)	1 (1.9%)	0 (0.0%)	20 (37.1%)
Prevailing prices	3 (5.6%)	2 (3.7%)	3 (5.6%)	3 (5.6%)	0 (0.0%)	1 (1.9%)	0 (0.0%)	0 (0.0%)	12(22.2%)
Government guidelines	1 (1.9%)	0 (0.0%)	0 (0.0%)	2 (3.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (1.9%)	4 (7.4%)
Type of customer	5 (9.3%)	7 (13.0%)	5 (9.3%)	3 (5.6%)	4 (7.4%)	1 (1.9%)	0 (0.0%)	0 (0.0%)	22 (40.7%)
No. seedlings bought	11 (20.4%)	7 (13.0%)	5 (9.3%)	3 (5.6%)	4 (7.4)	1 (1.9%)	1 (1.9%)	0 (0.0%)	31 (57.4%)
None	3 (5.6%)	11 (20.4%)	24 (44.4%)	33 (61.1%)	41 (75.9%)	46 (85.5%)	50 (92.6%)	52 (96.3%)	
Total	**54 (100.0%)**	**54 (100.0%)**	**54 (100.0%)**	**54 (100.0%)**	**54 (100.0%)**	**54 (100.0%)**	**54 (100.0%)**	**54 (100.0%)**	

Source: Field Data

4.2.3 Customers/ consumers (Farmers)

Consumers are the driving force in any business venture. They will be willing to sacrifice a price for the goods in the market (Longenecker *et al.*, 2003). The study revealed that the tree nursery operators rely on ad hoc and unreliable customers. *"Most of the customers just come into the nursery and need seedlings"* as reported by one of the operators. She noted that this makes sales planning very tricky. It was also observed that the few customers who make orders are more often NGO's and companies who pay low prices. At times pay later.

A few of the customers interviewed complained about the limited technical advice. A number were comfortable with the set seedling prices except for bamboo which they thought were so highly priced. There were also concerns about lack of after sale services by the operators. One of the farmers indicated that the operators lack written guidelines and can also not go with them to see the seedlings well planted. "*This is why we end up at the research, KFS and other commercial tree nurseries. This end up expensive since you must organize transport*" he noted.

It was also reported that the customers occasionally compare the prices of the seedlings with the other tree nurseries regardless of the cost of production. *"Customers are funny. They don't want to hear anything about cost of production. They come with price lists in their heads and pockets"* reported one of the operators.

4.2.4 Competitors

At any given time a producer must look at what others are offering in the market. How do they produce, price, promote and distribute their products (ibid, 2003). This in essence determines the

market segment a producer would want to tap. Competitors are influential in the profits a business makes. The study noted that most of the producers do business in an almost the same manner. The materials used in production and even the seedlings produced are almost similar. Pricing is almost uniform among the tree nursery operators. Promotion is by word of mouth and the operators wait for customers at the nursery site.

It was also reported that occasionally the producers would refer customers to the other operators for seedlings they do not have. The producers know one another but have no formal organization.

4.3 Profits in the community tree nurseries

Profit is the difference between the sales revenue and costs of doing a business (Longenecker *et al.*, 2003). This could be positive or negative. When positive the business can continue and expand as the proceeds can be re-invested. This is what makes businesses grow. Conversely, if negative profits (losses), most businesses close down or look for alternative ventures (Oduol and Franzel, 2014). Profitability depends on the CBA and is determined by the BEA, ROI and ROE. These are somewhat the relevant M&E tools in tree nursery. They promote learning while measuring performances. The intentions of M&E can't be met without set targets and good data collection (IFC Advisory Services, 2004 and UNDP Evaluation Office, 2002). The study sought to appraise existing M&E tools in the community tree nurseries thus tracking inputs and outputs.

4.3.1 Tree nursery records

Records and record keeping is an integral part of M&E which measures and reveals how a business is doing. Such financial information provides the complete picture of financial

activities. However small a firm or a business is there is need to provide accurate and thorough picture of the operating results; this permits quick comparison of current data with previous years; offer financial statements for both internal and external users; facilitate prompt filing of reports to regulatory agencies; and reveal fraud, waste and errors (Longenecker *et al.*, 2003). In accounting systems records of accounts receivable; accounts payable; inventory; payroll; cash; fixed assets; insurance register; leaseholds and firms investment are required (ibid, 2003).

The study revealed that only 4 (7.4 percent) and 10 (18.5 percent) of the interviewed tree nursery operators kept some inventory and sales records respectively (Figure 4-8). When probed further to show samples of records kept, only one was able to show a scanty receipt book which was last issued in the previous year. During FGDs when asked why they are not keeping records some cited semi-literacy which did not add up with the level of literacy found among the operators. Others just indicated that they did not feel it necessary. The absence of records made it difficult to assess the earlier performance of the tree nurseries and to project future production streams. It can be deduced that as much as the tree nurseries are established and managed for income, the income is just the sales received on day to day basis. They become part of the family incomes thus the tree nurseries are not treated as business ventures. The family is not separate from the tree nursery therefore as resources are spent with minimum returns, the operators would just close-down.

Lack of financial and management records explain why M&E is difficult as a result poor planning, control and decision making. Reliance on memory and improper sales revenue

management make forecasting a real challenge (Weetman, 2010, Horngren *et al.*, 2009 and Broadbent & Cullen, 2003).

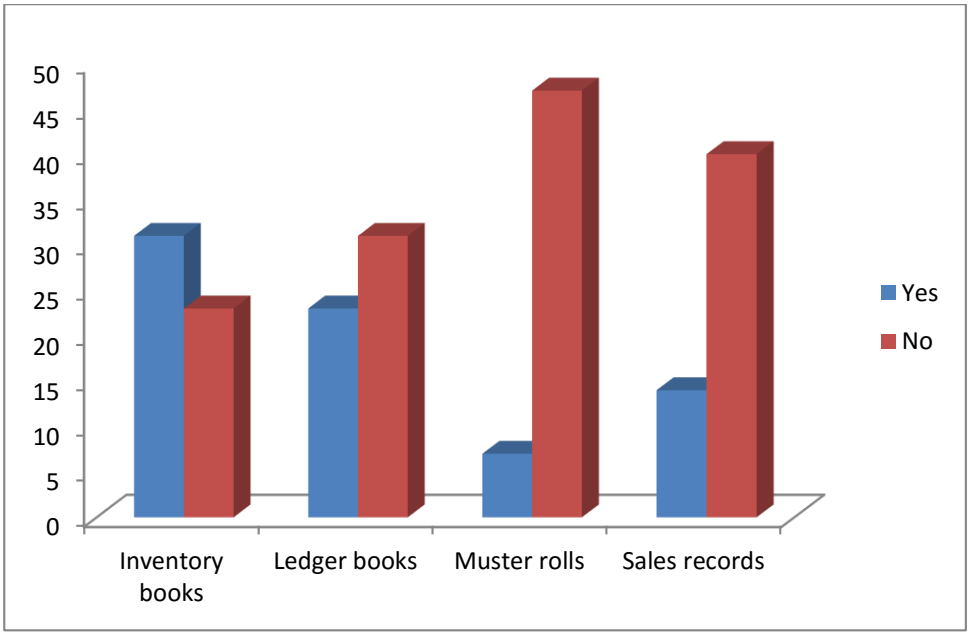

Figure 4- 8 Records kept by community tree nursery operators

Source: Field data

4.3.2 Cost Benefit Analysis (CBA)

Cost is the amount which is spent to produce or buy a commodity (Saleemi, 2000). Roshetko *et al.*, (2010) reiterates that among many other things tree nurseries may provide income generating opportunities to operators and enhance social capital. They also allude that most tree nurseries (community tree nurseries included) can be commercial and be able to sell to the community and/or other interested parties. These require prompt decision making by the tree nursery operators. For any decision making one must count the costs and the anticipated benefits. This is more critical if choices have to be made between and among a number of alternative projects. It is poignant that tree nursery operators consciously or unconsciously carry-out CBA which requires explicit data collection and management. From the study data it was evident that

cumulatively the tree nurseries are receiving KES 9,074,780.00 while spending KES 5,963,126.60 meaning that they are making KES 3,111,650.40 (Table 4-6) Individually, 53.7 percent are making negative profits (and Appendix 7 and 8). However the profit ranges are so huge that cumulatively there are still positive profits when calculated cumulatively.

Table 4- 6 Income Statement for Community Tree nurseries, June 2016

	KES
Sales revenue	9,074,780.00
Less Cost of goods	5,776,939.60
Gross profit	3,297,840.40
Less Operating expenses	186,190.00
Operating Profit	3,111,650.40
Less Interests	0.00
Net profit before taxes	3,111,650.40
Less taxes	0.00
Net profit	3,111,650.40
Retained earnings (previous year 2015)	0.00
Total	3,111,650.40
Dividends	0.00
Retained Earnings (Current year 2016)	3,111,650.40

Source: Field data

4.3.3 Break-Even Analysis (BEA)

Break-Even Analysis (BEA) helps in BEQ and BEP calculation. BEP shows the least (minimum) number of units a producer should strive to produce so as to be able to have sales revenue equal to costs of production. Longenecker *et al* (2003 and Gitman, 2006) confer that it is difficult for a business to flourish if there is no understanding of the BEP. The calculation helps producers to know what units and at what price would they meet the sales revenue.

