COMPARATIVE ANALYSIS OF ORGANIZATION OF CENTRALIZED AND DECENTRALIZED TREE NURSERY DEVELOPMENT APPROACHES IN KENYA: A CASE OF NAIROBI AND KISUMU DISTRICTS

By

EVANS ISIAHO KHAGULI

A THESIS SUBMITTED TO THE GRADUATE SCHOOL IN PARTIAL FULFILMENT FOR THE REQUIREMENTS OF THE AWARD OF THE MASTER OF SCIENCE DEGREE IN AGRICULTURAL ECONOMICS.

EGERTON UNIVERSITY

JULY 2007

DECLARATION AND RECOMMENDATION

DECLARATION

This thesis is my original work and to the best of my knowledge has not been presented for the award of a diploma or a degree in this or any other university.

Signature…… Date……

Evans I. Khaguli

KM15/O722/02

RECOMMENDATION

This thesis has been submitted with our approval as university supervisors.

Signature…… Date……..

Dr. Sabina Mukoya-Wangia

(EGERTON)

Signature…….. Date……..

Dr. Ramni Jamnadass

(ICRAF)

DEDICATION

To my late father, Daniel Isiaho Khaguli for being a great father, mentor and an inspiration to be the best I can be.

LIST OF ACRONYMS AND ABBREVIATIONS

ASAL Arid and Semi Arid Land

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

KEFRI Kenya Forestry Research Institute

FD Forestry Department

SPSS Statistical Package for Social Scientists

FONA Friends of Nairobi Arboretum

SCP Structure –Conduct-Performance Model

NEMA (NM) national Environmental Management Authority

VI Vi Agroforestry

AFRIC N Africa Now

TOTAL Total Kenya Ltd

GBM Greenbelt Movement

TBP Tree Biotechnology Project.

USAID The United States Agency for International Development.

TABLE OF CONTENTS

DECLARATION AND RECOMMENDATION ..... **ii**

DEDICATION ..... **iii**

LIST OF ACRONYMS AND ABBREVIATIONS ..... **iv**

TABLE OF CONTENTS ..... **v**

LIST OF TABLES ..... **viii**

LIST OF FIGURES ..... **x**

ACKNOWLEDGEMENT ..... **xi**

ABSTRACT ..... **xii**

CHAPTER ONE: INTRODUCTION **1**

1.1 BACKGROUND TO THE STUDY 1
1.2 STATEMENT OF THE PROBLEM 4
1.3 OBJECTIVES OF THE STUDY 4
1.3.1 General Objective *4*
1.3.2 Specific Objectives *4*
1.4 HYPOTHESES OF THE STUDY 5
1.5 JUSTIFICATION OF THE STUDY 5
1.6 DEFINITION OF TERMS 5

CHAPTER TWO: LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK . **7**

2.0 INTRODUCTION *7*
2.1.1 Emerging trends in the tree nursery development process *7*
2.1.2 Nursery organization *8*
2.1.3 Land tenure security *10*
2.1.4 Gender and land rights *10*
2.1.5 Human capital and the environment *11*
2.1.6 Nursery type and inter group dynamics *12*
2.1.7 Organizational Support *13*
2.1.8 Constraints to efficient nursery production. *14*
2.1.9 Support systems *14*
2.1.10 Gender in research and project design. *15*
2.1.11 Impact of Agroforestry systems *16*
2.1.12 Entry into the tree seedlings market *17*
2.1.13 Gaps in literature *19*
2.2 CONCEPTUAL FRAMEWORK 19
2.3 MARKET STRUCTURE-CONDUCT –PERFORMANCE MODEL (SCP) 23
2.3.1 Market structure *23*
2.3.2 Tree nurseries demand and supply conditions *27*
2.3.3 Market Conduct *28*

2.3.4 Market performance *30*
2.3.5 Critique of the SCP model *32*
2.4 THE ENTREPRENEUR'S CHOICE OF THE MARKET ENTRY LEVEL. 32
2.4.1 The Ordered Probit Model *33*

CHAPTER THREE:METHODOLOGY 34

3.1 STUDY AREA 34
3.1.1 Kisumu *35*
3.1.2 Nairobi *36*
3.2 SAMPLING PROCEDURES 36
3.3 DATA COLLECTION PROCEDURES 37
3.3.1 Nursery operator's survey: *37*
3.3.2 Organizations survey: *37*
3.4 DATA ANALYSIS 38
3.4.1 Objective One *38*
3.4.2 Objective two *38*
3.4.3 Objective three *39*
3.4.4 Objective four *40*

CHAPTER FOUR:RESULTS AND DISCUSSIONS 42

4.1 BACK GROUND OF RESPONDENTS 42
4.1.1 Gender proportions of the respondents *42*
4.1.2 Respondents age groups *43*
4.1.3 Education levels of the respondents *43*
4.1.4 Proportion of tree nurseries under the centralized and decentralized approaches. *44*
4.1.5 Respondents reason for choosing either decentralized or centralized approach. *45*
4.2 MARKET STRUCTURE IN THE TREE SEEDLINGS MARKET IN NAIROBI AND KISUMU. 46
4.2.1 Seller concentration at the primary seller level (tree nursery level). *46*
4.2.2 Product differentiation in the tree seedlings market *47*
4.2.3 Constraints / Barriers to enter the tree nursery business *48*
4.2.4 Identification of market structure in the tree seedlings market. *50*
4.3 CONDUCT OF TREE SEEDLING MARKET PARTICIPANTS IN NAIROBI AND KISUMU 50
4.3.1 Pricing strategies in the tree seedlings market *50*
4.3.2 Product strategies in the tree seedling market. *52*
4.3.3 Promotional activities *57*
4.3.4 Vertical integration *58*
4.3.5 Payment terms *59*
4.3.6 Information flow in tree nursery management *60*
4.3.7 Adaptation to risk and uncertainty in tree seedling production *62*
4.3.8 Supply conditions *65*
4.4 SUPPORT FROM ORGANIZATIONS IN THE DEVELOPMENT PROCESS 72
4.4.1 Mission for organizations involved in tree nursery development *72*

4.4.2 Provision of hard and soft support. ... *73*
4.4.3 Organizations purpose for setting up the tree nursery projects ... *75*
4.4.4 Organization involved in tree nursery development process reason for preferring a particular approach. ... *76*
4.4.5 Constraints faced by organizations involved in tree nursery development projects. ... *78*
4.4.6 Reason given by the organizations involved in the development process for emphasis on particular species. ... *79*
4.4.7 Other projects that Organizations involved in tree nursery development process engage in. ... *80*
4.4.8 Organizations tree seedling market efficiency strategies ... *81*
4.5 TREE SEEDLING MARKET PERFORMANCE ... 82
4.5.1 Output of seedlings per year. ... *82*
4.5.2 Demand for tree seedlings per year. ... *82*
4.5.3 Tree seedling market efficiency. ... *83*
4.5.4 Tree nursery performance based on support ... *85*
4.6 EFFECT OF MARKET STRUCTURE AND CONDUCT OF PARTICIPANTS ON PERFORMANCE OF TREE NURSERIES ... 87
4.6.5 Reliability of the regression models ... *95*
4.7 ENTREPRENEURS CHOICE OF MARKET ENTRY LEVEL. ... 96
4.8 NURSERY OPERATOR'S VIEWS ... 97
4.8.1 Requirements to Improve Skills ... *97*
4.8.2 Capital Requirements ... *98*
4.8.3 Water Requirements ... *98*
4.8.4 Future plan for Nursery ... *99*
4.8.5 Future plans for organizations involved in the development process. ... *100*
4.8.6 Ideas to Improve Business ... *101*
4.8.7 Organizations views on the way forward regarding their continued participation in the tree nursery development process. ... *102*

CHAPTER FIVE:SUMMARY, CONCLUSIONS AND RECOMMENDATIONS ... 104

5.1 SUMMARY ... 104
5.2 CONCLUSION ... 105
5.3 RECOMMENDATIONS ... 107
REFERENCES ... 110

APPENDIX ... 118

APPENDIX 1: SURVEY QUESTIONNAIRE FOR NURSERY OPERATORS ... 118
APPENDIX 2: QUESTIONNAIRE FOR ORGANIZATIONS SURVEY ... 124
APPENDIX 3: SAMPLE PHOTOS FROM TREE NURSERY SURVEY ... 128
APPENDIX 4: DATA RELIABILITY FOR THE SAMPLE DATA ... 129
APPENDIX 5: CHOW TEST ... 129
APPENDIX 6: SPECIES DIVERSITY ANALYSIS RESULTS ... 130
APPENDIX 7: SEEDLING PRICE DIFFERENTIALS FOR ALL SAMPLED NURSERIES ... 132
APPENDIX 8: MARKET EFFICIENCY DIFFERENTIALS ... 135

LIST OF TABLES

Table 1: Gender proportions for nursery operators in Nairobi and Kisumu……42
Table 2: Age categories for nursery operators in Nairobi and Kisumu……...43
Table 3: Education levels for nursery operators in Nairobi and Kisumu ……...44
Table 4: Proportion and nursery operators reason for choosing the decentralized or centralized approach……45
Table 5: Seller concentration at primary seller level in Nairobi and Kisumu…….46
Table 6: Tree seedling size specialization matrix and price differentiation in Nairobi and Kisumu…….47
Table 7: Tree seedling production constraints faced by nursery operators in Nairobi and Kisumu…….49
Table 8: Nursery operator's basis for pricing seedlings in Nairobi and Kisumu.....51
Table 9: Species Diversity in tree seedling markets in Nairobi and Kisumu ……53
Table 10: Dominant Tree species in decentralized and centralized Nurseries in Nairobi and Kisumu…….54
Table 11: Dominant tree species in all nurseries in either Nairobi or Kisumu……56
Table 12: Nursery operator's promotional strategies and performance in Nairobi and Kisumu…….58
Table 13: Other services offered by nursery operators in Nairobi and Kisumu……..59
Table 14: Incentives, terms of payment and performance for nursery operators in Nairobi and Kisumu……..60
Table 15: Source of nursery skills for tree nurseries in Nairobi and Kisumu……..…60
Table 16: Reasons given by nursery operators for training others……..61
Table 17: Nursery operators intended use of tree seedlings produced in Nairobi and Kisumu ……63
Table 18: Nursery operators perception on demand level for tree seedlings in Nairobi and Kisumu ……64
Table 19: Area under tree seedlings in tree nurseries in Nairobi and Kisumu……....65
Table 20: Land availability issues for nurseries in Nairobi and Kisumu ……67
Table 21: Labour aspects in tree nurseries in Nairobi and Kisumu.....68

Table 22: Main source of water for nurseries in Nairobi and Kisumu ……..……..69
Table 23: Nursery operator/managers access to and main source of capital …….70
Table 24: Production Methods used by Nursery operators in Nairobi and Kisumu ……..……71
Table 25: Missions of organizations involved in the tree nursery development process in Kisumu and Nairobi ……73
Table 26: Organizations strategies in provision of hard and soft support……...75
Table 27: Organization purpose for setting up the tree nursery projects ……76
Table 28: Organizations reasons for their nursery approach preferences……77
Table 29: Constraints faced by organizations in the development process ……78
Table 30: Reasons for emphasizing on particular species……...79
Table 31: other projects organizations are involved in……80
Table 32: Organizations product strategies …….81
Table 33: Tree nursery performance based on demand and supply for sampled tree nurseries in Nairobi and Kisumu…….84
Table 34: Performance of tree nurseries based on support from stakeholders in the development process in Nairobi and Kisumu……..86
Table 35: Description of regression model variables …….87
Table 36: Determinants of tree seedling Market efficiency SPSS Results ……89
Table 37: Factors Affecting an entrepreneur's choice of market entry level in Nairobi and Kisumu……...96
Table 38: Nursery operators views on what is needed to improve skills in Nairobi and Kisumu ……99
Table 39: Future plans for organizations involved in the development process……100
Table 40: Nursery operator's views on what can be done to improve the tree nursery business……..101
Table 41: Way forward for organizations involved in the development process……..103

LIST OF FIGURES

Figure 1: Operationalization of the theoretical framework…….22
Figure 2: Map of study area…….34
Figure 3: Fruit tree seedlings found in decentralized tree nurseries in Nairobi and Kisumu..55
Figure 4: Relationship between Elements in the tree seedlings market…….106

ACKNOWLEDGEMENT

I wish to thank the almighty God for the enablement and renewal of energy through the whole process from proposal development through data collection and thesis write-up.

I would also like to thank Egerton University Graduate School for admitting me into the master's programme and processing my proposals and the thesis. In addition, this work would not have been possible without the support of the World Agroforestry Centre (ICRAF).

Many thanks to my supervisors; Dr. Sabina Mukoya-Wangia (Egerton University) and Dr. Ramni Jamnadass (ICRAF) for the guidance, support and advice throughout my research and writing up of this thesis. Alongside them the invaluable contributions of Mr. Jonathan Muriuki and Mr. Anand Aithal of the trees and markets team of ICRAF who have helped me to gain a deeper understanding about Agroforestry issues, tree nurseries and in the general write up of this thesis.

I thank the staff of ICRAF Western Kenya and partner organizations for their cooperation and support during my fieldwork. Further I would also like to thank Dr. Obare, Dr. Njehia, Dr. Margaret W. Ngigi, Dr. Lang'at and Mr. Owour, all lecturers at the Department of Agricultural Economics and Agribusiness Management in Egerton University for their valuable advice on Data analysis and ensuring that the work maintained agricultural economics quality.

I wish to also appreciate my colleagues at Egerton University particularly Tabitha, Catherine, Waswa, Chuchu, Bett and Mureithi for their moral support and ideas that contributed to this work. I would also like to thank my family for their endless financial and moral support while I pursued this study.

Finally to all those who had input in this work from its inception to the final production of this thesis, that I may not have mentioned above, thank you so much for your support.

MAY GOD BLESS YOU ALL

ABSTRACT

Kenya like most countries in Sub-Saharan Africa will continue to depend largely on agriculture in the foreseeable future. Agricultural activities have however been shown to create problems such as soil erosion, soil nutrient depletion and fuel wood and timber shortages. These problems can be mitigated through planting of trees but this is hindered by lack of availability and accessibility of tree seedlings to farmers. To identify the sources of this marketing inefficiency, this study sought to investigate the influence of the existing market environment on the performance and organization of the tree seedlings market. This study was undertaken in the Kisumu and Nairobi districts of Kenya. Structured questionnaires and interview schedules were used to collect both primary and secondary data from a total sample size of sixty tree nurseries and nine organizations involved in the tree nursery development process. Data analysis was done within the Structure Conduct and Performance (SCP) modelling framework for performance and an Ordered Probit Model for organization. The study revealed that the tree seedlings market has a monopolistically competitive market structure comprising of several or many nursery operators/managers each producing similar but slightly differentiated tree seedling species. Each nursery manager /operator can set tree seedling prices on the basis of cost, demand and market without affecting the tree seedlings market as a whole. However the market has tendencies towards perfect competition in Kisumu and oligopolistic competition in Nairobi where central nurseries control most of the output and utilize non price competition (product development and advertising) and low prices. Cost plus pricing mechanism is utilised by all nursery operators and managers although there is no market leader for price leadership. Both markets comprise of a high proportion of decentralized nurseries managed by men aged between 30-50 years with primary and secondary education. The market offers 10-30 species comprising of exotic, medicinal and indigenous species in three sizes (Transplanting, medium and landscaping). Decentralized nurseries offer all three sizes with landscaping services while central nursery managers offer transplanting and medium sized tree seedlings with extension services. Hard support is provided through collaboration, contracting and use of local materials while soft support is provided through interactive extension and media. Main barrier to entry is access to capital. The overall market efficiency of the tree seedlings market is 54% and is influenced by both production and market aspects while the organization of the

market is influenced by prices and infrastructure. Production (sourcing of soil, manure, seeds, polytubes and implements) and management constraints (pest and disease control and funding shortages) still continue to plague the production of tree seedlings. These issues can be addressed through formulation of policies to ensure the provision of security, infrastructure, market information, credit and capacity building opportunities for entrepreneurs to ensure a sustainable supply of tree seedlings to farmers.