BEA used to determine the level of operations necessary to cover all costs and evaluate profitability associated with various levels of sales (Gitman, 2006). It was done to compare

alternative cost and revenue estimates for acceptable price determination. This was also to examine revenue-cost relationships and incorporating actual sales forecast (Longenecker, *et al.*, 2003). It helps to determine the quantity point at which the product will generate enough revenue to start generating profit for the business. The analysis takes care of both BEP and BEQ (Gitman, 2006 and Longenecker *et al.*, 2003).

The adopted formula was used:

$$S = \frac{FC}{1 - VC\%}$$

Where S=Sales (Quantity of sales)
FC= Fixed Costs
1 (or 100%) = Contribution margin
VC% = Total variable operating cost as a percentage of total sales

$$S = \frac{257{,}220}{1 - (5{,}705{,}910 / 9{,}074{,}780)}$$

S = KES 692,877.60

It is assumed that the firms' product mix remains the same at all levels of sales (Gitman, 2006 and Weetman, 2010). This study treated the tree nurseries as single units. Total number of seedlings produced per tree nursery, prices, fixed and variable costs were calculated. This helped calculate the revenues per tree nursery. Average number of seedlings produced, average prices, average variable costs, average fixed costs and revenue were then computed (Appendix 8). The tree species and flowers produced were treated as part of the market mix (Figure 4-9 and 4-10). Overall, using the above formulae it was realized that the BEP should be KES 110,428.00 at an average price of KES 12.2 per seedlings for each of the tree nurseries. Therefore the BEQ should be 14,926 seedlings per tree nursery. This BEQ is within the ability of most of the units (Roshetko *et al.*, 2010).

It was clear that 29 (53.7 percent) at their average set prices are producing below their anticipated BEQs thus making losses. The losses range from KES -324,125 to KES -1,050.50) (Appendix 7 and 8). Generally only 16 (29.6 percent) are producing above their average BEQs and 22 (40.7 percent) earnings below the BEP. Fortunately the ones making profit are making surmountable profits ranging from KES 2,000.00 to KES 1,714,590.00. Further 34 (63 percent) are earning below the anticipated BEP in terms of revenue. They are not able to meet their variable (operational) costs (Figure 4-11and 4-12). Critically, there is a challenge in seedling pricing.

The results show that even if the NGO's were to provide all the fixed cost which accounts for between 0 to 39 percent there would still be losses. As it is there is only one such tree seedling production unit producing above both the fixed and variable costs. The variable costs on average constitute 93 (61 to 99.9) percent; a 96 percent median and mode of 99 percent (Appendix 8). This is skewed to the right, showing the importance of variable costs in tree seedling production.

It was also observed that even among the tree nurseries producing above the BEP, it is those producing fruit trees and rear species like *Bambusa vulgaris* (bamboo) that make substantial profits (Figure 4-11 and 4-12). This is due to good pricing. In depth interviews revealed that it cost about KES-100 to produce a grafted fruit propagules while bamboo requires KES 120-150. The selling price is KES 150-200 and KES 250- 350 respectively therefore the high profits.

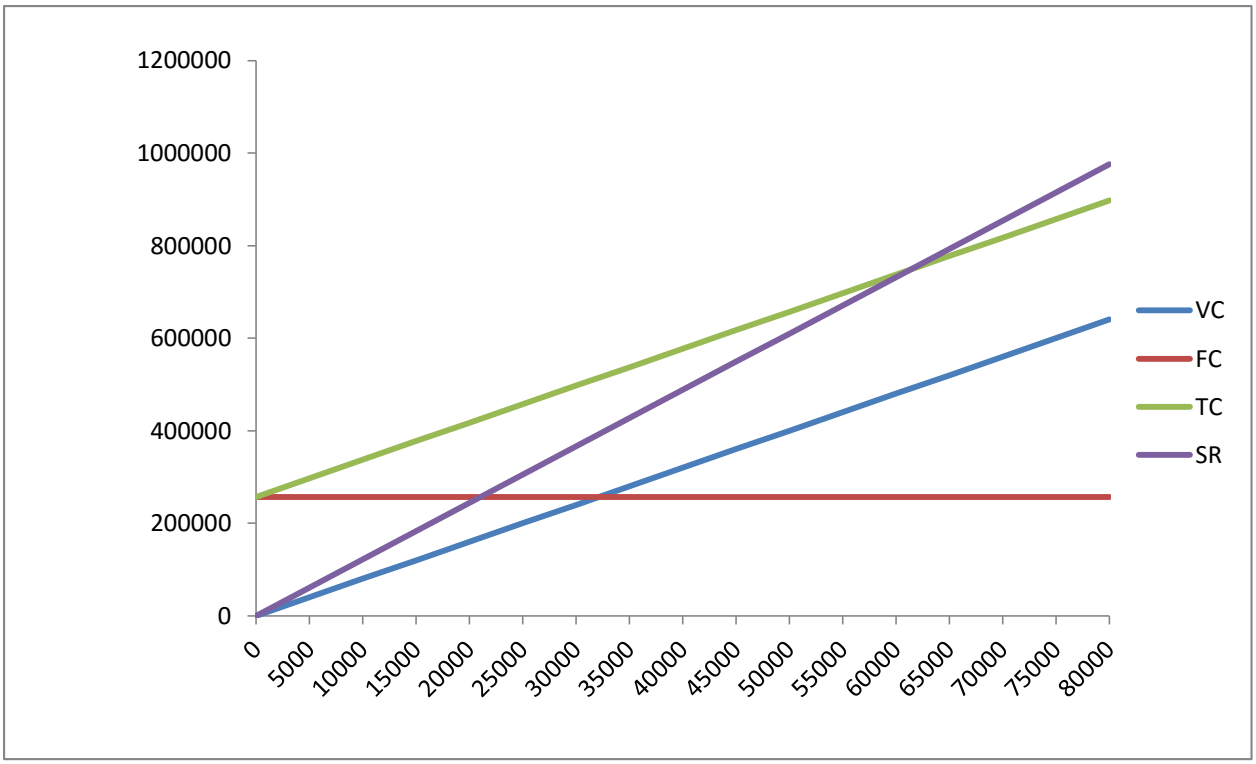

Figure 4- 9 BEP for the tree nurseries

Source: Field data

The results here are in line with Oduol & Franzel (2014), who noted that farmers pay better, prices than institutions more so the NGOs. Since the NGOs buy in bulk, they could therefore be able to bargain not taking cognizance of the production costs (Longenecker *et al.*, 2003, Swanepoel, 2009 and Weetman, 2010). The situation is further complicated since some of these NGO's give in-puts to farmers partly explaining the low fixed costs. The involvement of NGOs in giving part of the variable costs erodes the anticipated gains by the prices offered. Therefore, the tree nursery operators end up not making economic gains. This is a clear indication that the operators are not meeting their set objectives.