CHAPTER ONE
INTRODUCTION

1.1 Background to the study

Kenya has great topographical, climatic and ecological variations that contribute to the diversity and distribution of her natural resources. Agriculture is the backbone of the national economy and contributes to over 50% of the real Gross Domestic Product. It also supports over 80% of the population and employs over 70% of the country's labour force of over 10 million compared to only 3million employed by the formal sector. It generates 80% of the export earnings and supplies over 70 % of raw materials for the agro based industries and overall this sector contributes to over 45% of government revenue (Kosura, 1995). Only 18% of the total land area is considered arable and the remaining 82% is Arid and Semi Arid Land (ASAL) characterised by low erratic rainfall, high temperatures and fragile ecosystems. The main economic activities in high and medium potential areas are agriculture and intensive livestock husbandry while ASALs support pastoral ranching, wildlife based systems and some dry land farming (Mwichabe, 1996).

Although agricultural activities are central to the well being of the people in Kenya, they also create problems such as soil erosion, soil nutrient depletion, fuel wood and timber shortages (Ngugi and Brabley, 1986). These problems are also accentuated by high population densities, intensive cultivation methods, a preponderance of smallholdings because of repeated subdivision of family lands and a rapid decrease in land available for farming (Ministry of Planning and National Development, 1988). Studies have shown that farmers have been protecting useful natural resources on their farms for ages while actively planting trees by either transplanting naturally occurring volunteer seedlings or obtaining seedlings from whatever source they could access (Guggenberger *et al.*, 1989; Dewees, 1995a, b; Aalbaek, 2001). In addition the wealth of information on farmers' use and their valuation of trees on farms, indicates that trees have an important role to play in enhancing farm productivity, diversification, food security, household incomes and ecosystem services (Dewees, 1995b; Place and Dewees, 1999; Place and Otsuka, 2001).

Agroforestry has the potential of intensifying land use while maintaining the productivity of the natural resource base at a sustainable level, providing farmers with additional profitable and sustainable production to current farming practices. However, sustained adoption of Agroforestry has been hampered by various factors, the principal one being lack of availability of and accessibility to tree seedlings by farmers (Guggenberger *et al.*, 1989; Francis, 1995; Bohringer *et al.*, 1999; Place and Dewees, 1999; Aalbaek, 2001). This availability and accessibility to tree seedlings by farmers falls under the preserve of the market environment comprising of the organization and support components. The organization component concerns the approaches to tree nursery development while the support component involves the other stakeholders involved in the development process.

Tree nurseries as basic production units for tree seedlings fall under either the centralized or decentralized development approach on the basis of their function, nursery organization and management. The centralized approach comprises of central nurseries**,** which, belong to private or public bodies such as companies, schools, colleges, churches, NGOs or research organizations. An appointed manager usually manages them and they often specialize in species relevant to the organization such as firewood species for tobacco companies, timber species for wood carving centres or the Forest Department. The decentralized approach on the other hand comprises of group and individual nurseries. Group nurseries are those owned by a group and are usually managed by a leader with the assistance of other group members. Usually members have developed duty rotas for the common activities such as sowing, watering, and weeding. In most cases they are self-help activities which produce seedlings for the group members, but sometimes the surplus is sold. While individual nurseries are those run by a family or individuals for their own needs or for sale (Jaenicke, 2001). Tree nurseries therefore range from those that supply millions of seedlings every planting season, to those that produce fewer than ten seedlings raised by a farmer in a clay pot or tin can in a backyard. Consequently, these approaches differ on aspects concerning the distribution of benefits and planting material, production aspects (quantity and quality) and capital investment aspects (Shanks and Carter, 1994).

Many stakeholders including governmental and non–governmental organizations like the World Agroforestry Centre (ICRAF), Kenya Forestry Research Institute (KEFRI) and Forestry Department (FD), have been involved in attempts to raise the standard of tree nursery technology to boost production of tree seedlings. These stakeholders involved in the tree nursery development process have different objectives, pursue different strategies and focus in different parts of the country providing different support functions (Jaenicke, 2001). Consequently their activities have been shown to affect the nursery operator's production decisions and therefore the amount of tree seedlings available both in quantitative and qualitative terms (species diversity).

To help meet the farmer's needs for diverse tree species there was need to focus on the tree nurseries marketing activities. Through the marketing mix involved in the marketing of tree seedlings that is the product (tree species diversity); price of tree seedlings; promotion (activities undertaken to communicate and promote tree seedlings to farmers) and place (activities undertaken to make seedlings available and accessible to farmers like location of the tree nursery). The tree nurseries market performance indicator subject to the marketing mix would be the market efficiency expressed as the percentage of output of tree seedlings sold or delivered to farmers. Furthermore, the tree seedlings market just like any other market is subject to entry and exit of nursery operators which not only affects the organization of the market but also the supply of tree seedlings. In addition investment decisions facing nursery operators like when to invest or expand the capacity of their tree nurseries involve large sunk costs of investment and uncertainty about prices, demand, costs or competition. Thus most entrepreneurs have the opportunity to delay their entry decisions to learn more about prices, costs and other market conditions before making investment expenditures that are at least partially irreversible. Hence the need for a critical look at the effect of the market environment on both existing nurseries and potential entrants into the tree seedlings market to enhance the establishment of a sustainable tree seedling supply system that would lead to the sustained adoption of Agroforestry.

To critically examine the tree seedlings market we need an analytical framework that takes into consideration the effect of the organization and support components of the market

environment on the performance of tree nurseries. The structure conduct-performance model provides such a framework. In addition the effect of the same market components on the entry and exit decisions of individual entrepreneurs can be captured by the ordered probit model since the choices available to them can be placed on a continuum (individual, group and central nursery levels).

1.2 Statement of the Problem

Soil nutrient depletion, soil erosion, fuel-wood and timber shortages can be mitigated through planting of trees subject to the availability of tree seedlings to farmers in the right quantity and quality. Lack of availability and accessibility of tree seedlings to farmers is an indicator of inefficiency in the marketing system for tree seedlings and therefore the need for a critical look at marketing of tree seedlings in order to identify marketing constraints and provide more practical solutions. To identify the source of this marketing inefficiency, we need to compare the performance of tree nurseries in view of the existing market structure and conduct of participants in the tree seedlings market and effect of the same market environment on an entrepreneur's choice of market entry level (organization).

1.3 Objectives of the Study

1.3.1 General Objective

The general objective was to evaluate the effect of market structure and conduct on performance of the tree seedlings market (tree nurseries) and an entrepreneur's choice of market entry level.

1.3.2 Specific Objectives

1. To identify market structure in the tree seedlings market.
2. To establish the conduct of market participants.
3. To evaluate the effect of structure and conduct of market participants on the performance of tree nurseries.
4. To evaluate the effect of structure, conduct of market participants and performance on an entrepreneur's choice of market entry level.

1.4 Hypotheses of the Study

1. The structure and conduct of market participants have no effect on the performance of tree nurseries.
2. The structures, conduct of market participants and performance have no effect on an entrepreneur's choice of market entry level (organization).

1.5 Justification of the Study

Focus on the tree seedlings market environment comprising of both the organization and support components was meant to help highlight issues affecting both nursery operators and support organizations in the development process. Addressing these issues would help to improve the efficiency of the tree seedlings market system in its ability to satisfy farmer's needs for diverse tree species. Furthermore looking at the support component sought to foster increased collaboration between stakeholders in the provision of both hard and soft support. It was also expected that the formulation of appropriate policies would help to create a more conducive economic environment that would ensure stability in both performance and organization of the tree seedlings market and therefore guarantee farmers not only a stable but also a sustainable supply of tree seedlings that would lead to increased tree planting at the landscape level. Lastly the study also sought to identify areas for further research.

1.6 Definition of Terms

Agroforestry is a collective name for land use systems and practices where woody perennials are grown on the same land management unit as agricultural crops and animals either in a spatial mixture or temporal sequence. There must be significant ecological and economic interactions between the woody and non woody components.

Tree nursery as used in this study is a market where buyers and sellers meet for exchange of tree seedlings.

Tree seedling as used in this study refers to it as the main product of tree seedlings market.

Market structure as used in this study refers to the characteristics of the organization of the tree seedlings market, which influence strategically the nature of competition and pricing behaviour within this market. This market can be perfectly competitive; monopolistic; or oligopolistic.

Market conduct as used in this study refers to the conduct of stakeholders (nursery operators and organizations) as a result of the kind of market structure in place.

Market performance as used in this study refers to how much of the tree seedlings that are produced in the nursery find themselves in the hands of farmers. It results from a combination of strategies and due influence of market structure and the consequent conduct of stakeholders.

Species diversity index as used in this study refers to the number of tree species (richness) and abundance (evenness) on offer in the tree nursery**.**

Polythene bags and other containers fall under a containerised seedling production system in which the nursery operator raises the seedlings in individual polythene tubes or containers.

A Swaziland bed is a bare root nursery system in which seedlings are raised in large open beds of fertile soils with side supports. Roots are pruned from beneath the beds with piano wire and in between seedlings to provide each seedling with a block of soil.

CHAPTER TWO

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.0 Introduction

The lack of availability and accessibility of tree seedlings to farmers is a marketing problem and the notion of product market is fundamental to marketing theory. In this respect tree nurseries represent the basic marketing points for tree seedlings, providing not only a meeting ground for buyers and sellers but also bounded arenas in which prices and quantities for substitutable tree seedling species are negotiated. This study looks at the tree seedlings market because the tree seedling as a product of the tree nursery is the focal point of this study. It has been noted that the quality of tree seedlings produced is of particular concern. While Jones (1993) stressed that the basic goal of growing quality seedlings was to achieve the best growth possible, other researchers like Wightman (1999) and Jaenicke (1999) highlighted the negative effects of poor quality seedlings like frustrations, delayed benefits, reduction in the land's productive potential and overall discouragement of people from planting trees. Other studies have also shown that with the evolvement of farmer nurseries and the gradual shift from the production of low cost tree seedlings for basic food security and ecosystem services to high value ones for income, the quality of individual tree seedlings produced would be of topmost priority (Bohringer, 2002).

2.1.1 Emerging trends in the tree nursery development process

Recent studies (Basweti et. al, 2000; Muriuki and Jaenicke, 2001) have shown that in the past, government subsidized central nurseries represented the main source of tree seedlings in rural areas. Unfortunately the supply from these central nurseries was not based on farmers demand but rather on ill perceived national and institutional policies, which failed to address the complex sustainability needs of the household in terms of food security and farm diversification (Guggenberger *et al.*, 1989; Dewees, 1995a, b). In addition evidence from other studies in other countries like Malawi and Zambia have shown that the ongoing economic restructuring and market liberalization has negatively affected central nurseries as seen from their low seedling output and inability to meet demand (Forestry Research Institute

of Malawi; Chendauka Bwalya, undated and unpublished review of nurseries in Zambia). Similarly Kenya has experienced a gradual shift from the establishment of large central nurseries and training through the Rural Agroforestry Extension Scheme, RAES (1971) to offering advisory services through the Forestry Extension Service (FESD) in 1989.

Economic restructuring in many countries mainly targets seed, fertilizer and produce marketing and According to Venkatesan and Kampen, (1998) these three support components are targeted because of their inherent potential for profitable business opportunities, unlike the case of smallholder farmer training and advisory services which are likely to remain in the public domain. This has contributed to the marginal level of overall current national extension service support to small holder farmers as observed by Bohringer (2002). As a result Bohringer (2002) among others advocated for the building of farmers own capacity in producing tree seedlings as an efficient way of meeting rural demand for tree planting. In addition, this establishment of farmer nurseries was supposed to act as a catalyst in building natural, human and social capitals at the grass root level. The emerging trend then has been an increase in the formation of many small-scale local nurseries and private sector participation in provision of support. Furthermore, it has also been shown that smallholder farmers can play a crucial role in supplying tree germplasm for the development of sustainable land use systems (Bohringer *et al.*, 2002).

2.1.2 Nursery organization

2.1.2.1 Demography and land use

According to Kangasniemi and Reardon (1991), the effect of demographic pressure on the sustainability of agriculture in developing countries is presented in two conflicting hypotheses (the pessimistic and opportunistic hypotheses). While the pessimistic Ricardian hypothesis states that population growth forces farmers to mine their soils and expand cultivation to marginal (erodible) land. The optimistic hypothesis on the other hand states that the food security needs of small scale farmers influences the adoption of more sustainable labour intensive land use technologies. Economic theory can support either

hypothesis. On one hand it suggests that land scarce poor farmers may have a high rate of time preference and may sacrifice long term sustainability (planting trees) for immediate food security. On the other hand, it also suggests that as population growth changes the relative endowments of land and labour, it may also change relative prices so that using labour to maintain the productivity of land becomes more attractive. In the end it depends on the characteristics of and uses (crops) farmers can choose in a specific environment.

The increased farming on steep slopes (hillsides) due to high population density in Rwanda lent credibility to the pessimistic hypotheses (Kangasniemi & Reardon, 1991). Other studies from the South African region have also shown that high population density affects land availability which in turn determines both organization and tree nursery productivity. It was established that population density which affects the access to land and water during the dry season was able to influence the pattern of organization. This is supported by the fact that high demographic pressure in Malawi favoured group nurseries (low productivity) while low pressure in Tanzania favoured individual nurseries (high productivity) (Bohringer, 2002). It was also established that land practises like fallowing, species diversity, intended use of the seedling, labour availability and nursery method affected nursery productivity. In addition access to water was found to be a major determinant of tree nursery location as was observed by Bohringer (2002) across sites in Malawi, Tanzania and Zambia which in turn affected the distribution of nursery stock.

With respect to the nursery production method polythene bags were considered cost efficient and appropriate for raising smaller numbers of high value trees compared to raised beds which were more efficient for mass production of fewer species (Kwesiga & Beniest, 1998). Studies have also shown that although decentralized tree germplasm systems performed well in quantitative terms there was a possibility that they could fall short on quality and diversity goals of the society (Place & Dewees 1999). Bohringer (2002) also emphasized that high nursery productivity did not necessarily mean more sustainable land use since the latter depended on the actual number of trees being transplanted into the landscape and their rate of survival. He also acknowledged that an increase in species diversity (biodiversity) was an important element of building natural capital. With respect to the marketing of tree seedlings

studies have established that while competition among nurseries reduced individual nurseries market shares it resulted in better management, increased species diversity and productivity.

2.1.3 Land tenure security

Economic theory suggests that security of tenure is linked to higher productivity and better land management by reducing farmer risk and raising expected profitability (Panayatou, 1993). Tenure insecurity has been defined as the perceived probability or likelihood of loosing ownership of a part or the whole of ones land without his /her consent (Alemu, 1999). The strength of this perception may have a bearing on how farmers manage their land and this in return has an effect on agricultural production and the sustenance of the people who directly depend on it. Many authors have argued that tenure insecurity discourages investment on land by removing the incentives for it as one may not be able to collect the expected flow of the benefits of ones effort if there looms a threat of loosing the land in future (Maxwell & Weibe, 1999; Deininger & Feder, 1998; Kidanu & Alemu, 1994). Hayami & Otsuka (1988) acknowledged that it was possible that land tenure agreements that assigned land rights to the community rather than to the actual land users, could discourage long term investment in land improvement.