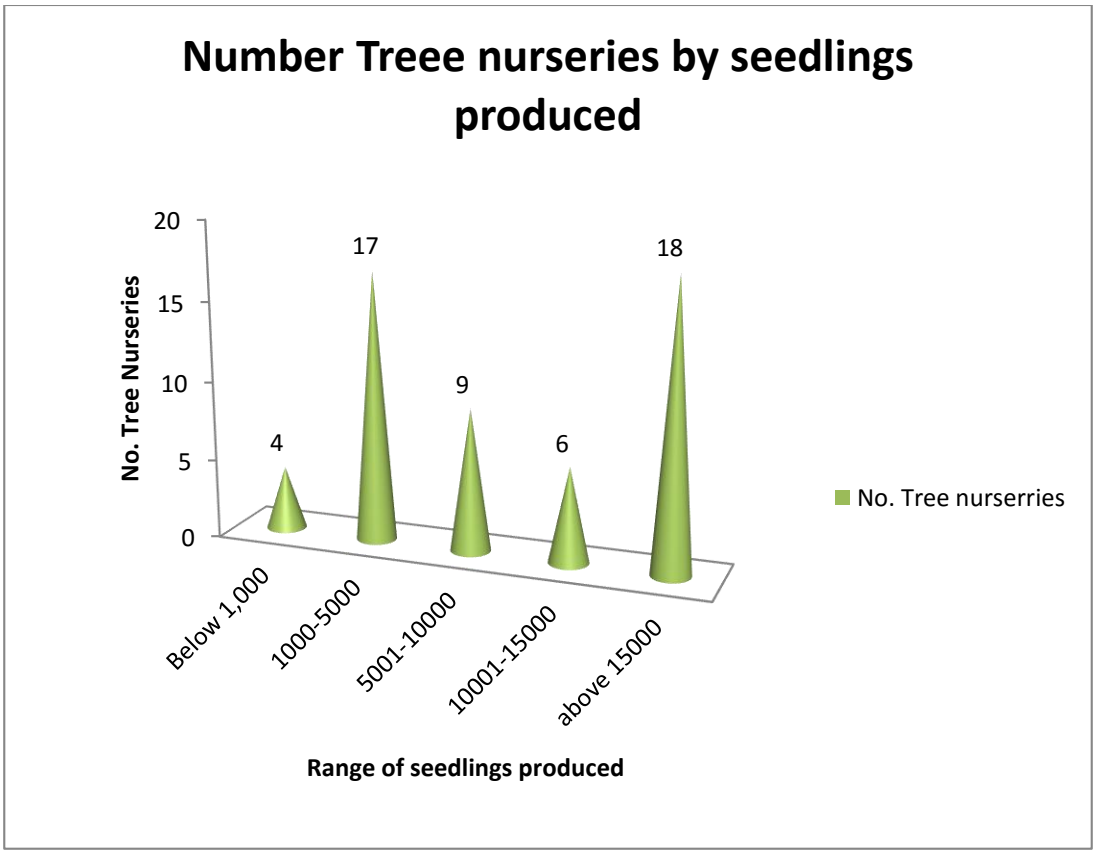

Figure 4- 10 Range of seedlings produced by the tree nurseries

Source: Field data

4.3.4 Return on Investment (ROI)

Investors and owners are always interested in knowing a firm's profitability. Managers use return on investment (ROI) to measure owners' equity which is the excess of assets over the liabilities (Horngren *et al.*, 2009, Gitman, 2006 and Longenecker *et al.*, 2003). ROI looks at the overall effectiveness in generating profits from the available assets including investment in working capital (Broadbent & Cullen, 2003). It therefore measures individual tree nursery operator's capital investment (paid-in capital plus retained earnings) less ownership claim arising from investment of previous profits. It helps firms understand how to finance whether to use debts or equity (Gitman, 2006 and Longenecker *et al.*, 2003). Simply put it is the economic profit

(residual income) or after tax operating income less capital charge (cost of capital multiplied by the amount of investment) or income (net profit divided by invested capital). Understanding ROI begins with understanding the gross margin, operating profit and asset turnover.

i) Gross profit margin

This measures the percent of each sales KES remaining after paying for goods. It is always believed that the higher the gross profit margin the better for a business (Gitman, 2006). It is:

$$\text{Gross profit margin} = \frac{9{,}074{,}780.00 - 5{,}776{,}939.40}{9{,}074{,}780.00} = \frac{3{,}297{,}840.60}{9{,}074{,}780.00}$$

Gross profit margin = 0.363 or 36.3 percent (Appendix 4-7 and 8)

After meeting the direct costs incurred in production, a 36.3 percent would remain in the business. This compares well with the findings of the Farm Plan department of Kisumu North District in 2012 where Maseno Division belonged by then. However, in both cases the venture remains below the other crop like bulb onions and commercial tree nurseries. No wonder the closures as there are other profitable alternative land uses.

Table 4- 7 Kisumu North Farm Plan, 2012

Land acreage	Crop/ Tree Nursery	Revenue (KES)	Cost (KES)	Gross/ Operating Profit	Profit margin (Percent)
1 acre	Water melon	200,000.00	71,610.00	128,390.00	197.3
1 acre	Maize (pure stand)	50,000.00	17,272.50	32727.50	189.5
1 acre	Sorghum (pure stand)	20,000.00	17,031.00	2,969.00	17.4
1 acre	Beans (pure stand)	48,000.00	26,817.00	21,183	79.0
1 acre	Kales	48,000.00	16,215.00	31,785	196.0
1 acre	Cabbages	120,000.00	59,850.00	60,150	100.5
1 acre	Bulb onions	350,000.00	61,005.00	288,995	473.7
1 acre	Commercial Tree nursery	1,050,000.00	201,705.00	848,295	420.6

Source: Kisumu North Farm Planning Office, 2012

ii) Operating profit margin

It represents the percentage of each KES remaining after all costs and expenses other than interest, taxes and preferred stock dividends are deducted (Gitman, 2006). At times it is referred to as the earnings before interest and taxes (EBIT). It shows how well a firm is managing the income statement. It is affected by sales volume, sales price, cost of goods sold and operating expenses like administrative and marketing expenses (Longenecker *et al*, 2003). In the community tree nursery case there are limited expenses. It is calculated as (Table 4-7 and Appendix 4-7 and 8):

$$\text{Operating profit margin} = \frac{\text{Gross profit - Operating expenses}}{\text{Sales}}$$

$$\text{Operating profit margin} = \frac{3{,}111{,}650.40}{9{,}074{,}780.00}$$

Operating profit margin = 34.3 percent

The results show potential business venture though with individual tree nursery variations with 29 (53.7) showing negative operating profit.

iii) Total assets turnover

This is the rate at which the assets are used to generate sales (Table 4-7 and Appendix 4-8).

$$\text{Total assets turnover} = \frac{\text{Sales}}{\text{Costs}}$$

$$= \frac{9{,}074{,}780.00}{5{,}963{,}129.60}$$

$$=1.52$$

This shows that the assets are well managed. For every KES value in asset there is more than half reward. At the big picture this could be very impressive. Average net profit is KES 57,623.20 but specifically, it can be noticed that only 25 (46.3 percent) of the tree nurseries are making profits. Seedlings produced vary from 235 to 78,950 with a standard deviation (SD) of

16,614. Costs vary from KES 3,669.60 to KES 613,676.00 and revenue from KES 700.00 to KES 2,253,200.00. These big margins would explain why the potentials in the business are not realized.

iv) Return on Investment (ROI)

The study observed that generally the tree nursery business would be a very lucrative business since the ROI is 52.2 percent way (Appendix 4-7) above the best American performing sectors (Figure 4-12). The results also compare well with the findings of Berzkalne and Zelgalve (2014) while comparing industry performance in Latvia. They found out that in 2012, the ROE for agriculture companies was almost 12 percent, for food production companies almost 5 percent and for retail companies the ratio was close to 17 percent. They also note that unlike the other companies, the agriculture companies' ROE remained stable. They however attribute this to the enabling government policies and subsidies. It would be good still to bare this in mind since tree seedling production can be considered an agricultural activity as much as it is a forest activity.

In Kenya it has been reported that the real-estate is the best performing sector but comparatively below the tree nursery. The paradox comes when 29 (53.7) tree nurseries are making losses and operating on negative ROI. This result is congruent to the findings of Oduol and Franzel (2014) when they state that the gross margins do not imply profitability since the computation of profitability requires inclusion of fixed costs (though revealed to be meager) such as land, nursery shade, depreciation cost of the nursery shade and farm tools. They also note that tree seedling enterprise is a recent business venture in the Nyando River basin; therefore the sampled operators were drawn from those who were participating in projects under donor-driven market conditions. They consequently note that the findings presented on nursery operators might not adequately reflect those confronted by seedling producers operating in a market driven

environment. There could be a mix of the same in this study. For example the Ngo'w group and associated tree nurseries which was just coming from a LVEMP II funding. These notwithstanding the results are indicative of what could be going on in the tree seedling production enterprise. Most of the nurseries are not economically viable but can continue because of the implicit costs. Since ROI can be increased by increasing returns on sales by reducing expenses or increasing capital turnover by decreasing investment it is prudent that variable costs be reassessed.

In this case ROI = $\frac{3,111,650.00}{5,963,129.60}$ = 52.2 percent

The study realized that 29 (53.7 percent) of the tree nurseries where making losses as their total costs were more than the total revenues (Appendix 8). There are 19 (35.2 percent) though not making losses are operating below the recommended industry profit margins. The remaining 6 (11.1 percent) are the only ones operating above the mean RoI of 52.2 (Appendix 8). Discussions with those who closed shop highlighted low profitability, theft by workers, low seedling prices, high cost of potting bags, high cost of seeds and low viability as the main precursors to closing.

These results are in tandem with work done in Bangladesh which shows a higher net annual return for NGOs, private and government tree nurseries respectively. There was a rate of returns over full-cost longer in NGO (1.50), private (1.43) and lowest in government (1.37) (Haque *et al.*, 2007). It is believed that community tree nurseries would produce at low costs since they use locally available materials and seedlings readily available at planting sites (Roshetko *et al.*, 2010). Tree species diversity is also promoted since most of the species are always adapted to the prevailing environmental and edaphic conditions (Wightman, 1999).