2.1.4 Gender and land rights

According to Mehra (1997) majority of women whether in tradition or modern tenure systems are either landless or have limited and insecure access to land and this has important consequences for sustainable development. Many authors (Cleaver & Schreiber 1992; Wynter 1990) have found tenure under the traditional systems to be unfavourable to women. In this case it has been shown that where women have use rights to land, their rights tend to be restricted and use specific mostly for subsistence. Under the modern tenure systems women tend to face even greater difficulties in obtaining access to land. In fact their land rights tend to deteriorate when governments institute land reform, land registration or resettlement schemes. Studies have shown that land registration programmes throughout Africa (Ethiopia, Guinea Bissau, Kenya and Zimbabwe) have failed to give women titles to

land even where they had customary access to land prior to registration (Davidson, 1988; Palmer, 1985 & Jacobs, 1991).

This evidence suggests that by undermining incentives for long-term investments, insecure tenure among women likewise has a negative effect on both farm productivity and environmental sustainability. Furthermore, these effects are more pronounced for female than male because women lack access to credit and other productivity enhancing resources and services. In many African countries, where women are the main food producers, low sometimes declining productivity among women can significantly jeopardize national food security. Evidence from northern Sudan shows that social and cultural factors strongly discourage women from even cultivating land they do not regard as their own. In addition many studies have documented that women farmers are less productive than men farmers not because they are less efficient but because they generally farm smaller amounts of lower quality land and have more restricted access to complementary resources, new technologies and adult labour. Other studies have also documented the skew ness of service delivery and access to inputs in the developing world in favour of male producers on better land (Ahmed, 1985; Berger *et al.*, 1984 & Staudt, 1982). According to Mehra (1997) evidence from other countries like Indonesia, Malaysia, Sri Lanka, Papua New Guinea, Zimbabwe and Botswana showed similar trends. Many studies have also explicitly highlighted the damaging environmental effects of land shortages, insecure tenure and uncertain land rights (Colchester and Lohmann, 1993; Cruz *et al.*, 1992; Myers, 1991). These problems include over use and abuse of fragile lands, shortening of fallow periods, deforestation and related ecological problems. Thus underlining the need for strengthening women's land rights to enhance productivity and mitigate environmental degradation.

2.1.5 Human capital and the environment

Studies have shown that casual empiricism in both developing and developed countries suggests that countries, regions and communities with lower educational attainment often experience greater environmental problems. Empirical evidence from the US showed that states with more highly educated populations tended to have fewer pollution problems. In the African scenario a study by Thomas Pinckney(1992) on coffee farmers in Kenya and

Tanzania revealed that households in which the agricultural decision maker was numerate and literate produced thirty percent more agricultural output but an increase in cognitive skills beyond basic literacy had no value added on production. Thus underlining Jamison's and Laus (1982) conclusions that on average four years of education would increase output by 7.2 percent and could be higher in rapidly changing agricultural productivity. Furthermore, recent studies have also confirmed a positive relationship between education and productivity (Pudasani, 1983; Jamison & Moock, 1984; Azhar, 1981) or education and adoption of new technologies (Lin, 1991). While other studies have shown that skills and experience which are attributes associated with human capital are major determinants of nursery productivity. Results from the study conducted by Bohringer (2002) in the Southern African region suggested a positive relationship between skills and nursery productivity. For example in Zambia first time nursery operators produced significantly less tree seedlings on average compared to more experienced ones while a high proportion of nursery operators having previous experience in nursery establishment led to consistent average production in Malawi. Consequently Bohringer (2002) proposed that a fifty percent decrease in nursery output should be anticipated with first time nursery operators compared to ones operated by more experienced ones.

2.1.6 Nursery type and inter group dynamics

Studies have shown that the social dimension of farmer nurseries could be exemplified by nursery type and intergroup dynamics. Results from Bohringer (2001)'s study showed that the type of nursery had significant effect on number of seedlings produced in Zambia, Malawi and Tanzania. Within and between countries analyses showed that individual nurseries on average produced more seedlings than group nurseries. This led to the conclusion that this difference in productivity could be interpreted as a kind of trade off between the two broader nursery objectives that were aimed at building natural and social capital.

The importance of inter group dynamics was also evident in the productivity levels of the different types of nurseries. Bohringer (2001) noted that even though group nurseries

provided members with the benefit of spreading overall production risks, the additional transaction costs of organization contributed to their low productivity. Furthermore frequent quarrels over sharing of nursery labour and seedlings produced often resulted in sub optimal care of tree seedlings. In addition sometimes complex incentive structures were needed when forming community tree nurseries (Place & Dewees, 1999). On the other hand little social transaction costs and high rewards for individual efforts ensured the high productivity for individual nurseries. Since most projects in the region advocate for group nurseries in smallholder farmer extension because of their efficiency (scope, time and cost), Bohringer (2001) proposed that there was need to determine the different kinds of incentives that individual and group nurseries required for them to contribute in a balanced way to the different kinds of capital. He also added that without such valuation a decision to favour one approach over the other in sustainable development was unjustified. Furthermore the recurrent deficits in the tree seedlings market also underlined the need for further evaluation of the tree seedling supply system in order to meet the farmers demand (Shanks and Carter, 1994).

2.1.7 Organizational Support

The type of support needed by smallholder farmers in Kenya varies widely as in most parts of Sub Saharan Africa. This support may be related to marketing, production technology, inputs, credit and infrastructure. In the case of farmer nurseries Bohringer (2002) classified this support under soft and hard. Soft support relates to information, training and advice while hard support on the other hand relates to inputs such as tree seed, water, innoculum, tools and fencing. In order to assess the effectiveness of support systems, Bohringer (2002) proposed measuring their impact on food security, wealth creation and environment conservation. As for Agroforestry he proposed the use of the extent of tree planting in terms of the area planted to trees and numbers of rural households using Agroforestry technologies. However for better assessment of this output, emphasis was put on the need for understanding the farmer's nursery problems, the support systems needed and the impact of tree planting on farmers.

2.1.8 Constraints to efficient nursery production.

Studies have shown that in the absence of incentives where partner organizations provide starter germplasm for initiating nurseries, the availability of tree germplasm has often been cited as a key constraint to farmer tree planting (Aalbaek, 2001). Other studies (O'Connor 1997; Basweti *et al.*, 2000; Muriuki *et al.*, 2001; Bohringer *et al.*, 2002) indicated the major constraints to effective seedling supply as pests, lack of raw material inputs, slow tree performance, marketing issues, information flow problems and the harassment of nursery operators by government authorities. In addition it was also noted that while over dependence on one tree seedling production system and its success spelt doom for other production methods, efficiency in tree nursery management required up to date information on the technical and cultural practices involved. Holding & Omondi (1998) on the other hand singled out issues to do with seed production and policy issues regarding the procurement of quality seeds. Shanks & Carter (1994) also noted that the provision of free seedlings could greatly undermine the establishment of sustainable tree seedling production systems due to the inevitable dependence on free seedlings and the ultimate collapse of local markets.

2.1.9 Support systems

In relation to the required support mechanisms in the provision of support to farmer's nurseries, Bohringer (2002) observed that hard inputs were largely provided by single agents, while soft inputs were provided by many agents through collaborations. He also observed a remarkable increase in farmers own support for hard inputs, which demonstrated that the provision of these inputs to farmers was counter productive to sustainable tree nursery production. Since many tree planting projects in the region still focused on hard support, he advocated for increased investments in the establishment of viable grass root level seed supply systems. Bohringer (2002) also observed that while there was a general reduction in support from government extension services, support from non governmental organizations was on the increase. He also noted that while ICRAF collaborated with other NGOs in information dissemination and provision of technical backstopping advice, ICRAF played a dominant role in nursery training. Thus he proposed for increased investment into training of

grassroots level trainers in the future to free up resources from other stakeholders in the development process towards the scaling up Agroforestry as opposed to training. In addition, the variations in levels of human resource capacities among service providers also affected the quality of advice given and this had an impact on tree nursery productivity, as exemplified by the significant differences between support provided by ICRAF and other development partners. Thus the inherent differences concerning the human capacities, scarcity and investment needs of the support functions determines the strategies to be used in the provision of support (Bohringer, 2002). Other researchers like Haug (1999) also noted that the general lack of collaboration between farmers, researchers and extensionists has resulted in the inefficient provision of support services at the grass root level. Hence the need for collaboration between stakeholders to ensure efficiency in service provision.

2.1.10 Gender in research and project design.

Literature shows that USAID is one of the major proponents for gender disaggregated data collection and the systematic inclusion of women as actors, producers and agents of development in all sectors (USAID, 1993). Hence these basic principles have been applied to projects on reforestation in Thailand, global climate changes in Brazil; mixed farming systems in Mali and fuel wood conservation in Nepal, India, Sudan and Southern Africa (Bonnard & Scherr, 1994). Recent literature also emphasizes on gender as a complex of identities and ideologies and examines not only male female differences but negotiations and relations between them (Rathgeber, 1990). The rationale for employing disaggregated household models in Agroforestry research and project design was attributed to differences in gender species preferences (Fortmann & Rocheleau, 1985) and tree planting culture (Hirschmann, 1993). Studies in Rajasthan and Senegal found that women preferred naturally growing trees for fodder, fuel and shade while men concentrated on the market value of tree products (Kaur, 1991; Kumar, 1988). However studies in Kenya have shown real resistance from men for women planting commercially valuable timber or fruit trees (Feldstein *et al.*, 1989) although there are still many examples of women engaging in fruit, fuel wood, and pole markets (Kumar, 1988; Molnar and Schreiber, 1989). Fortmann *et al.* (1997) in a study

of tenure security and gender differences in tree planting in Zimbabwe found that women were less likely to plant trees where they had less security of duration of tenure.

A study by Bonnard & Scherr (1994) in Siaya and South Nyanza in Kenya revealed that although farmer's objectives and available resources were to a greater extent delineated according to gender, profound and highly relevant differences among women were masked by routine classification by gender. Gender stereotypes concerning species selection, tree product use, soil conservation practices etc did not always hold true. These findings have raised questions regarding the logic of designing development projects and research on Agroforestry which distinguishes adopters or participants principally by gender, or the use of preconceived notions concerning gender specific preferences. Consequently Bonnard & Scherr (1994) concluded that while gender targeting was warranted as a means of drawing women into the development process, preconceived notions of women participation and preferences on the part of policy makers and project designers was likely to constrain women decision making and performance as well as reducing their incentives to engage in new productive opportunities.

2.1.11 Impact of Agroforestry systems

According to Bohringer (2002), the most reliable way to measure the impact of Agroforestry systems was through transplanting impact since high nursery productivity did not necessarily mean more sustainable land use. Bohringer's (2002) study provided fundamental linkages between nursery type, group composition (transactions cost, the relations among individual members on the diffusion and transplanting of tree seedlings) and soft support related to growth in human capital. This was exemplified in the case of individual nurseries in Malawi which despite their high productivity and larger number of trees transplanted from them, their overall tree planting impact at the community and landscape level was limited by the dominance of group nurseries (Bohringer *et al.*, 2002). Nursery location on the other hand showed no meaningful effect on average number of tree seedlings transplanted. Even though home yard nurseries resulted in significantly larger numbers being transplanted compared to nurseries in other locations their access was limited to few individuals. This limited access

was attributed to the fact that majority of home yard nurseries were of group type and were composed of members of the extended family who excluded outside recipients. On the other hand the increased seedling production was due to more efficient nursery organization as a result of the higher social capacities. These transaction costs were mainly attributed to the large fluctuations in membership among groups over time which affected group organization and resulted in low nursery output. But group nurseries provided the crucial human start-up capital for the establishment of individual nurseries underlining the close interrelationship between group and individual nurseries. There were significant relationships between education and nursery location with area managed. But the number of trees managed was explained by age, education, gender, and nursery location. However the most fundamental fact was that increased investment into the scaling up of Agroforestry was a sure way of increasing the demand for tree seedlings.

2.1.12 Entry into the tree seedlings market

Studies have shown that through investment farm households improve their productivity leading to increased agricultural output and increased income and wealth level. Secure tenure provides the proper incentives for farmers to make investments in the longer-term productivity of their land. We may therefore expect that tenure insecurity to have more impact on decisions like tree planting, building of conservation structures or irrigation than purchase of fertilizer, seeds and other inputs providing short term returns. Where tenure is secure farmers are more inclined to invest in slower growing tree crops or productivity enhancing inputs or more labour intensive land conservation practices thereby raising both productivity and the quality of their land. Alemu (1999), Holden and Yohannes (2001) in their studies in Ethiopia found that small farms invested more in land conservation than large farms in central and northern Ethiopia simply because land scarcity increased its value (Boserup's (1965) hypothesis). Tenure insecurity is likely to be of less importance if costs and benefits accrue in the short run than if they accrue over a longer period of time. Clay & Reardon (1997) in their study in Rwanda found that own sources of liquidity especially from off farm employment, smaller holdings, household labour and under certain circumstances conservation knowledge (possibly from investments) were important determinants of

conservation at the farm level. Thus they emphasized on the need for policies aimed at the development of off farm enterprises by farm families to promote soil conservation on the farm. They concluded that other extension services emphasis on conservation measures had clear payoffs at the farm level while also increasing the compatibility of conservation and income diversification.

Place & Hazell (1993) found that land rights (use rights or transfer rights) were not significantly related to yields in Ghana, Kenya and Rwanda. They concluded that lack of access to credit, insufficient human capital and labour shortages adversely affected investments more than insecurity of tenure. However, Gavian & Fafchamps (1996) were of the view that existing empirical studies have failed to establish strong links between land rights, investment and agricultural productivity on African croplands. Other literature has also shown that the choice of nursery type depends on how different types and sizes of nurseries fit together in the overall system of seed procurement, plant propagation, distribution, and demand for tree seedlings. According to Muriuki (2005) the entry into the tree nursery business provides an alternative source of off farm income as well as an opportunity for people with minimum land resources to benefit from Agroforestry as nursery operators. This investment decision like when to invest or expand current operations, as with many in agribusiness firms involves large sunk costs of investment and uncertainty about prices, demand, cost or competition. Thus most entrepreneurs have the opportunity to delay the entry decisions in order to learn more about prices, costs and other market conditions before making investment expenditures that are partially irreversible. For those already in the market, if the flow of their profits becomes negative, they have the option of suspending their operations and later restarting them but only at a substantial cost. In an uncertain economic environment most nursery operators are therefore faced with the decision of whether and how much to expand the capacity of their operations.

Since risk and uncertainty are inherent in the production process (Frank, 1921) and tree seedlings production being no exception we expect that these two factors will affect the nursery operator's decision making process. In this respect nursery operators need to respond to uncertainty when making decisions concerning entry and exit from markets. Consequently

most producers have been found to be risk averse and only those with large networths can and will assume more risks. Some of the ways that have been recommended for reducing risk are: use of sound management techniques by understanding the alternative technologies and utilizing decision making techniques (information), commercial insurance, forward and futures contracting and diversification. In order to factor in the effect of risk and uncertainty on the marketing of tree seedlings, this study looked at three aspects namely: the proportion of the nursery that was allocated to tree seedling production, perceived demand for tree seedlings and intended use of the seedlings produced.

2.1.13 Gaps in literature

While Bohringer's (2002) study highlighted fundamental issues concerning the organization and support for farmer nurseries, the study fell short in that it only looked at the decentralized approaches and limited the intended use of tree seedlings to own use. This limited the scope of his study because central nurseries are an integral part of the tree seedling supply system and nurseries produce seedlings for variety uses other than for own use. In addition his study as with other studies focused more on the production aspects and the scaling up of Agroforestry technology, while giving little attention to marketing aspects of tree seedlings. Thus underlining a common trend in many developing countries where economic development policies are more of productivity oriented than marketing (Ngigi 1988) and perhaps a contributory factor to the general lack of information on marketing especially on the tree seedlings.

2.2 Conceptual Framework

The marketing problem presented in the form of lack of availability and accessibility of tree seedlings to farmers requires a deeper understanding of producer behaviour in response to consumers having problems with accessing tree seedlings. Hence the need for tree seedlings market analysis.

Market analysis studies can be classified using descriptive, price efficiency and organizational criteria. The descriptive approach involves statistical analysis although

conclusions regarding performance and efficiency are based on the researcher's subjective assessment. This approach has been used extensively as a basis of studying commodity flows and marketing techniques (Smith, 1981). The price efficiency approach analyses marketing in its dimensions of space-time and form, through the application of various pricing criterions in the examination of the efficiency with which the market system sets prices and transmits price information among the different producer, wholesale and retail markets (Bressler & King 1970).

Industrial organization methodology is a standard tool for the analysis of markets in the US and UK (Scherer, 1980). It consists of the structure- conduct-performance model which has been used widely in agricultural marketing studies of different products all over the world and most importantly here in Kenya. This study adopted this framework in an attempt to understand the marketing system for tree seedlings in Nairobi and Kisumu. The SCP model having successfully been used to study other agricultural product markets in Kenya provided a basis that lent credibility towards the appropriateness and applicability of the same model to the tree seedlings market analysis. The conceptualisation of the tree seedlings marketing problem within the SCP model framework and ordered probit model is presented in Figure 1. The model is discussed in proceeding sections with relevant studies in this area.

The SCP model is based on the theory of industrial organization. This theory tells us that the market structure (the environment) determines market conduct (the behaviour of economic agents within the environment) and thereby sets the level of market performance (how close the industry comes close to meeting the norm or standard of reference of social welfare)(Caves, 1982). If we uncover reliable links between elements of structure, conduct and performance, we have a powerful tool for economic analysis. Causation may however run both ways from economic performance to conduct to structure. However, the relationship may also be dynamic in character and change with time limiting the predictive and analytical value of the approach and this should be considered when interpreting the results of industrial organization analysis. Thus on the basis of the same concept it was hypothesised that the tree seedling market structure would determine how stakeholders behaved and therefore the level of performance (ability of tree nurseries to satisfy farmers' demand for diverse tree species

through availability and accessibility of the same). This effect captured by the SCP model was to explain the behaviour of existing tree nurseries in the tree seedlings market.

The entry or exit of nursery operators into/from the tree seedlings market depends on how they perceive the same market conditions. This decision making is bound to have a direct impact on the availability and accessibility of tree seedlings to farmers. The ordered probit model was used in an attempt to capture the decision making or behaviour of nursery operators (entrepreneurs) in response to changes in the market environment in their quest to satisfy farmer's demand for diverse tree species. Both models were intended to address the problem of availability and accessibility of tree seedlings which affected the tree planting process.

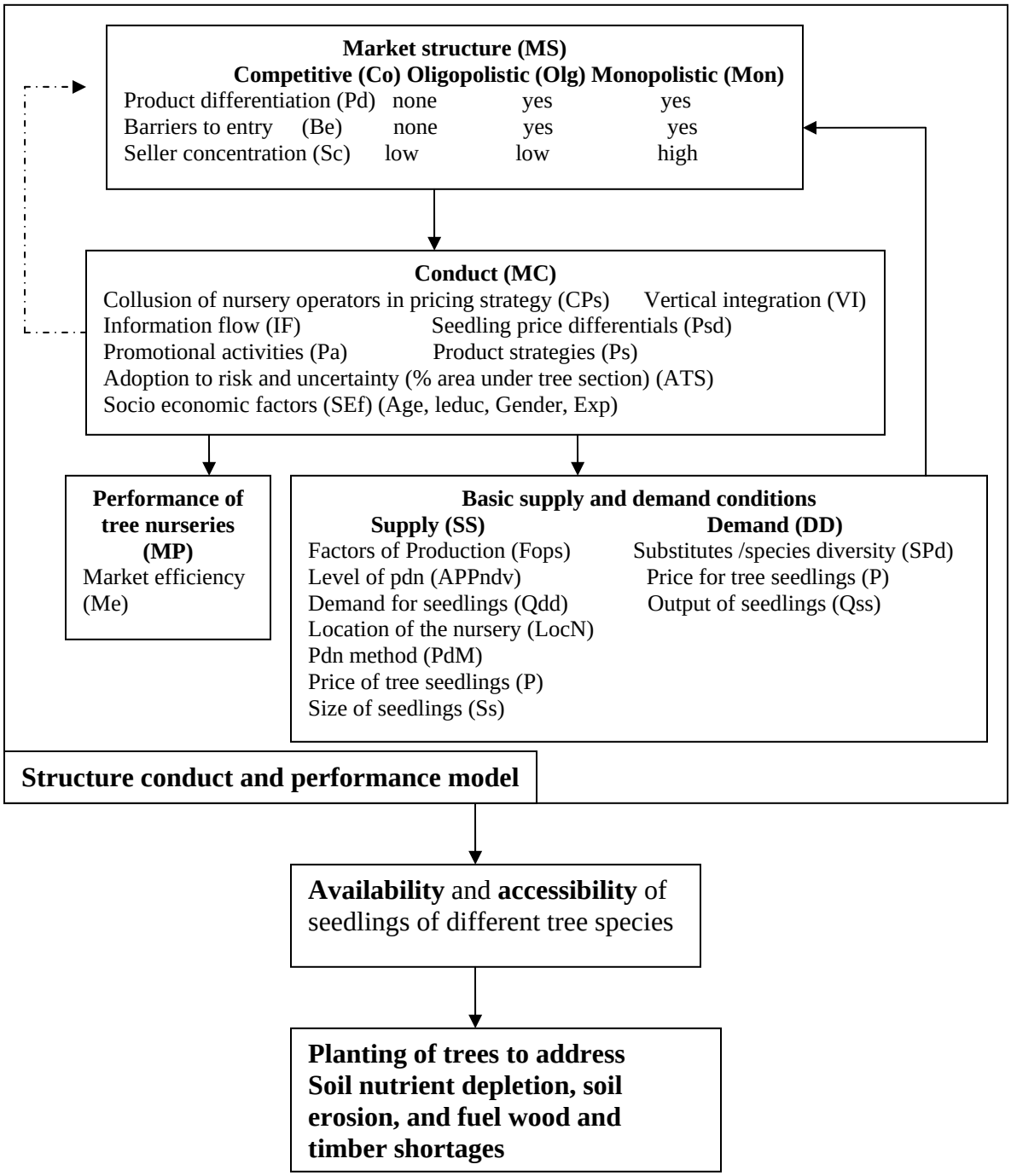


Figure 1. Conceptual framework

2.3 Market structure-conduct –performance model (SCP)

2.3.1 Market structure

Market structure is defined as the characteristics of the organization of a market, which seem to influence strategically the nature of competition and pricing behaviour within the market (Bain, 1968). Structural characteristics may be used as a basis of classifying markets into perfectly competitive; monopolistically competitive; or oligopolistically competitive.

Perfect competition is an economic model of a market possessing the following characteristics: each economic agent acts as if prices are given (price taker) i.e. no large firm or group of firms dominates buying and selling. The product being sold is considered a homogenous good. Product differentiation does not exist. There is free mobility of all resources including free entry and exit of business firms. And finally, all economic agents in the market possess complete and perfect knowledge (Scherer, 1980).

A monopolistically competitive market is characterized by: the presence of many producers and consumers in the market; consumers have clearly defined preferences and sellers attempt to differentiate their products from those of their competitors; the goods and services are heterogeneous, usually (though not always) intrinsically so; there are a few barriers to entry and exit; have a degree of control over price. Hence the characteristics of a monopolistically competitive market are almost the same as in perfect competition with the exception of heterogeneous products and that monopolistic competition involves a great deal of non price competition (based on subtle product differentiation). Which give the firm a certain amount of influence over the market; it can raise its prices without loosing all the customers owing to brand loyalty. Thus in simple terms monopolistic competition is a market structure in which several or many sellers each produce similar but slightly differentiated products. Each producer can set its price and quantity without affecting the market place as a whole (Gans, *et.al*, 2003).

An oligopoly is a market form characterised by: A small number of sellers; Interactivity where the decisions (strategic plans) of one firm influence and are influenced by the decisions of other firms; High risk for collusion; Imperfect competition where the product or services firms offer are differentiated and barriers to entry are strong; Fierce price competitiveness; non price competition like product development and advertising in order to accrue greater revenue and market share. Oligopolistic competition can give rise to monopolistic tendencies where firms may collude to raise prices and restrict production through cartels and the presence of price leadership through informal market leaders. Oligopolistic competition can also give rise to perfect competition conditions where fierce competition between sellers leads to low prices and high production. However there is a possibility of excessive levels of differentiation in oligopolies in order to stifle competition (Davis &Cline, 2005).

The four salient aspects of market structure include the degree of buyer and seller concentration; degree of product differentiation; and the conditions of entry (Koch, 1980) these elements measure the extent of deviation, the more imperfectly competitive is the market (an extreme case would be monopoly).

Marketing studies that have been done in Kenya have identified different market structures for example an oligopolistic market structure was identified in both the animal feeds industry and the egg market (Kailikia, 1992 & Ngigi, 1988) while a competitive structure was identified in the cooking banana market (Ayieko, 1995). According to Ackello-ogutu (1976) a high concentration and inequality could indicate oligopoly, though tendencies towards competitiveness are likely if there are no barriers to entry for example the animal feeds (Kailikia, 1992) and the egg markets (Ngigi, 1988) were both characterized by high degrees of concentration and inequality with respective traders controlling over 70% of the market share. Economic theory also suggests that concentration is an important determinant of market behaviour and market results (Rosenbluth, 1955).

Koch (1980) describes market concentration as the number and size distribution of sellers and buyers in the market place. Concentration is felt to play a large part in the determination of market behaviour within an industry because it affects the interdependence action among firms. A high degree of concentration raises the possibility of price collusion in the market. While empirical relationships between structure and performance are not always known, almost all studies of seller concentration suggest a positive, though often weak association between concentration and profitability. However, Scott (1995) warns that these relationships between concentration and market behaviour and performance must not however be interpreted in isolation. Other factors such as the firm's objective, barriers to entry, economies of scale and assumptions about rival firms' behaviour, will all be relevant in determining the degree of concentration and its relationship with behaviour and performance.

Measures of market power include the Lerner index (Lerner, 1934), which measures the deviation of price from marginal cost; the Rothschild index (Rothschild, 1942), which is a measure of the elasticity of industry demand for a product relative to that of an individual firm: R has a value between 0 (perfect competition) and 1 (monopoly). When an industry is composed of many firms, each producing similar products, the Rothschild index will be close to zero; the Bain profit index (Bain, 1941); and Papandreou's index of penetration and insulation (Papandreou, 1949). Koch (1980) lists two kinds of partial concentration indices: the Ginni coefficient and the Herfindahl index. Both utilize market shares to determine the extent of market concentration. The Ginni coefficient is based on the Lorenz curve, which plots a cumulative distribution of income against a corresponding population or group. If the concentration ratio and Ginni coefficients are high then oligopolistic tendencies are suggested (Koch, 1980). High concentration ratios are indicative of an advantage held by the market participants who are in a position to influence the selling prices, thereby being able to exploit the consumers. If the coefficient is close to one it indicates inequality (Inequality refers to the degree to which a small percentage of the market participants control a large percentage of the market).

Product differentiation deals with the degree to which products of one seller are distinguished from those of others. According to Chamberlain (1933), product differentiation will exist in the market if there is a fancied or real, basis, which distinguishes products, and leads to the preference for one over the other. Products may be differentiated by brands or after sales service offered by traders. These aspects bring about consumer loyalty and consequently reduce competition in the market because buyers view the product of one seller as being different from those of other sellers. Kailikia (1992) reckons that if this happens then there is a likelihood of excessive non-price competition such as unproductive advertising and special services, resulting in an increase in the cost of doing business. Marketing studies have shown that the degree of product and service differentiation varies from market to market. For example in the egg market product features like the colour, cleanliness of the shell and the relative size of the egg were used (Ngigi, 1988). The animal feeds utilized different brand names, prices and service differentiation (limited credit and good customer relationship) (Kailikia, 1992). While in the cutflower market Exporters sold cutflowers using natural flower names (Nduati, 1993). Consequently these studies underline Bain (1968)'s theory that "market structure influences conduct".

In the case of tree seedlings, species diversity is of essence because tree seedlings are sold on the basis of species names. Species diversity is a single figure (i.e. univariate) numerical measure of diversity which incorporates species richness and equitability (i.e. evenness). Different priorities in the reconciliation of the two factors have led to the invention of a variety of indices which are optimised in different ways and hence have different merits. Although diversity indices provide a summary statistic of the diversity of a community, no one could be said to be superior for all circumstances. A family of related indices, including k-dominance, Berger-Parker, H', Simpson's index, and a simple count of the number of species, are known as intrinsic diversity (Biodiversity, 2003). Many diversity indices exist because information on richness and evenness can be combined in many different ways. Some indices will be more influenced by evenness whereas others are more influenced by richness. This study will make use of the Shannon index which is a member of Simpson's index family to compare the species diversity between tree nurseries in Nairobi and Kisumu.

Barriers to entry deal with those advantages held by existing firms over those with potential to enter a market (Bain, 1968). If a market has few barriers to entry then it becomes more likely to be competitive than one with many barriers to entry. Barriers to entry may include technical know how, capital required to enter a particular industry, market information and legal requirements which new firms should fulfil before entering an industry. High barriers to entry into the market are more likely to lead to oligopoly. As regards barriers to entry most of the studies have documented lack of adequate capital (credit) to be a major constraint to participants in the marketing system, as they have to rely on their savings to start their business (Ngigi, 1988; Ainebyona, 1988). Other constraints included poor market transparency and over reliance on public transport (hired lorries) for marketing functions (Ainebyona, 1988), unavailability of high quality raw materials, delays in processing import licenses and limited forex allocation (Kailikia, 1992). This indicated that barriers to entry were industry specific thus they varied. This study focused on the following aspects of market structure (MS): product differentiation (Pd), barriers of entry (Be), and the seller concentration (Sc), which will be given by the Herfindahl index.

$$MS = f(Pd, Be, Sc) \quad (1)$$

Possible values for market structure (MS) would be a competitive (Co), oligopolistic (Olg) or monopolistic (Mon) structure.

2.3.2 Tree nurseries demand and supply conditions

Tree seedlings are subject to the laws of demand and supply. Hence for the tree nursery operator or entrepreneur to survive in a competitive market and achieve a unique selling position it's important to look at these conditions that influence their everyday production decisions. Supply for tree seedlings (SS) will be a function of the (Fops)factors of production(land (Na) labour (La), capital (Ka), water (Wa)), nursery type (APPndv)(individual, group, central nursery), size of seedlings (Ss), production method (PdM) (polytubes, Swazi beds) ,location of the nursery (LocN),Prices for tree seedlings (P) and demand (DD). The demand for tree seedlings (DD) on the other side will be a function of substitutes available (SPd) (species diversity), Price for tree seedlings (P) and Supply for tree seedlings (SS).

Fops =f (Na, La, Ka, Wa) (2)

SSc =f (Fops, APPndv, Ss, LocN, PdM, P, DD) (3)

DD =f(SPd, P, SS) (4)

2.3.3 Market Conduct

Market conduct refers to the patterns of behaviour that firms follow in adapting or adjusting to the markets in which they sell or buy (Bain, 1968). Such a definition implies the analysis of human behaviour patterns that are not readily identifiable, obtainable, or quantifiable. Thus in the absence of a theoretical framework for market analysis there is a tendency to treat conduct variables in a descriptive manner or as Ishak (1988) points out as spill over in the assessment of market performance.