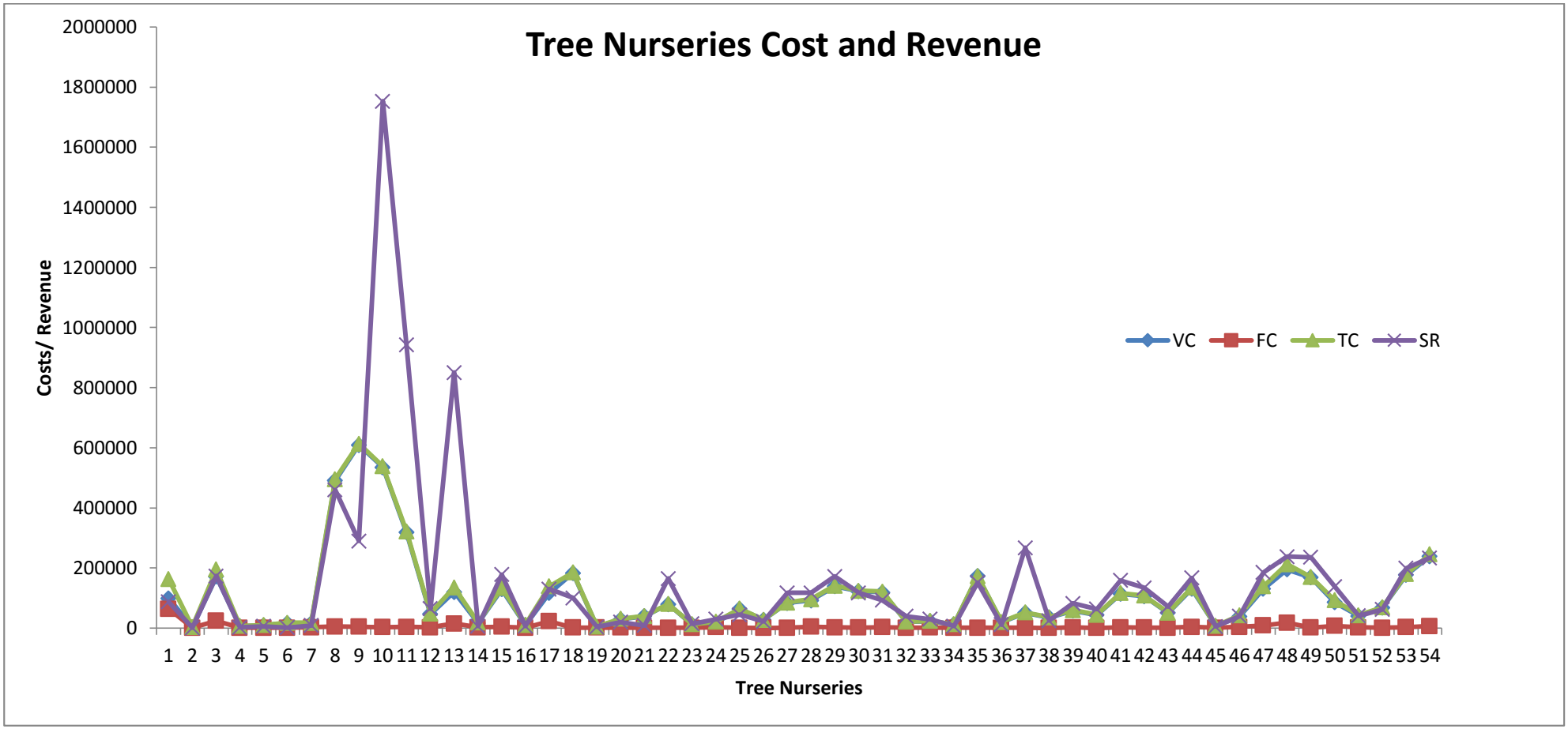

Figure 4- 11 Cost/ Revenue of seedlings by the tree nurseries

Source: Field Data

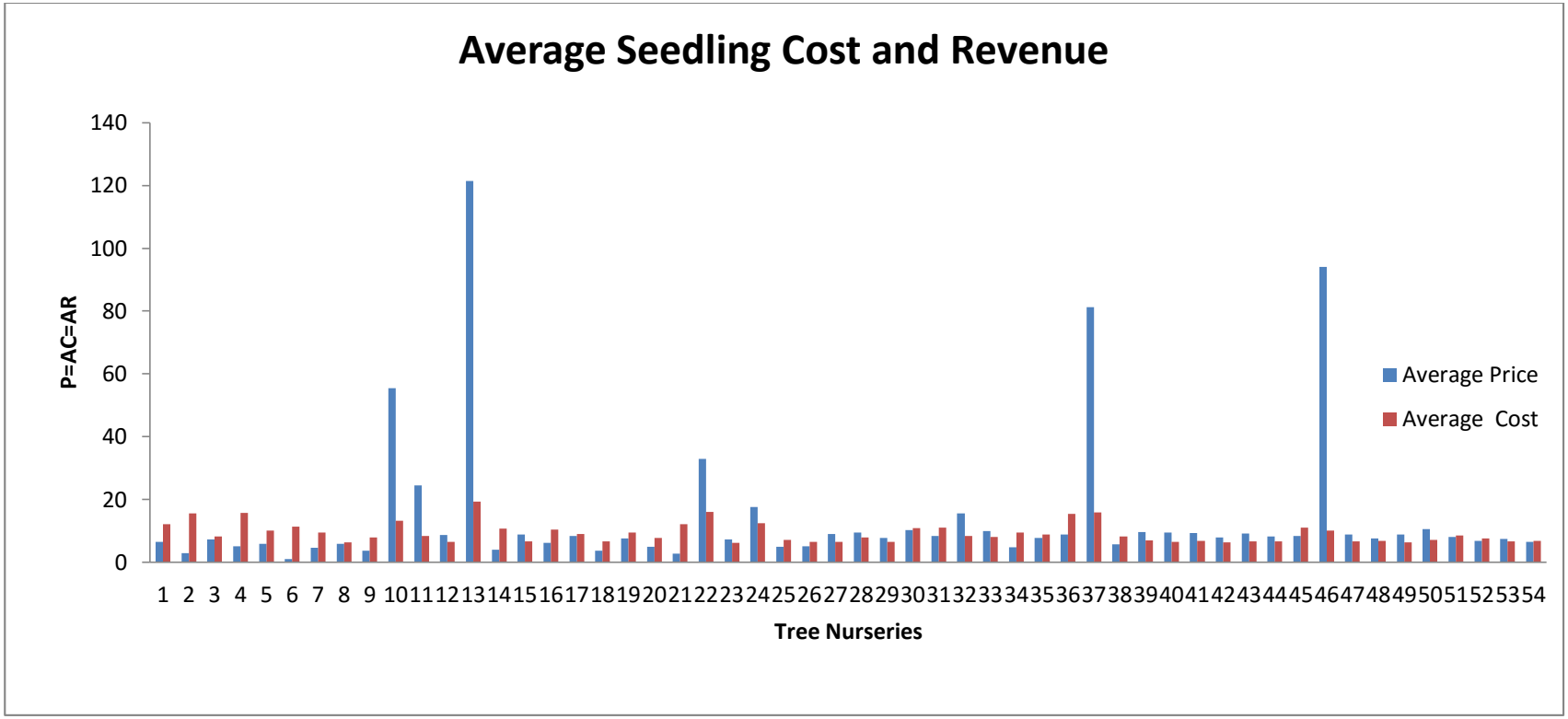

Figure 4- 12 Average Costs and Prices of seedlings by the community tree nurseries

Source: Field Data

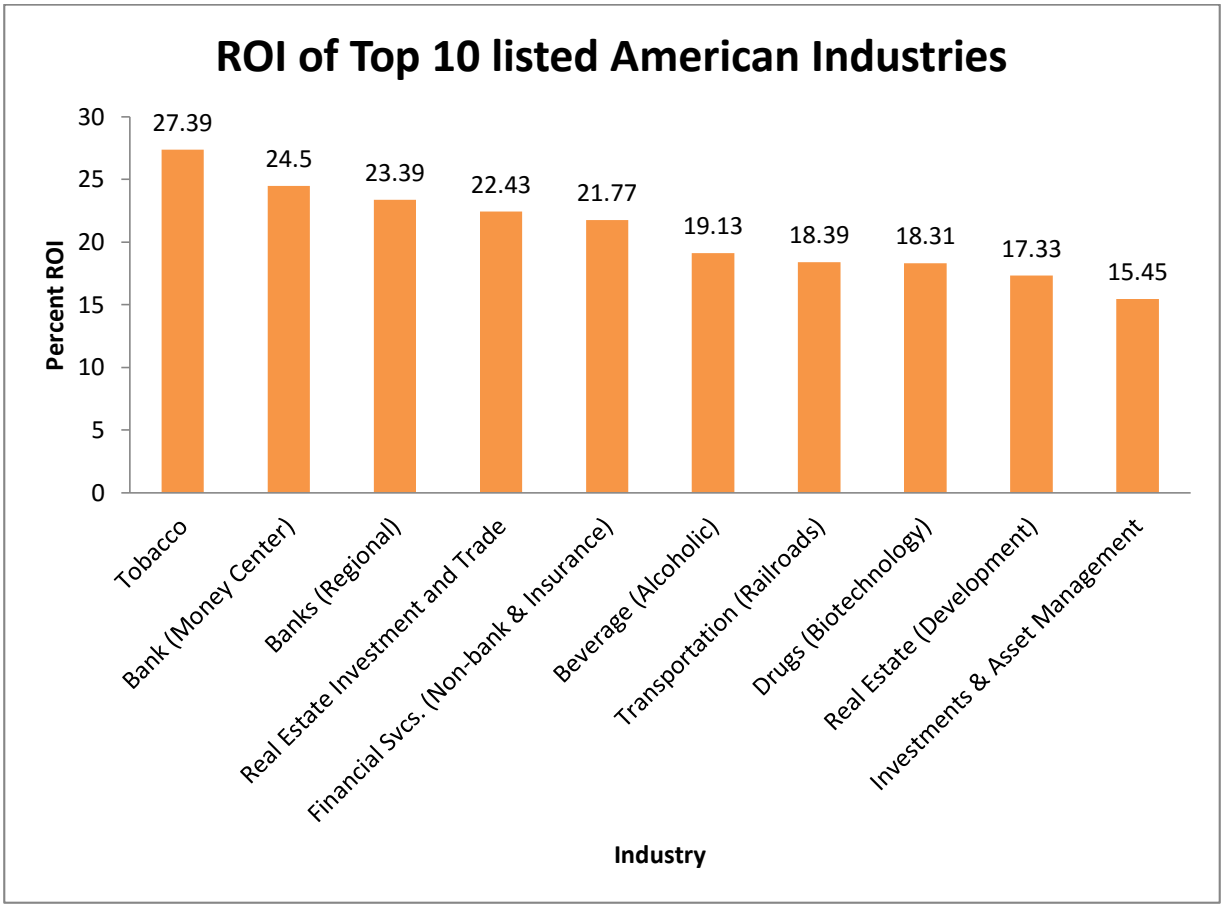

Figure 4- 133 ROI of top 10 American industries

Source: http://www.stern.nyu.edu/~adamodar/pc/datasets/margin.xls

CHAPTER 5

SUMMARY, CONCLUSION AND RECOMMENDATIONS

A summary, conclusion, recommendations and likely research areas are highlighted in this chapter. They are provided in line with the set study objectives.

5.1 Summary

The study sought to evaluate the economic viability of community tree nurseries in Maseno Division, Kisumu West Sub-County of Kisumu County. Active tree growing has been on-going within the division over the last two decades. There have been a number of research projects since 1987. The Maseno KFS station known for providing tree seedlings has been in the division since the 1970s serving the division and beyond.

The study revealed that tree seedling production in Maseno division is done mostly by males (75.9 percent). Most of the tree nurseries are individually owned (91.7 percent) and depend on family resources. Additionally 42.6 percent of the operators are literate (secondary school education and above). This shows the proficiency of the venture for employment especially in the rural areas. The tree nurseries though established for income generation (94.4 percent) are not managed as such. There is remarkable inadequate record keeping posing a great challenge to profitability analysis.

Most of the farmers are willing to pay any prices for quality seedlings regardless of where and how they obtain the tree seedlings. This is in line with the desires of the tree nursery operators who commence seedling production to earn income. Water availability and security are the priority reasons while locating a tree nursery. Most of the nurseries can produce 20,000-40,000

assorted tree seedlings annually which are feasible within the 10m x 10m (0.001ha) space available in the family land. However lack of planning and management impede profitability.

End-use of the species, adaptability and seed availability are the main reasons considered while choosing which species to raise. Most operators (83.3 percent) produce *Eucalyptus species* followed by *Grevillea robusta* (64.8 percent) both known for timber and agroforestry potentials respectively. This is conforming to the belief that Eucalypts are among the most widely cultivated forest trees in the world. Its fast growth makes it a preferred species despite the other negative environmental effects. The agroforestry potentials of *Grevillea robusta* provides the incentive for its growing as farm sizes continue dwindling.

The reasons given by the operators (producers) as timber, fruits, agroforestry among others for choosing given species blends well with the reasons given by farmers (consumers). A total of 744,076 seedlings (range 235 to 78,950) were counted in the 54 tree nurseries. It can be deduced that tree seedling production is in line with tree growing which is a worldwide concern. The 10 percent recommended vegetation cover can be met with quality seedlings from the community tree nurseries.

Value addition and species diversity (31 different tree species observed) produced are impressive in the tree seedling production venture yet only six (11.1 percent) of the tree nurseries operators are carrying out value addition. They earn super-normal profits.

Lack of credit facilities make the operators produce only what they can fund from their own family and household resources. This limits their production potential confirming reports by Oduol and Franzel (2014) and Thorlarkson (2011) that limited access to business services like credit facilities, rural advisory services, market information and transport services by operators' curtails production.

Production processes are dependent on the number and species of tree seedlings produced with water, pest and diseases the major challenges. The operators spent about KES 5,963,130.00 in production. It was observed that variable costs constitute 95.7 percent (61-99.9 percent) of the total production costs. This includes potting media, potting bags, water, labour, land rent and seeds. There is a lot of seedling wastage during and after production. It was found out that the remnants constitute 12.6 percent while those lost through drought, pest and diseases account for 16.5 percent. This partially explains the high production costs and losses realized by the operators.

The study discovered that the tree nursery operators rely on own intelligence and past experience which are more product or sales oriented. There is no market research thus customer-orientation is low (Longenecker *et al*, 2003). The market is not organized *per se*. Most sales are ad hoc making planning and sales forecasting intricate.

Pricing depends on the species, number of seedlings bought and seedling size. The market forces of demand and supply do not really come to force in deciding prices to be charged. A number of the nurseries are earning less than the anticipated revenue despite producing at or above the

breakeven quantities. A total of KES 9,074,780 was received from sales. Most of the consumers are comfortable with the prevailing prices except for bamboo. They also complained about the limited knowledge especially in technical and after sale services. Pricing thus remain a charade in the community tree nurseries.

It is observed that competition is low in the tree seedling production. The study noted that most of the producers do business in an almost homogeneous manner. They offer same products and prices using the same marketing strategy. This is in tandem with results by tree nursery operators in Nyando basin (Oduol and Franzel, 2014). The materials used in production and even the seedlings produced are almost similar. Promotion is by word of mouth and the operators wait for customers at the nursery site. This hinders innovativeness and reduces the running of the tree nurseries for income.

The CBA, BEA and ROI revealed that on average the tree nursery operators earn KES 3,111,650.00 denoting a 36.3 percent operating profit margins and a RoI of 52.2 percent. These notwithstanding 53.7 percent of the tree nurseries make losses as 35.2 percent producing below BEP or BEQ. The study also realized that 35.2 percent operate below the recommended industry profit margins (Longenecker *et al.*, 2003). Notably, the ones operating at or above the industry profit margins are those that produce fruit trees, rear species like *Bambusa vulgaris* (bamboo) and flowers. They are equally the ones making substantial profits.

5.2 Conclusion

The production process remains fairly traditional (no mechanization) which results in high production costs mostly variable costs. The processes depends on the tree nursery site and size; and tree species, seedlings quantity and quality. This increases the failure rates

Marketing strategies depend on product and sales philosophy with limited focus on the customers. As it is the number of seedlings bought and type of species are the determinants of prices charged negating the supply and demand functions. These make pricing a challenge resulting in the low revenue thus community production units.

According to the findings, 53.7 percent of the tree nurseries are making losses while 35.2 percent are producing below BEP or BEQ thus only 11.1 are making profits and operating within or above the average ROI. This shows economic in-viability and the rampant closure realized.

Overall, the traditional production processes and inadequate marketing strategies reduces the economic viability therefore the close-ups.

5.3 Recommendations

Conduct intensive technical and management trainings on production; marketing; seed collection and handling; and business planning. This should be conducted for operators and would be tree nursery operators. The trainings should be tailor made to take care of those interested in tree seedling production with or without formal education.

Intensify collaborations, linkages and networks with regulating, research and development institutions. Clear role definitions and agreements should be made and if possible contracts signed with the operators. The operators could also be helped to start cooperative societies or set up forums where they can share experiences and be able to link up with policy regulators.

There should be efforts towards enabling the community tree nursery operators' access credit facilities. Tree seedling production is dictated by the amount of money an operator has to investment. The cash flow outlays should be worked and picks noted.

Diversify or improve the depth of product lines through value addition. This will promote innovations and competitiveness.

5.4 Research opportunities

There is need to find out the cause for low seed germination even the ones bought from authorized seed suppliers, vendors and traders. Also a follow up should be made to realize the impact of training on tree nursery operators. Efforts should be made to work out individual BEAs for specific tree species in respective tree nurseries. Research on the proposed areas will help bring-out the dynamics in community tree seedling production and act as precursors to profitability and policy formulation and implementation in response to climate change.