Bain (1968) names two closely interrelated aspects of market conduct: “the manner in which and the devices and mechanisms by which, the different sellers coordinate their rivalrous decisions and actions, adapt to each other or succeed in making them mutually consistent as they react to demands for their products in a common market” and “the character of pricing policies and related market policies that the sellers in the industry adopt; assessed in terms of the individual or collective aims or goals that they pursue as they determine their selling prices, their sales promotion outlays, the designs and qualities of their products etc”. By examining the relationship between the factors and market structure and these prices setting practices it may be possible to make some predictions about the consequences of these behavioural patterns on performance (Scott, 1995).

On the basis of Bain’s theory that market structure affects conduct there is a general price setting behaviour that characterizes a perfectly competitive market, a monopolistic and an oligopolistic market. Market conduct thus defines the conditions, which make possible exploitative relationships between producers and buyers. This is done via unfair price setting practices which Smith (1981) classified as collusive, predatory or exclusionary. These practices result in a level of profit over and above marketing costs and low or non-existent profit margins for the producer. Perfect competition describes a market in which there is

complete absence of direct competition among economic agents (Gould and Ferguson, 1980). The price setting mechanism can be viewed via the tatonnement process in a walrasian world whereby consumers do not interact with producers except by the auctioneer who sets market clearing. At the other end of the spectrum is the monopolist who may set purchase prices lower than equilibrium levels thus capturing additional consumer surplus. The oligopolist is on an intermediate level and his market conduct is characterized by the tendency to influence prices and an awareness that his profits depend upon the actions of his rivals.

Many marketing studies have identified positive linkages between price-setting practices and the market structures in place. For example Ainebyona, (1988) found that price determination at the market led to collusion and low prices for quality bananas. In the cutflower marketing system Nduati (1993) found that cutflowers were sold through auction markets and to individual flower dealers which resulted in different price setting mechanisms. The auction market determined prices by the forces of demand and supply while individual sales to dealers were negotiated. Kailikia (1992) found the Prices of animal feeds to be decontrolled and Unga feeds limited acted as the dominant price leader with its cost plus pricing system providing a base for the other firm's prices while their was Price undercutting and collusive activities in price setting at the small holder level. At the manufactures level competition was reduced through advertising and price undercutting (Kailikia, 1992).

This study thus looked at the following aspects of Market conduct(MC): Collusion of nursery operators in their pricing strategies (CPs), seedling price differentials (Psd), product strategies (Ps), vertical integration (VI,) flow of information (IF) (research and innovation), promotional activities (Pa), % of area under the tree section (ATS) (adoption to risk and uncertainty).In addition other Socio Economic factors (SEf) like age, level of education, gender and experience were looked at in this study since they were likely to affect the market participation of an individual as cited by Ngigi (2002).In this case the market conduct (MC) was given by the following equation.

$$MC = f(CPs, Psd, VI, IF, Pa, Ps, ATS, SEf) \quad (5)$$

2.3.4 Market performance

Market performance refers to the impact of structure and conduct as measured in terms of variables such as prices, costs and volume of output (Bressler and King, 1970). By analyzing the level of marketing margins and their cost components it's possible to evaluate the impact of structure and conduct characteristics on market performance (Bain, 1968). For most countries its generally acknowledged that a distribution system displaying acceptable performance is one that allows technological progress, has the ability to adapt, innovate, and utilize resources efficiently and to transmit prices that reflect costs. Prices are thus viewed as a stimulus for an efficient allocation of resources. Hence desirable market performance is directly related to the competitiveness of an industry because distortions thereof tend to impede price efficiency. The analysis of market performance using the industrial organization framework is as follows: collusive pricing (market conduct) becomes possible if market concentration is high (market structure); entry barriers are high (market structure); and market information is not available to all participants (market conduct). This results in net returns that are much higher than the fair amount. The analysis of net returns aims to verify or refute the existence of above average profits to traders. If the market were perfectly competitive, net returns would roughly equal the return to the trader's capital. However oligopolistic market structure would tend to increase returns as it manifests price distortions as well as bias buying and selling practices (Scott, 1995).

However literature review indicates lack of unanimity in definition for market performance. For instance Sosnick (1964) defined the following twelve performance dimensions: production efficiency, technological progressiveness, profit rates, product suitability, level of output, exchange efficiency, cost of sales promotion, unethical practices, participant rationality, conservation, external effects and labour relations. Bain (1959) defined four dimensions: efficiency, progressiveness, full employment and equity. Koch (1980) defined seven dimensions: output, growth in output, technological advance, employment, allocative efficiency, output efficiency and equity. Bressler and King (1970) assessed market performance in the dimensions of time, space and form. According to the three criteria, prices in a perfect market were related through time by storage costs through space by transfer costs and through form by production costs. Ngigi (1988) assessed performance in

the following dimensions: participant's rationality, employment resources, market coverage, equity and efficiency.

According to Bain (1968) Market performance is an end result, which firms in any market arrive at by pursuing the line of conduct they have deemed best for themselves. The fact that most of the marketing systems studied showed the markets to be in the hands of private traders, price inefficiencies were likely to exist. Ayieko (1995) attributed the high prices that prevailed in the cooking banana market to the existing market structure and collusive tendencies aggravated by poor price information. In the animal feeds industry the observed production of low quality and shortage of feeds was attributed to poor infrastructure (transport storage facilities) while the large price differentials for different brands of feeds were attributed to the oligopolistic market structure (Kailikia, 1992). Nduati (1993) on the other hand attributed the inefficiencies in the cutflower industry to the existence of a dual market structures (oligopolistic export market structure and a competitive local market). This resulted in traders enjoying high profits not withstanding the high barriers to entry.

Given that the main objective of this study was to try and address the issue of lack of availability and accessibility of tree seedlings, this study looked at market efficiency (**Me**)(% of output sold or delivered to the customers) as a function of the marketing mix involved in the marketing of tree seedlings that is the product (tree species diversity); price of tree seedlings; promotion (activities undertaken to communicate and promote tree seedlings to farmers) and place (activities undertaken to make seedlings available and accessible to farmers like location of the tree nursery. Thus market performance (MP) for tree nurseries was to be given by the equation below.

MP=**Me** =f (price, product, promotion and place) (6)

However according to the theory of industrial organization based on the SCP model market performance (MP) is as a result of the existing market structure (MS) and conduct of participants (MC) subject to the supply (SS) and demand for tree seedlings (DD). This gave rise to the following equation.

Me=f (MC, MS, SS, DD) (7)

2.3.5 Critique of the SCP model

The industrial organization approach emerged in the developed country context where industries, often dominated by a few very large firms, represented a prominent sector of the economy (Bain, 1968). Its applicability to more atomistic situation typical of agricultural factor and product markets in developing countries has been questioned. In addition, Smith (1981) believes that the structure –conduct – performance (SCP) framework has limited transferability to the developing country scene because of underdeveloped infrastructure, intersectoral relations and development objectives as well as the unique social and political structures found in the third world. Smith proceeded to develop performance criteria that he considered more relevant to developing countries, although the issue of evaluating departures from the perfectly competitive model remained intact.

Other critics of the SCP model like E.G. Nourse also content that there is no necessary relationship between market structure and performance rather firms conduct and performance are functions primarily of the individual idiosyncrasies of the firms managers. Kaysen and Turner (1959) proponents of the model also warned that we can neither predict market performance from market structure nor can we tell from structure alone how competitive the processes of the market are. The SCP model thus cannot and should not be considered a rigidly deterministic relationship. However price theory and empirical evidence support the contention that there is some sort of causal relationship in which structure determines performance but the relationship is both ways. Since this model has been widely utilized in marketing studies of different products in Kenya, the tree seedlings market can benefit greatly from a study that utilizes the industrial organization approach and hence its relevance to this particular study.

2.4 The entrepreneur's choice of the market entry level.

The establishment of a sustainable tree seedling supply system is not only dependent on the existing tree nurseries but also on those to be established in future by potential market entrants. Since the quantity of tree seedlings supplied is dependent on the choices made by entrepreneurs its important to be able to predict choices likely to be made if market

conditions remain the same and the factors we can alter if we want to induce a shift in the market towards more efficient approaches. This study utilized the ordered probit model to try and explain the decision making process. The relevance of this model was based on the fact that individuals choose to enter the market depending on how they perceive the market. Furthermore the choice set available to the individual entrepreneur can be placed on a continuum with individual and central nurseries on the extreme ends and group nurseries in the middle. To realize the effect of market environment we needed to incorporate a model that would take into consideration the qualitative and polychotomous nature of the dependent variable. Since the dependent variable in this case was discreet and involved multinomial and ordered choices, the ordered probit model was the appropriate analytical framework. We also assumed that potential market entrants were rational and would have liked to maximize their utility by selecting the most effective and sustainable approach to tree nursery development from the given set of alternatives (y_1 =individual, y_2 =group and y_3 =central nurseries)**.** Although this alternatives fall under mainly two approaches namely the decentralized and centralized approach.

2.4.1 The Ordered Probit Model

In an ordered probit model, the error term associated with this continuous descriptor is assumed to follow a normal distribution. According to Green (2000), the standard probit model can be defined as:

$$y_n^* = \beta' x_n + \varepsilon_n \qquad \textbf{(8)}$$

Where y_n^* is the unobserved latent and continuous measure of the importance of the dependent variable to response n**,**

x_n is a vector of explanatory variables ,

β is a vector of parameters to be estimated and ε_n is a random term (assumed to follow a standard normal distribution). Estimation in this model is done by maximum likelihood.

CHAPTER THREE

METHODOLOGY

3.1 Study area

This study was carried out in Nairobi (Nairobi city) and Kisumu (mainly Kisumu and parts of the neighbouring vihiga and siaya districts). Nairobi urban has experienced a lot of agricultural activities recently and the potential for Agroforestry is seen in the prevalence of decentralized tree nurseries, which supply seedlings to various parts of the country (Basweti *et al.*,2001). The area was therefore seen as a good focus to study the market for tree seedlings. Kisumu was chosen to represent a rural area where Agroforestry research and development activities have been started and /or encouraged by the government and other research and development organizations. Furthermore, Statistics from the FD showed Nairobi to have a higher tree seedling output than Kisumu, thus Nairobi represented a surplus area due to its status as a major metropolitan, commercial and industrial Centre while Kisumu represented a deficit area due to its proximity to farming areas like the sugar belt and the extensive Kano irrigation scheme.

Figure 2. Map of study area. **Source:** www.pnm.my/mtcp/images/maps/Kenya-map.jpg

3.1.1 Kisumu

Kisumu City is bordered by Lake Victoria to the southwest, the sugar belt and the extensive Kano irrigation scheme to the east. At over 1100 mm above sea level the city falls within the humid climate (LM3) agro ecological zone. Kisumu has a mean annual rainfall of 1280 mm. The lowland area forms a trough of low rainfall of between 1000mm and 1800 mm and has bimodal pattern; a long rain season, between March and June and short rains between October and November. The Short rains range between 450mm and 600mm. low Rainfall reliability and long distribution has made the cultivation of second crops difficult. Mean annual temperature range is 20^{o}-30^{o} C and mean humidity of 70 (Kisumu District Development Plan 1997-2001). Kisumu has a population of approximately 345,312 people with a population density of 828 persons/km^2 and a growth rate of 2.8 % p.a. (1999 Kenya Population and National Housing census, 2001). The city covers area ca 417km^2 comprising of 297 km^2 of dry land and 120 km^2 under water. Kisumu is the third largest city in Kenya and has the triple role of being the headquarters of the city of Kisumu, Kisumu district as well as Nyanza province. Kisumu has a 30% unemployment rate with 52% engaged in the informal sector. The average monthly gross income is in the range of Ksh. 3,000-4,000. The agricultural sector is dominated by small holdings ranging between 2.4 – 2.5 hectares. Main food crops are maize, beans, finger millet and sorghum with cash crops such as rice, sugarcane, cotton, coffee and fishing. Livestock production in the district includes the rearing of dairy animals, poultry, bees, sheep, goats and pigs. However due to lack of market and dilapidated infrastructure, frequent droughts alternating with severe floods and poorly drained intractable soils of the flat plains, no sufficient income is realized from these activities.

Possible contribution of planting of trees in alleviating these problem means there is potential for tree seedlings trade if farmers are encouraged to plant trees. The district has no forests or extensive woodlands except bush and shrubs which occupy 20 % of the land area. There are many tree species notably *Acacia sevyal* and *cassia* species with *eucalyptus* species woodlots on the Kisumu border with Vihiga district indicating a spill over from Kakamega. Constraints include: Poor and inadequate infrastructural facilities; Inadequate and poorly developed raw materials for industrialization; Poor marketing system characterised by lack of information on goods locally produced and the marketing skills in the district are yet to be developed.

Agricultural credit facility is still not conveniently available to farmers especially for small scale jua kali operators. Under developed human resources due to lack of adequate training opportunities, malaria menace and the Aids pandemic have had devastating effects on the size of the labour force between the 15-59 age group. This has affected the educated and trained segments of the labour force thus reducing the capacity of the district to cope with challenges of industrialization. With a 43 % implementation rate for the whole district for projects there is potential for increasing this value while helping the district achieve its development objectives through research on tree nursery development.

3.1.2 Nairobi

Nairobi is the capital city and a major metropolitan, commercial and industrial Centre of Kenya with an area of 696.1 Km^2. It is located at an altitude of 1500m above sea level with a bimodal pattern; with short rains between September and November and long rains between March and April. The average rainfall is about 1000mm and the mean daily temperature range is 13^o-25^oC (FONA, 2001). Nairobi has a population of ca 3 million and a growth rate of 4.8 % (1999 Kenya national population and housing census). Economic pressure due to downward trend economic growth has caused a major shift of people from the rural areas and other towns to Nairobi to look for work. The divisions in districts that border the city have a peri urban setting with great city influence in product markets and seedling trade is a viable enterprise (Basweti *et al.*, 2001). Tree planting is a viable practice with many farmers establishing fruit, timber and ornamental species and accessing tree seedlings from peri urban nurseries. Search for employment or a way to earn a living has also contributed to increase in the number of tree nurseries being established (Basweti *et al.*, 2001).

3.2 Sampling Procedures

The sampling unit was a tree nursery (central, group and individual nurseries) and organizations involved in tree nursery development process.

From a list of tree nurseries provided by ICRAF and FD, stratified random sampling procedure was used to select a total of 60 nurseries (30 from each district), that were either linked or not linked to organizations involved in tree nursery development process. The tree nurseries were stratified into three groups (central, group and individual). Random samples

were then taken in each stratum. The study focused on the organizational aspects of these nurseries while targeting the tree seedlings section.

From a list of organizations involved in environmental issues from the NGO Co-ordination Board, a total of nine organizations based in Nairobi and Kisumu were purposely selected for this study due to their active involvement in the tree nursery development process in Kenya. The organizations selected were, Tree Biotechnology project, Forestry Department, Greenbelt Movement, National Environment Management Authority (NEMA), Total Kenya Limited, ICRAF, KEFRI, VI Agro forestry and Africa Now.

3.3 Data collection procedures

The following research instruments were administered to collect both primary and secondary data:

3.3.1 Nursery operator's survey:

Formal personal interviews using structured questionnaires were administered to nursery operators. Focus was on tree seedling production and marketing strategies and the resultant performance of the tree nursery enterprises (see Appendix 1). Thirty nursery operators were interviewed in each district making a total of sixty respondents for the survey.