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APPENDICES

Appendix 1: Community Tree Nursery Operators' Interview Schedule

Community Tree Nursery Operators' Interview Schedule

A. Location information

1.	Name of Community/Group/Individual	
2.	Location	
3.	Sub-location	
4.	Village	

B. Interviewer's information

8.	Interviewees Name/ Code	
9.	Position/ Title	
10.	Date and Time of Interview	

C. Informed Consent

Interviewer to introduce him/herself	
State purpose of the interview	To evaluate the economic viability of community tree nurseries in Maseno Division, Kisumu West Sub-county, Kisumu County, Kenya
Seek verbal consent - Proceed if granted/ state why if not	

D. Tree nursery ownership- Group/ Institutional/Individual (*Tick one*)

For Group or Individual go to (i) or (ii) below respectively

(i) Group Information

No	Age range (when joined group and now) 1-Under 18 2-18- 35 3-35-55 4-55-60 5-60 +	Position in group 1-Chairperson 2-Secretary 3-Treasurer 4-Member 5-Other (specify)	Level of education 1-No formal education 2-Primary school 3-Secondary school 4-Tertiary College 5-University graduate 6-Other (Specify)	Main source of income (Rank) 1-TN 2-On farm 3-Labourer 4-Employment 5-Other (Specify)
01				
02				
03				
04				
05				

Use extra sheet if need be!

When was the group formed	Is the group registered? Yes/ No	If yes by whom?	If yes is there a written constitution? Yes/ No. (If yes request to see if possible)	When last were elections held?	Give a brief on the organizational structure

(ii) Individual/ Private (Characterize those who work in the tree nursery)

No	Age range 1-Under 18 2-18- 35 3-35-55 4-55-60 5-60 +	Relationship to owner and contribution to nursery activities 1-Self 2-Spouse 3-Son 4-Daughter 5-Other (specify)	Level of education 1-No formal education 2-Primary school 3-Secondary school 4-Tertiary College 5-University graduate 6-Other (Specify)	Main source of income (Rank) 1-TN 2-On farm 3-Labourer 4-Employment 5-Other (Specify)
01				
02				
03				
04				
05				
06				

Use extra sheet if need be!

E. Approximate area under tree nursery

Area		**Ownership** **1.Inherited 2.Leased 3.Bought**
<100m^2		
101 - 400m^2		
401-800m^2		
801-1200m^2		
1201 -1600m^2		
>1600m^2		

F. What informed your decision to start the tree nursery?

No.	**Reason**	**Tick**	**Rank**
1.	To produce quality seedlings (availability)		
2.	To produce quantity seedlings (accessibility)		
3.	To produce given tree species		
4.	To generate income generation		
5.	Others (specify)		

G. Factors considered while locating tree nursery

No.	**Factor**	**Rank**	**Comments**
1.	Permanent water source		
2.	Gentle slope		
3.	Soils		
4.	Security		
5.	Accessibility		
6.	Area free for expansion		
7.	Shade		
8.	Other (Specify)		

How do you decide on what to produce and in what quantities?

Species	Reasons for choosing it?	Numbers to produce

Use additional sheet if need be

Seedlings produced for last 2 seasons

No.	Species	Amount of seed sown	Estimated no. pricked out	No. Planted/ Distributed	No. sold (to who where possible)	Remnants	Time to planting size	Unit prices
1								
2								
3								
4								
5								

Use additional sheet if need be

N. What are your estimated expenditures? List where possible

(i) Fixed costs

Item	Source 1- Own farm 2-Vendors 3-Traders 4- Institutions 5-Others (specify)	Source of funds 1-Own farm 2- Own savings/ Profits 3-Contributions/ Subscriptions 4-Fiends/ Relatives 5-Loans (Specify source) 6-Others (Specify)	Unit Cost
Shade- poles, metals, net, iron sheets			
Sowing beds			
Watering cans			
Water containers			
Spade			
Jembes			
Pangas/ machete			
Pruning knives/ wire			
Others (specify)			

Use additional sheet if need be!

(ii) Variable costs

Item	Source	Source of funds	Unit Cost
Seeds			
Potting media			
Potting bags (sizes)			
Water			
Labour			
Land rent/ rates			
Others (specify)			

R. Do you carry out any value addition? Yes/ No

If yes state

Value addition (Technique)	On which trees
Grafting	
Budding	

Rooting of cuttings	
Tissue culturing	
Air laying	
Cloning	
Seed pre-treatment	
Others (Specify)	

O. Price determination

How do you decide the prices of your seedlings?

Reasons	Rank	Comments
Species		
Size of seedling		
Cost of production		
Prevailing demand		
Prevailing prices		
Government guidelines		
Type of customer		
Number of seedlings bought		
Others (Specify)		

How do you reach out to your potential customers?

How do you favourably compete in the tree seedling market arena?

How do you ensure maximum sales and revenues?

M. What records do you maintain?

Records	Comments
Inventory books	
Ledger books	
Sales record book	
Muster roll	
Others (Specify)	

N. What challenges do you face in tree seedling production?

Challenge	Ways of overcoming them

NB: Use extra sheet if need be!

O. Did you receive any TN training since you began? Yes/ No

If yes, from whom/ where / when did you receive it?

How beneficial was it?

P. Would you require any other TN/ NRM training? Yes/ No

If yes state……..

Q. What TN plans do you have for the future?

R. Are you aware of the current government policies on tree seedling production? Yes/ No

If yes state…….

S. What comments or observation would have?

.....

Thanks for your time and continued support

Appendix 2: Check-list for key informants and FGDs (Producers)

What is the policy guideline on seedlings prices?

What is the guideline on tree seed pricing?

How much water do you need for 100 seedlings at the different sizes?

What could be the price of water?

How much labour do you spend in the tending operations?

How do you pay- task, per day or per month?

What are the policy and regulations on minimum wages?

How much potting media do you require per bag (different sizes)?

Where do you get potting media from and how much do you pay for it?

What are the contributions of community tree nurseries in environmental conservation and protection or improving vegetation cover?

Appendix 3: Check-list for key informants and FGDs (consumers)

How many seedlings did you buy and plant in the past 5 years?

What were the prices?

Which are the preferred species?

How many are you planning to plant in the near future?

What prices are you willing to pay?

What are your motivations to tree growing?

What products have you/ or do you anticipate to get from your tree growing exercise?

Appendix 4: Check-list for key informants and FGDs (Failed tree nursery operators)

When did you start your tree nursery?

When did you close the tree nursery?

What were some of the reasons for closing-up?

Which tree species did you use to produce and/or sell?

What plans do you have for the future?

What can be done to improve the community tree seedling production process?

What would be your counsel to tree nursery operators and/or tree growers?

Appendix 5: Species source of seeds by tree nurseries

No.	Tree species	Source of seed species				
		Donations	Wildings/ Local collections	KEFRI/ ICRAF/KFS	Local vendors	Total
1	*Eucalyptus spp*	2	23	16	4	45
2	*Grevillea robusta*	5	12	14	5	36
3	*Casuarina spp*	4	10	5	3	22
4	*Dovyalis caffra*	1	9	2	5	17
5	*Flowers*	0	15	0	0	15
6	*Carica papaya*	0	11	0	3	14
7	*Cupressus lusitanica*	2	9	1	2	14
8	*Markhamia lutea*	3	8	1	0	12
9	*Mangifera indica*	0	10	0	1	11
10	*Persia americana*	0	7	0	1	8
11	*Croton megalcarpus*	1	2	1	2	6
12	*Citrus sinensis*	0	5	0	0	5
13	*Bischofia japonica*	5	0	0	0	5
14	*Passiflora edulis*	2	3	0	0	5
15	*Pinus patula*	0	4	1	0	5
16	*Moringa oleifera*	1	2	0	0	3
17	*Syzygium cuminii*	0	3	0	0	3
18	*Jacaranda mimosifolia*	0	2	0	0	2
19	*Terminalia brownie*	0	0	2	0	2
20	*Prunus africana*	1	0	0	0	1
21	*Acacia polycantha*	0	0	1	0	1
22	*Senna siamea*	0	1	0	0	1
23	*Podocarpus spp*	0	0	0	1	1
24	*Bambusa gigantica*	0	0	0	1	1
25	*Calitris robusta*	0	1	0	0	1
26	*Leucena spp*	0	1	0	0	1
27	*Fraxinifolia pennyslovania*	0	1	0	0	1
28	*Trichilia emetica*	0	1	0	0	1
29	*Morus alba*	0	1	0	0	1
30	*Calliandra calothyrsus*	0	1	0	0	1