3.3.2 Organizations survey:

Formal interviews were conducted in which a questionnaire was administered to organizations involved in the development process. The survey aimed at capturing information on missions, objectives and strategies used in the provision of support in the tree nursery development process (see Appendix 2). A total of nine organizations from the two districts were interviewed making a total of nine respondents for the survey. Additional secondary data was also acquired from the organizations.

3.4 Data Analysis

SPSS for windows and Biodiversity Analysis Package were used in the data analysis and the following procedure was followed. The reliability of the sample data collected was tested using the Data reliability coefficient (Daniel et. al, 1975).

3.4.1 Objective One: The Herfindahl index was used to determine the structure of the industry. It utilized market shares to determine the extent of market concentration. The Herfindahl index is a measure of dispersion that can vary between zero and one. Herfindahl index gives the sum of squares of the relative sizes of the firms in the market. Where these relative sizes are expressed as a percentage of the total size of the market (Koch, 1980). The following relation expresses this index.

$$H = \sum_{i=1}^{n} s_i^2 \qquad (9)$$

Where: H is the herfindahl Index

S_i is the market share of the ith firm (tree nursery)

n is the number of firms (tree nurseries)

When a large number of firms of equal sizes exist, thus suggesting the existence of competition, the Herfindahl index approaches a value of zero. When only one firm exists the index assumes a value of one, indicating monopoly in the market.

3.4.2 Objective two: Descriptive analysis, cross tabulations and Pearson's correlation analysis at 5 % level of significance were done for the structure, conduct and performance. As for species diversity which had two facets: **richness** or the number of species, and **evenness** or **equality** in the abundances of each tree specie. Thus A community that had more species would have a greater diversity index than a community of similar evenness with fewer species. While a community with greater evenness would also have a larger diversity index than a community of the same richness with lower evenness (Biodiversity, 2003). Since diversity entailed both richness and evenness, it was possible that one community would be richer, whereas the other community would be more even.

Shannon index was calculated from the proportional abundances p_i of each species (abundance of the species / total abundances, noted here as $p_i = n_i / N$) (Biodiversity, 2003).

$$H = -\sum_{i=1}^{S} p_i \ln(p_i) \qquad (10)$$

For fixed species richness, the most even distribution would be where each species had the same abundance, and thus a proportional abundance of 1/S. The maximum value of H for fixed species richness was therefore ln(S). Comparing the obtained H with the maximum possible H for the same species richness could be used as an expression of the evenness of the community as:

$$J = \frac{H}{\ln(S)} \qquad (11)$$

An alternative evenness measure derived from the Shannon index using the same philosophy was:

$$E = \frac{\exp(H)}{S} \qquad (12)$$

Taking the logarithms of evenness measure E would demonstrate that the Shannon index could be decomposed into an expression of richness and evenness as:

$$H = \ln(S) + \ln(E)$$

The above formula also showed that a larger Shannon index for one community did not necessarily mean that *both* richness and evenness were larger for this community - it was for instance possible that the Shannon index was larger because of a substantially greater richness only (Biodiversity, 2003).

3.4.3 Objective three: The performance of both centralized and decentralized tree nurseries was captured by a linear regression model. The dependent variable was seedling market efficiency since it is a function of all the other performance variables.

Me =f (MC, MS, SSc, DDc) **(7)**

Linear regression model.

$$Me = \Sigma\gamma_i C_{j+}\eta \quad \textbf{(13)}$$

Where **Me** is the performance measure (market efficiency), (η) is unobservable stochastic factor. (γ_i) are parameters for the explanatory variables ($C_{j,}$) respectively. We assume that, (η) is normally distributed across observations, normalized with mean zero and standard deviation one. This should provide us with factors that influence performance of tree nurseries.

Since the study was to utilize samples from Nairobi and Kisumu, the **Chow Test** was used to test the equality between coefficients of the linear regression models presented above (Koutsoyiannis, 1977).

3.4.4 Objective four: Ordered probit model was used for entrepreneur's choice of market entry level.

$$\mathbf{y_i^*} = \beta_0 + \beta_1 X_i + \varepsilon_i \quad \textbf{(14)}$$

Where $\mathbf{y_i^*}$ is the unobserved latent and continuous measure of the importance of the dependent variable to response n, $\boldsymbol{\beta}$ Is a vector of parameters to be estimated along with υ_i s. $\mathbf{X_i}$ is a vector of variables from correlation analysis of variables from the SCP model.

The probability associated with the responses coded as = k of the probit model is as follows:

$$P_n\ (y_n = k) = P(\beta' x) \quad \textbf{(15)}$$

Where k is a response alternative, $P_n\ (y = k)$ is the probability of outcome k in n observations. The marginal effects of independent variables $\mathbf{X_i}$, on the dependent variable y, are obtained by finding the derivative of the probability function,

$$\Pr ob(y_n = k) = P(\beta' x) \quad \textbf{(16)}$$

$$\frac{\delta E[y|x]}{\delta x} = \phi(\beta' x)\beta \text{ Where } E[y|x] = P(\beta' x) \quad \textbf{(17)}$$

The general likelihood function for the ordered probit model is given as:

$$L = \prod_{n=1}^{n}[P_n(1)]^{\delta_{1n}}[P_n(2)]^{\delta_{2n}}\cdots[P_n(y)]^{\delta_{kn}} = \prod_{n=1}^{n}\prod_{k=0}^{k}[P_n(y)]^{\delta_{kn}} \quad \textbf{(18)}$$

Where n is an individual (1….n),

Y is an alternative (0…. k),

$P_n(y)$ is the probability that an individual n chooses an alternative y δ_{yn} =1 if an individual chooses an alternative and δ_{yn} =0, otherwise.

Given that $\Pr ob_n(y_n = k) = P(\beta' x)$, maximizing the log-likelihood function with respect to β gives the maximum likelihood estimates of the parameters.

Based on the above procedure what will be observed is

y =0 if **y*** <= 0

y =1 if 0< **y*** <= υ_1

y =2 if υ_1 < **y*** <= υ_2

The dependent variable can take the value below (y_1=Decentralized approach, y_2=Centralized Approach), υ_i s are boundary values or threshold values defining the ranges of utility index within which an entrepreneur is likely to choose a particular approach.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

Presentation and interpretation of research findings

The research findings on the organizational component are presented and interpreted in sections 4.1 to 4.3 below. The support component is considered in section 4.4. Section 4.5 looks at the tree seedlings market efficiency. The effect of structure and conduct of participants on the performance of the tree nurseries is considered in Section 4.6. While section 4.7 examines the effect of structure, conduct of participants and performance of tree nurseries on an entrepreneur's choice of market entry level. Lastly, section 4.8 presents views of nursery operators on what should be done to create a more conducive economic environment for them.

4.1 Back ground of respondents

4.1.1 Gender proportions of the respondents

The survey revealed that while men operated majority (85%) of decentralized nurseries and managed all (100%) of the central nurseries, women operated only 15% of the decentralized nurseries in Nairobi and Kisumu respectively. Thus 87% of all nurseries in Nairobi and Kisumu were operated by men with women operating only 13% of these tree nurseries (Table 1). The higher proportion of men involved in tree nursery business in Kisumu and Nairobi could be due to the underlying effects of a tree planting culture where tree planting and nursery establishment activities in both rural and urban areas were initially associated with the male gender (Muriuki, 2005).

Table 1: Gender proportions for nursery operators in Nairobi and Kisumu.

	Nairobi			Kisumu		
Gender	Dec	Cent	Total (%)	Dec	Cent	Total (%)
Male	22(85)	4(100)	26(87)	23(85)	3(100)	26(87)
Female	4(15)	0	4(13)	4(15)	0	4(13)
Total	26(100)	4(100)	30(100)	27(100)	3(100)	30(100)

Dec=decentralized ,cent=centralized **Source: Tree nursery survey 2004**

4.1.2 Respondents age groups

The survey revealed that in Nairobi fifty percent (50%) of the decentralized nursery operators and all (100%) the centralized nursery managers were aged between 30-50 years. Thirty five percent (35%) of these decentralized nursery operators were aged less than thirty years with only fifteen percent (15%) aged over fifty years. In Kisumu 52% of the decentralized nursery operators and 67% of centralized nursery managers were aged between 30-50 years with only 11% of the decentralized nursery operators aged less than 30 years. Furthermore 37% of decentralized nursery operators and 33% of central nursery managers were aged over 50 years. All in all only 30% of nursery operators in Nairobi and 10% in Kisumu were aged less than 30 years , with majority (57%) in Nairobi and 53% in Kisumu aged between 30-50 years and 13% in Nairobi and 37% in Kisumu in the 0ver 50 years age group(Table 2).

Table 2: Age categories for nursery operators in Nairobi and Kisumu.

Region		Nairobi			Kisumu	
Age category	Dec	Cent	Total (%)	Dec	Cent	Total (%)
<30 years	9(35)	0	9(30)	3(11)	0	3(10)
30-50 years	13(50)	4(100)	17(57)	14(52)	2(67)	16(53)
>50 years	4(15)	0	4(13)	10(37)	1(33)	11(37)
Total	26(100)	4(100)	30(100)	27(100)	3(100)	30(100)

Note: Dec-decentralized approach; cent-centralized approach.

Source: Tree nursery survey 2004

4.1.3 Education levels of the respondents

Forty six percent (46%) of decentralized nursery operators and 25% of centralized nursery managers in Nairobi had attained primary school education while 42% and 25% had attained secondary education at the decentralized and centralized level respectively. Fifty percent of centralized nursery managers and only 12% of decentralized nursery operators had attained college or university education. In Kisumu 41% of decentralized nursery operators and 33% of centralized nursery managers had attained primary school education with 44% of the decentralized nursery operators and none of the centralized managers having attained secondary school education. Majority (67%) of centralized nursery managers and only 15%

of decentralized nursery operators had attained college or university education. All in all it was observed that majority (80%) of nursery operator had either primary or secondary education with rest (20%) having college or university education (Table 3).

Table 3: Education levels for nursery operators in Nairobi and Kisumu

Region	Nairobi			Kisumu		
Education Level	Dec	Cent	Total	Dec	Cent	Total
Primary	12(46)	1(25)	13(43)	11(41)	1(33)	12(40)
Secondary	11(42)	1(25)	12(40)	12(44)	0	12(40)
Tertiary	3(12)	2(50)	5(17)	4(15)	2(67)	6(20)
Total	26(100)	4(100)	30(100)	27(100)	3(100)	30(100)

Dec=decentralized ,Cent =centralized **Source: Tree nursery survey 2004**

4.1.4 Proportion of tree nurseries under the centralized and decentralized approaches.

The study revealed that eighty seven percent (87%) of tree nurseries in Nairobi and 83% of those in Kisumu were individual nurseries. Nairobi had no group nurseries while Kisumu had 7% of nurseries as group nurseries. The rest (13% in Nairobi and 10% in Kisumu) were central nurseries (Table 4). Consequently the tree seedlings market was dominated by the decentralized approach (individual and group nurseries) (88%) compared to the centralized approach (central nurseries) (12%). This distribution could be attributed to the high demographic pressure in Kenya which has resulted in restricted access to land and water during the dry season thus favouring the establishment of decentralized approaches. Similar trends have been observed in other countries in Africa like Tanzania and Zambia (Bohringer, 2002).

4.1.5 Respondents reason for choosing either decentralized or centralized approach.

Majority of nursery operators gave reasons for choosing their nursery management approach as difficulty to work with groups (50% in Nairobi and 37% in Kisumu), removal of license barriers (7% in Nairobi), benefits of own initiative (17% in Nairobi and 30% in Kisumu) and lack of existing groups when the tree nursery was started (7% in Nairobi and 13% in Kisumu). This seemed to support the dominance of decentralized nurseries in the two zones. Other reasons like the nursery were either a government or private nursery (20% in Nairobi and 7% in Kisumu) would explain the small number of centralized nurseries observed in two zones. While other reasons advanced such as spread of risks and limited space accounted for the presence of group nurseries only in Kisumu (Table 4). This linkage between the distribution of nurseries observed in the two zones and the reasons advanced by nursery operators for choosing a particular approach underlines the importance of an individual's perception of a particular approach and its affect on his decision to invest in either. These results were consistent with those of Bohringer (2002) who highlighted the relationship between nursery type, intergroup dynamics and the organization of tree nurseries in the Southern African countries. This also confirmed that intergroup dynamics of the different nursery types do affect the organization aspects of the market.

Table 4: Proportion and nursery operators reason for choosing the decentralized or centralized approach.

Approach	Nursery type	Nairobi	Kisumu	Total
Decentralized	Individual	26(87)	25(83)	51(85)
	Group	0	2(7)	2(3)
Centralized	Central	4(13)	3(10)	7(12)
Reason for choosing approach	Group hard to work with	15(50)	11(37)	26(43)
	Removal of license barriers	2(7)	0	2(3)
	Benefits of own initiative	5(17)	9(30)	14(23)
	No groups were existing when the nursery was started	2(7)	4(13)	6(10)
	Government nursery/private nursery	6(20)	2(7)	8(13)
	Spread risks	0	1(3)	1(2)
	Group registration problems	0	1(3)	1(2)
	Limited space	0	1(3)	1(2)
	None	0	1(3)	1(2)
	Total	30(100)	30(100)	60(100)

Source: Tree nursery survey 2004

4.2 Market structure in the tree seedlings market in Nairobi and Kisumu.

4.2.1 Seller concentration at the primary seller level (tree nursery level).

The survey revealed that tree nurseries in Nairobi produced almost twice the amount of tree seedlings produced by those in Kisumu (Table 5). However in Nairobi decentralized tree nurseries (87%)controlled only 14% of total tree seedling output compared to Kisumu where decentralized tree nurseries(90%) controlled 95% of total tree seedlings output. Centralized nurseries (13%) in Nairobi controlled the remaining 86% of total tree seedling output while in Kisumu centralized tree nurseries (10%) controlled only 5% of total tree seedling output (Table 5). These results showed that although decentralized nurseries constituted a large proportion of tree nurseries in Nairobi control of the market was firmly in the hands of few centralized nurseries, in Kisumu the reverse was true as decentralized nurseries firmly controlled most of the output. These results were consistent with other marketing studies that have been done in Kenya and found the marketing systems to be in the hands of the private sector Ngigi (1988). Since tree nurseries in Nairobi produced almost twice the output of seedlings from Kisumu, operators in Nairobi seemed to be more efficient in production terms. If sustainable land use system was not dependent on nursery productivity but on transplanted seedlings, the high market power for central nurseries in Nairobi showed that their overall transplanting impact at the watershed level could be limited by their specialization in few species. However the reverse case was true for the Kisumu market where individual nurseries had high market power. This underlined the fact that a market organization in which central nurseries had high market power was likely to undermine gains in natural capital (biodiversity).

Table 5: Seller concentration at primary seller level in Nairobi and Kisumu.

Site		Nairobi			Kisumu	
Tree nursery approach	%	Total output seedlings pa	% of total	%	Total output seedlings pa	% of total
Decentralized	87	370,700	14	90	1,355,500	95
Centralized	13	2,332,000	86	10	66,000	5
Total	100.0	2,702,700	100	100	1,421,500	100

Source: Tree nursery survey 2004

4.2.2 Product differentiation in the tree seedlings market

The survey revealed that ninety six percent (96%) of decentralized nurseries and all (100%) centralized nurseries in Nairobi offered the transplanting size (15-45cm) of seedling at Ksh.24 and Ksh 7 respectively. The medium size (46-90cm) was offered at Ksh 96 by all decentralized nurseries (100%) and none of the centralized nurseries with only 54% of decentralized nurseries offering landscaping size (over 90cm) at Ksh 472. In Kisumu ninety three percent (93%) of decentralized nurseries and all (100%) centralized nurseries offered the transplanting size (15-45cm) at Ksh 11 and Ksh 9 respectively. The medium size (46-90cm) was offered by sixty seven percent (67%) of decentralized nurseries at Ksh 33 and thirty three percent (33%) of centralized nurseries at Ksh 12 with only 41% of decentralized nurseries offering the landscaping size (over 90cm) at Ksh 68. On average 97% of all nurseries in Nairobi offered transplanting size (15-45cm) seedling at Ksh 22 compared to 93% of all nurseries in Kisumu offering the same at Ksh 10. Eighty seven percent of all nurseries in Nairobi offered the medium size (46-90cm) at Ksh 83 compared to seventy percent (70%) in Kisumu offering the same size of seedling at Ksh 31.Forty seven percent (47%) of all nurseries in Nairobi offered the landscaping size (over 90cm) at Ksh 409 compared to 37% in Kisumu offering the same size at Ksh 61 (Table 6). Further analysis showed that prices for transplanting and medium sized seedlings varied significantly between approaches and districts (P<.01) while price variations for landscaping seedlings were insignificant (Appendix 7).

Table 6: Tree seedling size specialization matrix and price differentials

Region	Nairobi (N=30)					Kisumu (N=30)				
Tree Seedling Size (cm)	Dec	Price	Cent	Price	Total **(pavg)**	Dec	Price	Cent	Price	Total **(pavg)**
15-45cm	25(96)	24	4(100)	7	97**(22)**	25(93)	11	3(100)	9	93**(10)**
46-90cm	26(100)	96	0	0	87**(83)**	20(67)	33	1(33)	12	70**(31)**
Over 90cm	14(54)	472	0	0	47**(409)**	11(41)	68	0	0	37**(61)**

Dec=decentralized ,cent=centralized, pavg =average price **Source: Tree nursery survey 2004**

The results thus indicated that tree seedlings were more expensive in Nairobi than in Kisumu. The above observations could be attributed to either high costs of production in Nairobi than

in Kisumu or more demand for landscaping services among the higher income people in Nairobi. These price differentials could also help to explain the differences in market power observed. The high market power for centralized nurseries in Nairobi had contributed to their low prices resulting from economies of scale. This could be attributed to the fact that the high level competition had increased customer sensitivity to quality and prices, thus any nursery operator/manager offering the best quality of seedling at the lowest prices won the day. In addition it was also observed that decentralized nursery operators had different prices for different tree species a fact that further disadvantaged them against central nurseries that had uniform prices for all species. Further analysis presented (see Appendix 7) also showed that while prices for both transplanting and medium sized seedlings were likely to be competitive, prices for landscaping size of seedlings were not. Thus opening up opportunities for collusion in price setting since few nursery operators specialized in this size of seedlings.

4.2.3 Constraints / Barriers to enter the tree nursery business

The nature of constraints that nursery operators in the two zones faced touched on three areas: namely production, management and security.

In Nairobi 23% of decentralized nurseries and 25% of centralized nurseries in Nairobi were affected by production constraints like the sourcing of soil, manure and seeds compared to only 48% of decentralized nurseries in Kisumu facing the same constraint. While 19% of decentralized nurseries and 33% of centralized nurseries in Kisumu were affected by other production constraints like lack of polytubes and other implements, in Nairobi only 25% centralized nurseries were affected by the same constraints. Management constraints like pest and disease control affected only 31% of decentralized nurseries in Nairobi compared to 19% of decentralized nurseries and 33% of centralized nurseries. Other management constraints like lack of enough funds affected 15% of decentralized nurseries and 25% of centralized nurseries in Nairobi compared to 11% of decentralized nurseries and 33% of centralized nurseries in Kisumu. Security constraints like vandalism and theft by rivals affected only 4% of decentralized nurseries in Nairobi. However a significant number (27%) of decentralized nursery operators and (25%) of centralized nursery mangers in Nairobi and 4% of decentralized nursery operators in Kisumu reported that they had no constraints.

All in all production constraints like the sourcing of soil, manure and seeds affected (23%) of nurseries in Nairobi and 43% of nurseries in Kisumu. Other production constraints like lack of polytubes and other implements affected only 3% of nurseries in Nairobi and 20% of nurseries in Kisumu (Table 7). Management constraints like pest and disease control affected 27% of nurseries in Nairobi and 20% of nurseries in Kisumu. Other management constraints like and lack of enough funding affected 17% of nurseries in Nairobi and 13% of nurseries in Kisumu. Security issues like incidents of theft and vandalism by rivals affected only 3% of nurseries in Nairobi. The rest of nursery operators (27% in Nairobi and 3% in Kisumu) had no constraints (Table 7). In addition the lack of access to capital by majority of operator's shows that access to capital is a major barrier to entry in the tree nursery business (See **section 4.3.8.4**).

Table 7: Tree seedling production constraints faced by nursery operators in Nairobi and Kisumu

Region		Nairobi			Kisumu		
Aspects	Constraints	Dec	Cent	Total	Dec	Cent	Total
Production	Sourcing for soil, manure and seeds	6(23)	1(25)	7(23)	13(48)	0	13(43)
	Lack of poly tubes and other implements	0	1(25)	1(3)	5(19)	1(33)	6(20)
Management	Pest and disease control	8(31)	0	8(27)	5(19)	1(33)	6(20)
	Lack of enough funding	4(15)	1(25)	5(17)	3(11)	1(33)	4(13)
Security	Vandalism and theft by rivals	1(4)	0	1(3)	0	0	0
	None	7(27)	1(25)	8(27)	1(4)	0	1(3)
	Total	26(100)	4(100)	30(100)	27(100)	3(100)	30(100)

Dec=decentralized ,cent=centralized **Source: Tree nursery survey 2004**

These constraints were similar to those highlighted by other studies which pointed to their persistence. A closer observation of the two zones showed differences with regard to need for both soft and hard support. The fact that more operators in Nairobi required support in pest and disease control more than any thing else showed the importance of soft support to this area. The small percentage requiring hard support underlined the fact that the market was developing and there was an attempt to be sustainable. The different picture observed in Kisumu highlighted the young development stage of the market, hence the need for both hard and soft support. This was strongly supported by the observation that more operators in

Nairobi had no problems compared to Kisumu. Thus organizations had to be sensitive to these issues in order to develop appropriate support mechanisms.

4.2.4 Identification of market structure in the tree seedlings market.

Market shares for the tree seedlings market in Nairobi and Kisumu were estimated based on amount of tree seedlings handled (produced) by each tree nursery as a percentage of total volume of tree seedlings produced. Use of the herfindahl index formulae (Equation 9) yielded an index of 0.56 for Nairobi and 0.28 for Kisumu. These results suggested the existence of oligopolistically competitive market structure in Nairobi and a monopolistically competitive market structure in Kisumu with tendencies towards perfect competition. Thus the tree seedlings market is characterised by a market structure in which several or many nursery operators each produce similar but slightly differentiated tree seedling species. Each nursery operator/ manager can set tree seedling prices and quantity without affecting the tree seedling market place as a whole. However the oligopolistic competitive structure in Nairobi can be attributed to central nurseries selling quality tree seedlings at low (subsidized) prices and the use of non price competition like product development and advertising to beat the competition. The greater efficiency in Kisumu also reflected the tree planting impact at the community and watershed levels with regard to species diversity and nursery type.

4.3 Conduct of tree seedling market participants in Nairobi and Kisumu

4.3.1 Pricing strategies in the tree seedlings market

All decentralized nursery operators and centralized nursery managers in Nairobi used cost plus pricing compared to only 29% of decentralized nursery operators in Kisumu. In Kisumu 44% of decentralized nursery operators and 33% of centralized nursery managers utilised demand based pricing while only 7% of decentralized nursery operators based their prices on competition. Market based pricing was utilised by 15% of decentralized nursery operators and 66% of centralized nursery managers in Kisumu with only 4% of decentralized nursery operators having no prices as the seedlings were exclusively for own use. All in all cost plus pricing was utilised by all nurseries in Nairobi and 27% of nurseries in Kisumu. Demand based pricing was utilised only in Kisumu by 43% of all nurseries with only 7% making use

of competitive pricing technique. Market based pricing was utilised by 20% of all nurseries in Kisumu with only 3% utilising none of the pricing techniques (Table 8). From the above results it can be seen that there is a positive linkage between the pricing technique and the intended use for tree seedlings produced in the tree nurseries.

Table 8: Nursery operator's basis for pricing tree seedlings in Nairobi and Kisumu

Region	Nairobi		Kisumu		
Basis	Decentralized	Centralized	Decentralized	Centralized	Total
Cost plus	26(100)	4(100)	8(29)	0	8(27)
Demand	0	0	12(44)	1(33)	13(43)
Competition	0	0	2(7)	0	2(7)
Market	0	0	4(15)	2(66)	6(20)
Not for sale	0	0	1(4)	0	1(3)
Total	26(100)	4(100)	27(100)	3(100)	30(100)

Source: Tree nursery survey 2004

Cost plus pricing was where the nursery operators considered all the costs incurred in production then added a mark up to set the price for seedlings thus the prices changed according to changes in production costs. In demand based pricing, nursery operators based their prices on the demand level for tree seedlings such that the species in high demand sold for higher prices than those in low demand. Market based pricing was where the nursery operators based their prices on what other operators were charging for the same size of seedling (collusion led to same prices). Competition based pricing was where nursery operators charged lower prices to beat the competition thus benefiting the consumer. This kind of competition did not allow nursery operators to make good profit margins from their sales and in many cases, loses were incurred. Muriuki and Carsan (2004), advocated for nursery operator associations to help overcome this problem among others. Seedlings indicated not for sale had been produced for nursery operator's own use and as such they had no prices attached.

4.3.2 Product strategies in the tree seedling market.

4.3.2.1 Species diversity in centralized and decentralized nurseries.

The survey revealed that 4% of decentralized nurseries and 25% of the centralized nurseries in Nairobi offered less than ten species compared to 33% of decentralized nurseries in Kisumu offering the same. Majority of decentralized nurseries (85% in Nairobi and 67% in Kisumu) offered between 10-30 tree species compared to centralized nurseries (25% in Nairobi and 100% in Kisumu) in the same category. Eleven percent (11%) of decentralized nurseries and 50% of centralized nurseries in Nairobi offered over 30 species with none of the tree nurseries in Kisumu offering tree species in the same category. All in all majority of tree nurseries in Nairobi (77%) and Kisumu (70) offered between 10-30 species with small proportion of tree seedlings (7% in Nairobi and 30% in Kisumu) offering less than 10 species. More importantly only 16% of all tree nurseries in Nairobi offered over 30 tree species with none in Kisumu offering the same (Table 9).

Biodiversity analysis results based on the total number of tree species in nurseries in the two zones (see Appendix 6) showed that there was no significant variation in species richness between and within the two approaches in Nairobi and Kisumu respectively. However there was significant variation in species richness of nurseries between the two study areas. Further analysis based on the dominant species in the nurseries (see Appendix 6) revealed that both Species richness and Shannon index did not differ significantly. Consequently it was concluded that the two zones basically had the same diversity as far as dominant species were concerned.

Table 9: Species diversity in tree seedlings market in Nairobi and Kisumu.

Region	Nairobi			Kisumu		
SPd	Decentralized	Centralized	Total	Decentralized	Centralized	Total
< 10 species	1(4)	1(25)	2(7)	9(33)	0	9(30)
10-30 species	22(85)	1(25)	23(77)	18(67)	3(100)	21(70)
>30 species	3(11)	2(50)	5(16)	0	0	0
Total	26(100)	4(100)	30(100)	27(100)	3(100)	30(100)

Source: Tree nursery survey 2004

The species diversity in the decentralized nurseries (individual and group nurseries) in Nairobi consisted mainly of *Prunus africana, Ficus benjamina, Filicium decipiens, Calistemon citrina, Spathodea campanulata, Casia spectabilis, Terminalia mantaly, Moringa oleifera, and Cuppressus lusitanica* while in Kisumu the decentralized nurseries had *Pirocansa, Dovyalis caffra, Candle nut, Delonix regia, Moringa oleifera and Warburgia ugandensis* (Table 10). On the other hand the species diversity in centralized nurseries in Nairobi consisted mostly of *Leucaena diversifolia, Spathodea nilotica, Teclea nobilis and Croton megalocarpus* while their counterparts in Kisumu *had Dovyalis caffra and Acrocarpus fraxinifolious* (Table 10). The species diversity consisted mostly of high value exotic species and could address various on farm requirements like food, fodder for livestock, apiculture, timber and fuel wood with a few indigenous and medicinal species.

Table 10: Dominant Tree species in decentralized and centralized nurseries in Nairobi and Kisumu

Nursery approach	Common name (botanical)	Mean	Max	Sum
Decentralized Nairobi	Meratina	39	1000	1000
	Mueri*(Prunus africana)*	90	2000	2330
	Australian pine *(Casuarina Cuninghamiana)*	31	500	800
	Evergreen (*Vicus benjamina)*	121	2000	3156
	Thika palm (*Filicium decipiens)*	191	2000	4955
	Bottle brush (*Calistemon citrina)*	310	4000	8060
	Nandi flame *(Spathodea campanulata)*	100	1000	2608
	Cassia (*Cassia spectabilis)*	270	6000	7010
	Java cedar (*Bischofia javanica)*	73	1000	1900
	Neem tree *(Azadirachta indica)*	50	500	1293
	Umbrella tree *(Terminalia mantaly)*	104	500	2710
	Moringa (*Moringa oleifera)*	58	1500	1500
	Alkaria	127	1500	3310
	cypress *(Cuppressus lusitanica)*	446	5000	11584
Centralized Nairobi	*Croton megalocarpus* (Musine)	250	1000	1150
	Leucaena diversifolia (Wild tamarind)	750	3000	3000
	Spathodea nilotica (Nandi flame)	1250	5000	5000
	Teclea nobilis (Small fruited teclea)	307.5	1000	1230
	Albizia brownei (Nongo)	280	1000	1120
	Capense	250	1000	1000
	Acacia xanthoploea (Naivasha thorn)	250	1000	1000
Decentralized Kisumu	Flamboyant (*Delonix regia)*	53	500	1591
	Mahogany (*Trichilia roka)*	30	500	884
	Mueri (*Prunus africana)*	7	100	221
	Moringa (*Moringa oleifera)*	155	4500	4645
	Pepper bark tree *Warburgia ugandensis*	69	1700	2070
Central nurseries Kisumu	*Acrocarpus fraxinifolious* (Cedar tree)	66.67	200	200
	Dovyalis caffra (Kei apple)	733.33	1200	2200

These tree species can be used for Food, fodder, apiculture, fuel wood, timber and medicinal

Source: Tree nursery survey 2004

Fruit tree seedlings found in decentralized tree nurseries in Nairobi and Kisumu.

The study found that only the decentralized nurseries (group and individual nurseries) had fruit tree seedlings in their tree nurseries. Among the fruit trees available in high quantities were *Mangifera indica* (grafted mangoes), *Passiflora edulis* (passion fruits), *Carica papaya* (pawpaw), *Persea Americana* (avocado), *Eriobotrya japonica* (loquat), *Psidium quajava* (guavas) and *Citrus sinensis* (oranges) (Figure 3). Due to the fact that the nurseries that had fruit trees had no registration certificates we could attribute the above observations to possibility that the promotion of fruit trees was not an objective of the sampled central nurseries. The government policy that prohibits local nurseries from sowing and selling fruit trees unless they are registered then has little effect in this case as other observations have shown central nurseries like KARI thika among others deal with fruit trees in their nurseries (Muriuki pers. comm.).