Appendix 6: Reasons for raising given species seedlings in the tree nursery

Species	Not giving a reason	Fuelwood	D/P/ D Tolerance	Agroforestry	Medicine	Timber	Fruit Trees	Seed	Fence	Aesthetic Value	Soil conservation	Fodder	Total
M. lutea	42 (77.7%)	1 (1.9%)	6 (11.1%)	5 (9.3%									54 (100%)
G. robusta	18 (33.3%)			22 (40.7%)		11 (20.4%)		1 (1.9)		2 (3.7%)			54 (100%)
P. africana	53 (98.1)				1 (1.9%)								54 (100%)
C. megalocarpus	48 (88.8%)		4 (7.4%	1 (1.9%)				1 (1.9%)					54 (100%)
A. polyacantha	53 (98.1%)		1 (1.9%)										54 (100%)
S. siamea	53 (98.1%)		1 (1.9%)										54 (100%)
C. papaya	41 (75.9%						13 (24.1)						54 (100%)
Citrus spp	49 (90.7%						5 (9.3%)						54 (100%)
M. indica	43 (79.6)						11 (20.4%)						54 (100%)
P. americana	46 (85.2%)						8 (14.8%)						54 (100%)
Eucalyptus spp	9 (16.7%					37 (68.5%)		8 (14.8%)					54 (100%)
D. caffra	37 (68.5%)											17 (31.5%)	54 (100%)
Podocarpus spp	32 (59.2)			7 (13.0)		11 (20.3%)		1 (1.9%)		3 (5.6%)			54 (100%)
P. patula	53 (98.1%)					1 (1.9%)							54 (100%)
M. oleifera	51 (94.4%)				3 (5.6%)								54 (100%)
B. japonica	49 (90.7%)		2 (3.7%)			1 (1.9%)				2 (3.7%)			54 (100%)
B. gigantic	53 (98.1%)										1 (1.9%)		54 (100%)
Flowers	40 (74.0%)		1 (1.9%)							13 (24.1%)			54 (100%)
M. eminii	49 (90.6%)		1 (1.9%)			3 (5.6%)					1 (1.9%)		54 (100%)
C. lusitanica	40 (74.0%)					10 (18.5%)			2 (3.7%)	1 (1.9%)		1 (1.9%)	54 (100%)
J. mimosifolia	52 (96.3%)									2 (3.7%)			54 (100%)
S. cuminii	51 (94.4%)				1 (1.9%)	2 (3.7%)							54 (100%)
P. edulis	49 (90.7%)						5 (9.3%)						54 (100%)
P. patula	49 (90.7%)						2 (3.7%)			3 (5.6%)			54 (100%)
C. robusta	53 (98.1%)					1 (1.9%)							54 (100%)
C. calothyrsus	53 (98.1%)											1 (1.9%)	54 (100%)
L. leucocephala	53 (98.1%)											1 (1.9%)	54 (100%)
T. brownii	52 (96.3%)					2 (3.7%)							54 (100%)
F. pennyslovania	53 (98.1%)									1 (1.9%)			54 (100%)
T. emitica	53 (98.1%)			1 (1.9%)									54 (100%)
M. alba	53 (98.1%)											1 (1.9%)	54 (100%)

Appendix 7: Summary Income Statement for Community Tree Nurseries, Maseno Division, Kisumu County, June, 2018

TN	Sales revenue	Cost of goods	Gross profit	Operating expenses	Operating profit	Less Interests	Profit before taxes	Less Taxes	Net Profit	Retained Earnings (2015)	Total Earnings	Dividends	Retained Earnings (2016)
1	87500	159640	-72140	3350	-75490	0	-75490	0	-75490	0	-75490	0	-75490
2	700	3611	-2911	58.75	-2969.75	0	-2969.75	0	-2969.75	0	-2969.75	0	-2969.8
3	173600	188930	-15330	5950	-21280	0	-21280	0	-21280	0	-21280	0	-21280
4	2250	6892	-4642	111.25	-4753.25	0	-4753.25	0	-4753.25	0	-4753.25	0	-4753.3
5	6000	10072	-4072	255	-4327	0	-4327	0	-4327	0	-4327	0	-4327
6	1550	17140	-15590	387.5	-15977.5	0	-15977.5	0	-15977.5	0	-15977.5	0	-15978
7	8800	17433	-8633.2	474.25	-9107.45	0	-9107.45	0	-9107.45	0	-9107.45	0	-9107.5
8	459825	475870	-16045	19737.5	-35782.5	0	-35782.5	0	-35782.5	0	-35782.5	0	-35783
9	289550	594300	-304750	19375	-324125	0	-324125	0	-324125	0	-324125	0	-324125
10	2253200	528460	1724740	10150	1714590	0	1714590	0	1714590	0	1714590	0	1714590
11	942250	312500	629750	9625	620125	0	620125	0	620125	0	620125	0	620125
12	65000	46860	18140	1875	16265	0	16265	0	16265	0	16265	0	16265
13	850000	133500	716500	1750	714750	0	714750	0	714750	0	714750	0	714750
14	6870	18250	-11380	437.5	-11817.5	0	-11817.5	0	-11817.5	0	-11817.5	0	-11818
15	178600	128797	49803	5005	44798	0	44798	0	44798	0	44798	0	44798
16	6500	10690	-4190	262.5	-4452.5	0	-4452.5	0	-4452.5	0	-4452.5	0	-4452.5
17	130000	135240	-5240	3850	-9090	0	-9090	0	-9090	0	-9090	0	-9090
18	100675	178085	-77410	6900	-84310	0	-84310	0	-84310	0	-84310	0	-84310
19	4000	4918	-918	132.5	-1050.5	0	-1050.5	0	-1050.5	0	-1050.5	0	-1050.5
20	20000	30032	-10032	1005	-11037	0	-11037	0	-11037	0	-11037	0	-11037
21	9000	39230	-30230	825	-31055	0	-31055	0	-31055	0	-31055	0	-31055
22	165000	78700	86300	1250	85050	0	85050	0	85050	0	85050	0	85050
23	14500	12000	2500	500	2000	0	2000	0	2000	0	2000	0	2000
24	29700	20576	9124	421.25	8702.75	0	8702.75	0	8702.75	0	8702.75	0	8702.75
25	44500	62350	-17850	2250	-20100	0	-20100	0	-20100	0	-20100	0	-20100
26	22000	26860	-4860	1075	-5935	0	-5935	0	-5935	0	-5935	0	-5935
27	117200	81550	35650	3250	32400	0	32400	0	32400	0	32400	0	32400
28	117100	93330	23770	3075	20695	0	20695	0	20695	0	20695	0	20695
29	172000	135850	36150	5500	30650	0	30650	0	30650	0	30650	0	30650
30	117330	121440	-4110	2850	-6960	0	-6960	0	-6960	0	-6960	0	-6960
31	92750	118986	-26236	2771.25	-29007.3	0	-29007.3	0	-29007.3	0	-29007.3	0	-29007
32	39400	20664	18736	631	18104.6	0	18104.6	0	18104.6	0	18104.6	0	18104.6
33	30000	23300	6700	750	5950	0	5950	0	5950	0	5950	0	5950
34	6530	12722	-6192	342.5	-6534.5	0	-6534.5	0	-6534.5	0	-6534.5	0	-6534.5
35	152000	168560	-16560	4900	-21460	0	-21460	0	-21460	0	-21460	0	-21460

36	11800	20248	-8448	332.5	-8780.5	0	-8780.5	0	-8780.5	0	-8780.5	0	-8780.5
37	267200	51324	215876	822.5	215053.5	0	215054	0	215053.5	0	215053.5	0	215054
38	25000	34720	-9720	1081.25	-10801.3	0	-10801.3	0	-10801.3	0	-10801.3	0	-10801
39	82000	57630	24370	2125	22245	0	22245	0	22245	0	22245	0	22245
40	63250	42420	20830	1675	19155	0	19155	0	19155	0	19155	0	19155
41	159000	112050	46950	4250	42700	0	42700	0	42700	0	42700	0	42700
42	134000	103750	30250	4250	26000	0	26000	0	26000	0	26000	0	26000
43	72000	49530	22470	1950	20520	0	20520	0	20520	0	20520	0	20520
44	167000	129970	37030	5050	31980	0	31980	0	31980	0	31980	0	31980
45	5500	7040	-1540	162.5	-1702.5	0	-1702.5	0	-1702.5	0	-1702.5	0	-1702.5
46	39500	41120	-1620	1050	-2670	0	-2670	0	-2670	0	-2670	0	-2670
47	185000	134010	50990	5250	45740	0	45740	0	45740	0	45740	0	45740
48	238000	204700	33300	7750	25550	0	25550	0	25550	0	25550	0	25550
49	235800	163550	72250	6625	65625	0	65625	0	65625	0	65625	0	65625
50	138000	89600	48400	3250	45150	0	45150	0	45150	0	45150	0	45150
51	41000	41790	-790	1262.5	-2052.5	0	-2052.5	0	-2052.5	0	-2052.5	0	-2052.5
52	62000	66400	-4400	2250	-6650	0	-6650	0	-6650	0	-6650	0	-6650
53	199200	173200	26000	6750	19250	0	19250	0	19250	0	19250	0	19250
54	233650	236720	-3070	9050	-12120	0	-12120	0	-12120	0	-12120	0	-12120
	9074780	5777111	3297669.6	186019	3111650.4	0	3111650.4	0	3111650.4	0	3111650.4	0	3111650.4

Appendix 8: Profitability calculations

TN	No. Seedlings (Ns)	Sales revenue (SR)	Average Seedling price (P=AR) = SR/Ns)	Total FC (FC)	Total VC (VC)	Total Cost (TC)	FC per seedling (AFC)	VC per seedling (AVC)	TC per seedling (ATC)	Gross/ Operating profit (SR-TC)	Unit Contribution (ASP-AVC)	AVC/ ATC	S = FC/ 1-VC%	BEQ = S/AP	ROI/ ROA
1	13400	87500	6.53	64100	98890	162990	4.78	7.38	12.16	-75490.00	-0.85	0.61	162990	24960	-46.3
2	235	700	2.98	1200	2469.75	3669.75	5.11	10.51	15.62	-2969.75	-7.53	0.67	3669.75	1231	-80.9
3	23800	173600	7.29	23900	170980	194880	1.00	7.18	8.19	-21280.00	0.11	0.88	194880	26733	-10.9
4	445	2250	5.06	1250	5753.25	7003.25	2.81	12.93	15.74	-4753.25	-7.87	0.82	7003.25	1384	-67.9
5	1020	6000	5.88	1000	9327	10327	0.98	9.14	10.12	-4327.00	-3.26	0.90	10327	1756	-41.9
6	1550	1550	1	970	16557.5	17527.5	0.63	10.68	11.31	-15977.50	-9.68	0.94	17527.5	17528	-91.2
7	1897	8800	4.64	2250	15657.5	17907.5	1.19	8.25	9.44	-9107.45	-3.61	0.87	17907.5	3859	-50.9
8	78950	459825	5.82	5000	490608	495608	0.06	6.21	6.28	-35782.50	-0.39	0.99	495607	85156	-7.2
9	77500	289550	3.74	4300	609375	613675	0.06	7.86	7.92	-324125.00	-4.12	0.99	613675	164084	-52.8
10	40600	2253200	55.5	3350	535260	538610	0.08	13.18	13.27	1714590.00	42.32	0.99	538610	9705	318.3
11	38500	942250	24.47	3900	318225	322125	0.10	8.27	8.37	620125.00	16.20	0.99	322125	13164	192.5
12	7500	65000	8.67	2360	46375	48735	0.31	6.18	6.50	16265.00	2.49	0.95	48735	5621	33.4
13	7000	850000	121.43	15300	119950	135250	2.19	17.14	19.32	714750.00	104.29	0.89	135250	1114	528.5
14	1750	6870	3.93	2050	16637.5	18687.5	1.17	9.51	10.68	-11817.50	-5.58	0.89	18687.5	4755	-63.2
15	20020	178600	8.92	4800	129002	133802	0.24	6.44	6.68	44798.00	2.48	0.96	133802	15000	33.5
16	1050	6500	6.19	900	10052.5	10952.5	0.86	9.57	10.43	-4452.50	-3.38	0.92	10952.5	1769	-40.7
17	15400	130000	8.44	22500	116590	139090	1.46	7.57	9.03	-9090.00	0.87	0.84	139090	16480	-6.5
18	27600	100675	3.65	1900	183085	184985	0.07	6.63	6.70	-84310.00	-2.98	0.99	184985	50681	-45.6
19	530	4000	7.55	1450	3600.5	5050.5	2.74	6.79	9.53	-1050.50	0.76	0.71	5050.5	669	-20.8
20	4020	20000	4.98	2020	29017	31037	0.50	7.22	7.72	-11037.00	-2.24	0.93	31037	6232	-35.6
21	3300	9000	2.73	750	39305	40055	0.23	11.91	12.14	-31055.00	-9.18	0.98	40055	14672	-77.5
22	5000	165000	33	700	79250	79950	0.14	15.85	15.99	85050.00	17.15	0.99	79950	2423	106.4
23	2000	14500	7.25	800	11700	12500	0.40	5.85	6.25	2000.00	1.40	0.94	12500	1724	16.0
24	1685	29700	17.63	3260	17737.3	20997.3	1.93	10.53	12.46	8702.75	7.10	0.84	20997.3	1191	41.4
25	9000	44500	4.94	1300	63300	64600	0.14	7.03	7.18	-20100.00	-2.09	0.98	64600	13077	-31.1
26	4300	22000	5.12	620	27315	27935	0.14	6.35	6.50	-5935.00	-1.23	0.98	27935	5456	-21.2
27	13000	117200	9.02	1250	83550	84800	0.10	6.43	6.52	32400.00	2.59	0.99	84800	9401	38.2
28	12300	117100	9.52	4450	91955	96405	0.36	7.48	7.84	20695.00	2.04	0.95	96405	10127	21.5
29	22000	172000	7.82	2650	138700	141350	0.12	6.30	6.43	30650.00	1.52	0.98	141350	18075	21.7
30	11400	117330	10.29	1600	122690	124290	0.14	10.76	10.90	-6960.00	-0.47	0.99	124290	12079	-5.6
31	11085	92750	8.37	3250	118507	121757	0.29	10.69	10.98	-29007.25	-2.32	0.97	121757	14547	-23.8
32	2524	39400	15.61	650	20645.4	21295.4	0.26	8.18	8.44	18104.60	7.43	0.97	21295.4	1364	85.0
33	3000	30000	10	1500	22550	24050	0.50	7.52	8.02	5950.00	2.48	0.94	24050	2405	24.7
34	1370	6530	4.77	950	12114.5	13064.5	0.69	8.84	9.54	-6534.50	-4.07	0.93	13064.5	2739	-50.0

35	19600	152000	7.76	800	172660	173460	0.04	8.81	8.85	-21460.00	-1.05	1.00	173460	22353	-12.4
36	1330	11800	8.87	1050	19530.5	20580.5	0.79	14.68	15.47	-8780.50	-5.81	0.95	20580.5	2320	-42.7
37	3290	267200	81.22	1250	50896.5	52146.5	0.38	15.47	15.85	215053.50	65.75	0.98	52146.5	642	412.4
38	4325	25000	5.78	500	35301.3	35801.3	0.12	8.16	8.28	-10801.25	-2.38	0.99	35801.2	6194	-30.2
39	8500	82000	9.65	2130	57625	59755	0.25	6.78	7.03	22245.00	2.87	0.96	59755	6192	37.2
40	6700	63250	9.44	500	43595	44095	0.07	6.51	6.58	19155.00	2.93	0.99	44095	4671	43.4
41	17000	159000	9.35	2350	113950	116300	0.14	6.70	6.84	42700.00	2.65	0.98	116300	12439	36.7
42	17000	134000	7.88	1550	106450	108000	0.09	6.26	6.35	26000.00	1.62	0.99	108000	13706	24.1
43	7800	72000	9.23	850	50630	51480	0.11	6.49	6.60	20520.00	2.74	0.98	51480	5577	39.9
44	20200	167000	8.27	4100	130920	135020	0.20	6.48	6.68	31980.00	1.79	0.97	135020	16326	23.7
45	650	5500	8.46	900	6302.5	7202.5	1.38	9.70	11.08	-1702.50	-1.24	0.88	7202.5	851	-23.6
46	4200	39500	9.4	4100	38070	42170	0.98	9.06	10.04	-2670.00	0.34	0.90	42170	4486	-6.3
47	21000	185000	8.81	8910	130350	139260	0.42	6.21	6.63	45740.00	2.60	0.94	139260	15807	32.8
48	31000	238000	7.68	17600	194850	212450	0.57	6.29	6.85	25550.00	1.39	0.92	212450	27663	12.0
49	26500	235800	8.9	2000	168175	170175	0.08	6.35	6.42	65625.00	2.55	0.99	170175	19121	38.6
50	13000	138000	10.62	7300	85550	92850	0.56	6.58	7.14	45150.00	4.04	0.92	92850	8743	48.6
51	5050	41000	8.12	2600	40452.5	43052.5	0.51	8.01	8.53	-2052.50	0.11	0.94	43052.5	5302	-4.8
52	9000	62000	6.89	1000	67650	68650	0.11	7.52	7.63	-6650.00	-0.63	0.99	68650	9964	-9.7
53	27000	199200	7.38	3000	176950	179950	0.11	6.55	6.66	19250.00	0.83	0.98	179950	24383	10.7
54	36200	233650	6.45	6500	239270	245770	0.18	6.61	6.79	-12120.00	-0.16	0.97	245770	38104	-4.9
Total	744076	9074780	12.20	257220	5705910	5963130			8.00	3111650.40	4.20			806007	
Average	13779												110428	14926	52.2

NB: 1. The tree nurseries marked green are making profits.

2. The tree nurseries marked blue are making losses despite positive unit contribution.

3. The tree nurseries marked red are making losses.