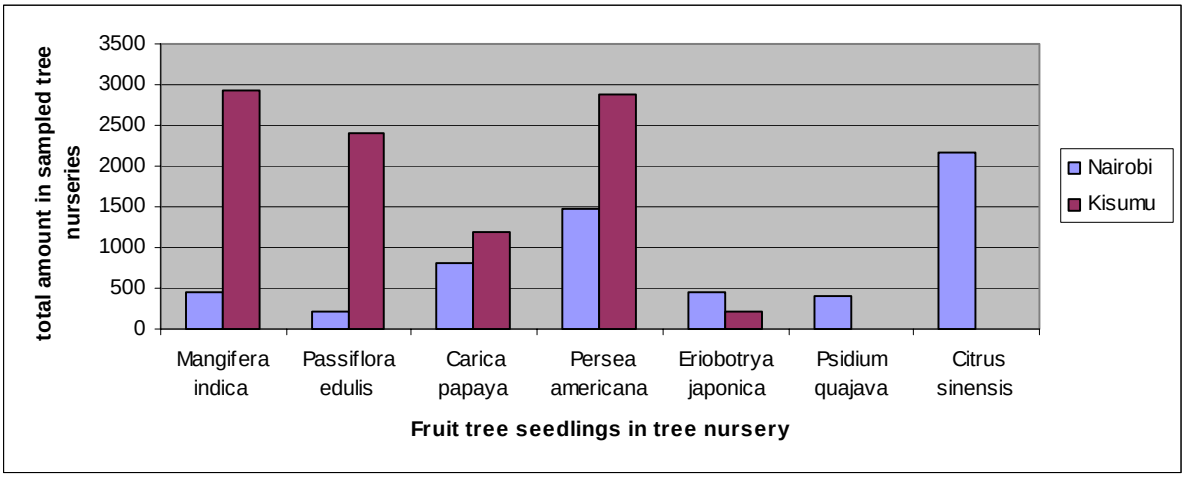


Figure 3: Fruit tree seedlings found in decentralized tree nurseries in Nairobi and Kisumu

Tree species found in all tree nurseries in Nairobi and Kisumu

All tree nurseries in Nairobi and Kisumu were found to have *Grevillea robusta, Eucalyptus saligna, Casuarina equisetifolia, Markhamia lutea* and *Cupressus lusitanica* available in high quantities (Table 11). While Species like *Podocarpus usambarensis, Schinus molle,* and *Vitex keniensis* were found in all nurseries only in Nairobi with species like C*alliandra calothyrsus, Maesopsis eminii, Leucaena diversifolia* and *Bischofia javanica* being found in all tree nurseries only in Kisumu (Table 11). All these species were multipurpose species

with wide range of uses like timber, medical, fuel wood, apiculture, fibre, essential oils, gum, poison, resins and tannins.

Table 11: Dominant tree species in all nurseries in Nairobi and Kisumu

Site		Nairobi					Kisumu				
	Species	Dec	%	Cent	%	Total	Dec	%	Cent	%	Total
Both Nairobi and Kisumu	*Grevillea robusta*	22471	36	40150	64	62621	24620	84	4800	16	29420
	Eucalyptus saligna	10240	1	2012000	99	2022240	23223	64	13400	36	36623
	Casuarina equisetifolia	9400	65	5000	35	14400	8792	67	4300	33	13092
	Markhamia lutea	3930	80	1010	20	4940	1017	42	1400	58	2417
	Cupressus lusitanica	2000	33	4000	67	6000	5460	37	9200	63	14660
	Podocarpus usambarensis	1145	48	1260	52	2405					
Nairobi only	*Schinus molle*	2300	28	6000	72	8300					
	Vitex keniensis	280	22	1000	78	1280					
	Dovyalis caffra	5100	15	30000	85	35100					
Kisumu only	*Calliandra calothyrsus*						3295	66	1800	34	5275
	Maesopsis eminii						85	36	150	64	235
	Bischofia javanica						4086	82	900	18	4986

Uses: Food, fodder, timber, fuel wood, apiculture, fibre, lipids, tannins, essential oils, poison, medical etc.

Source: Tree nursery survey 2004

Given that the species diversity was dominated by high value exotic species could indicative of effects of the tree planting culture that is prevalent in Kenya, where tree planting activities and nursery establishment are mainly associated with the male gender. Since other studies have highlighted linkages between gender and species preferences, this study's results are consistent with others in that earlier results in this study had established male dominance in tree nursery business and consequently the species diversity consisting of high value species. Hence the need for the development of tree nursery projects that can be attractive to women in the tree nursery business. Given that tree nurseries in Nairobi produced almost twice what their counterparts in Kisumu produced (see Table 5), the above results seemed to support the notion that the species diversity in the two zones was influenced more by species richness than evenness (abundance). In addition these results also seem to underline the effect of awareness campaigns by the support organizations where most of them actually emphasize on the planting of exotic species with very few advocating for indigenous species (**see section 4.4.6**).

4.3.3 Promotional activities

Majority (62%) of decentralized nurseries operators and none of centralized nursery managers in Nairobi relied on Location of nursery and signboards to promote their tree seedlings. Majority (50%) of central nursery managers and only 15% of decentralized nursery operators relied on sale of high quality seedlings in Nairobi. Only 8% of decentralized nursery operators and 25% of centralized nursery managers in Nairobi promoted their tree seedlings through announcements in chief's *barazas*, field days, shows, exhibitions and issue of free samples (Table 12). The creation of customer loyalty through good customer relations, longstanding reputation in growing seedlings and extension contracts was utilised by 25% of centralized nursery managers and 15% of decentralized nursery operators in Nairobi. Majority (48%) of decentralized nursery operators and 67% of centralized nursery managers in Kisumu promoted their tree seedlings through announcements in chief's *barazas*, field days, shows, exhibitions and issue of free samples. Only twenty two percent (22%) of decentralized nurseries operators and none of centralized nursery managers in Kisumu relied on Location of nursery and signboards to promote their tree seedlings. Interestingly only 8% of decentralized nursery operators relied on sale of high quality seedlings in Kisumu The creation of customer loyalty through good customer relations, longstanding reputation in growing seedlings and extension contracts was utilised by 33% of centralized nursery managers and 22% of decentralized nursery operators Kisumu.

All in all 53 % of nurseries in Nairobi and 20% in Kisumu relied on location of nursery and signboards to promote their tree seedlings. Sale of high quality seedlings was utilized by only 8% of all nurseries in Kisumu and 20% of those in Nairobi. While 50% of all nurseries in Kisumu utilised announcement in chief's *barazas*, field days, shows, exhibitions and issue of free samples as promotion strategy in Nairobi only 10% of all nurseries used the same strategy. The rest (17% in Nairobi and 23% in Kisumu) utilized the creation of customer loyalty through good customer relations, longstanding reputation in growing seedlings and extension contracts (Table 12). The above results highlighted the use non price competition like low cost advertising and product development (high quality seedlings) at the decentralized level with aggressive product development and advertising at the centralized level to counter the location disadvantages in the tree seedlings market.

Table 12: Nursery operator's promotional strategies in Nairobi and Kisumu

Region	Nairobi			Kisumu		
Promotional strategies	Dec	Cent	Total	Dec	Cent	Total
Location of nursery, signboards	16(62)	0	16(53)	6(22)	0	6(20)
Sale of high quality seedlings	4(15)	2(50)	6(20)	2(8)	0	2(7)
Announcement in chiefs barazas, field days, shows , exhibitions and issue of free samples	2(8)	1(25)	3(10)	13(48)	2(67)	15(50)
Good customer relations, longstanding reputation in growing seedlings and Extension contracts (Customer loyalty)	4(15)	1(25)	5(17)	6(22)	1(33)	7(23)
Total	26(100)	4(100)	30(100)	27(100)	3(100)	30(100)

Dec=decentralized ,cent=centralized **Source: Tree nursery survey 2004**

4.3.4 Vertical integration

This section looks at other activities that nursery operators are involved in other than tree seedlings.

4.3.4.1 Other services offered by nursery operators other than the sale of tree seedlings

The study found that seventy percent of nursery operators in Nairobi (70%) and Kisumu (77%) complimented the sale of seedlings with offering other services to maximize their sales and ensure customer satisfaction (Table 13). Majority of decentralized nursery operators in Nairobi (62%) and Kisumu (48%) offered landscaping services while 11% were involved in sale of ornaments, flower pots, manure, topsoil and pest control products in their nurseries with none of the centralized nurseries offering any of these services (Table 13). However majority of centralized nursery managers in Nairobi (50%) and Kisumu (67%) offered extension services with only 11% of decentralized nursery operators in Kisumu offering the same. In addition other services like sale of horticultural products, honey and vegetables were only offered by 8% of decentralized nursery operators in Kisumu. Interestingly a significant number of nursery operators offered no services other than the sale of tree seedlings although a higher proportion in Nairobi than Kisumu.

All in all majority of operators in Nairobi (53%) and Kisumu (43%) offered landscaping services while 10 % of operators in Nairobi and Kisumu were involved in the sale of ornaments, flower pots manure, topsoil, and pest control products. In Kisumu, extension

services were offered by 17% of nursery operators compared to 7% in Nairobi and a small number of nursery operators, honey, vegetables, fish and other horticultural products for sale. This showed the efforts put in by nursery operators in recognition of their customers diverse needs and therefore strategies to provide a competitive edge over other nurseries. The sale of vegetables, horticultural products and beekeeping also showed that nursery operators were quite innovative and could also come up with other small projects that could put into use the multipurpose nature of the kind of species they were raising on their farms. Thus nursery operators should be encouraged to explore other uses of these tree species for it would not only contribute to their welfare but also tree planting at the community or landscape level.

Table 13: Other services offered by nursery operators in Nairobi and Kisumu

Region	Nairobi			Kisumu		
Types of services	Dec	Cent	Total	Dec	Cent	Total
Sale of ornaments, flower pots manure, topsoil and pest control products	3(11)	0	3(10)	3(11)	0	3(10)
Landscaping services	16(62)	0	16(53)	13(48)	0	13(43)
Extension services	0	2(50)	2(7)	3(11)	2(67)	5(17)
None	7(27)	2(50)	9(30)	6(22)	1(33)	7(23)
Sale of horticultural products, honey and growing vegetables	0	0	0	2(8)	0	2(6)
Total	26(100)	4(100)	30(100)	27(100)	3(100)	30(100)

Dec=decentralized ,cent=centralized **Source: Tree nursery survey 2004**

4.3.5 Payment terms

The survey found that majority of operators in Nairobi (97%) and Kisumu (100%) preferred strictly cash for payment for tree seedlings with the rest of operators in Nairobi accepting both cash and credit cards as modes of payment (Table 14). Fifty three percent (53%) of nursery operators in Nairobi issued receipts for sale of seedlings compared to only 20% in Kisumu. Only 3% of operators in Kisumu offered discounts for customers who bought in large quantities. The preference for strictly cash terms may be indicative of the fact that majority of nursery operators were weary of financial risk posed by credit facilities since they did not have the mechanisms to deal with the administration of credit cards. This limited them to serving customers who offered cash only and greatly left them at a disadvantage with those customers who would have wished to purchase seedlings using their credit cards.

Table 14: Incentives, terms of payment and performance for nursery operators in Nairobi and Kisumu.

Region		Nairobi	Kisumu
Other incentives	Issuance of receipts	16(53)	6(20)
	Offering discounts	0	1(3)
Payment terms	Strictly cash terms	29(97)	30(100)
	Cash and credit cards accepted	1(3)	0
	Total	30(100)	30(100)

Source: Tree nursery survey 2004

4.3.6 Information flow in tree nursery management

Ninety seven percent (97%) of nursery operators' in Nairobi and Kisumu had previous experience in nursery management before establishing the tree nursery enterprises with only 3% being first timers. Majority of operators in Nairobi (97%) and all in Kisumu agreed that skills had an impact on nursery production. Consequently most (97%) operators in both regions said they had improved their skills in nursery production since engaging themselves in the activity. Majority (89%) of decentralized nursery operators in Nairobi and 48% in Kisumu indicated other nursery operators as their main source of nursery skills while their counterparts in centralized nurseries utilised information from extension officers exclusively. Consequently other nursery operators were a basic source of nursery skills for most of the nursery operators in Nairobi (77%) and Kisumu (43%). With the rest (23% in Nairobi and 57% in Kisumu) depending on forestry extension being offered by various organizations (Table 15).

Table 15: source of nursery skills for tree nurseries in Nairobi and Kisumu.

Region	Nairobi			Kisumu		
Source of Nursery Skills	Dec	Cent	Total	Dec	Cent	Total
Other nursery operators/manager	23(89)	0	23(77)	13(48)	0	13(43)
Forestry extension	3(11)	4(100)	7(23)	14(52)	3(100)	17(57)
Total	26(100)	4(100)	30(100)	27(100)	3(100)	30(100)

Dec=decentralized ,cent =centralized

Source: Tree nursery survey 2004

4.3.6.1 Training in nursery management services in the tree nursery

In looking at the flow of information the survey also tried to find out the willingness of nursery operators to share information with other operators through offering training in the

tree nursery management. Majority of nursery operators in Kisumu (73%) and Nairobi (53%) were already offering some training for different reasons (Table 16). Thirty nine percent of decentralized nursery operators in Nairobi offered training simply because it led to the establishment of other nurseries compared to 55% of decentralized nursery operators and 33% of centralized nursery managers in Kisumu for the same reason. While 50% of centralized nursery managers and only 15% of decentralized nursery operators in Nairobi offered training due to their willingness to share information, in Kisumu only 19% of the decentralized nursery operators and 33% of centralized managers felt the same. However a significant number of decentralized nursery operators (46% in Nairobi and 26% in Kisumu) and centralized managers (50% in Nairobi and 33% in Kisumu) had no reason for not offering training in nursery management.

All in all most of the tree nursery operators in Kisumu (53%) and Nairobi (33%) simply offered training because it led to the establishment of other nurseries. Twenty percent (20%) of them in both regions attributed this to their willingness to share information with others and a significant percentage of operators had no reason (47% in Nairobi and 27% in Kisumu) for not offering training. Many of these operators did not charge training fees as the trainees were part of the workforce.

Table 16: Reasons given by nursery operators/managers for training others

Region	Nairobi			Kisumu		
Reason for offering training	Dec	Cent	Total	Dec	Cent	Total
Apprenticeship led to the establishment of other nurseries	10(39)	0	10(33)	15(55)	1(33)	16(53)
Willingness to share information with others	4(15)	2(50)	6(20)	5(19)	1(33)	6(20)
None (not offering training)	12(46)	2(50)	14(47)	7(26)	1(33)	8(27)
Total	26(100)	4(100)	30(100)	27(100)	3(100)	30(100)

Dec=decentralized, cent=centralized **Source: Tree nursery survey 2004**

4.3.7 Adaptation to risk and uncertainty in tree seedling production

Due to risk and uncertainty in tree seedling production this study looked at three aspects of tree nursery management that affect the allocation of resources in the tree nursery. These aspects were: The intended use of the tree seedlings produced; the nursery operator's perception of the demand level and finally the area allocated to the tree section in the nursery.

4.3.7.1 Nursery operator's intended use for tree seedlings produced

Ninety six percent of decentralized nurseries in Nairobi produced seedlings strictly for sale with the rest (4%) producing for own use but surplus for sale compared to the centralized nurseries (25%) producing seedlings in both categories. Majority of centralized nurseries (50%) and none of decentralized nurseries in Nairobi produced seedlings strictly for their own use. While all centralized nurseries (100%) in Kisumu produced seedlings for own use and sold the surplus, only 37% of decentralized nurseries produced seedlings for the same purpose. Majority (56%) of decentralized nurseries in Kisumu produced seedlings strictly for sale with only 7% producing seedlings strictly for own use.

Thus majority (87% in Nairobi and 50% in Kisumu) of tree nurseries produced tree seedlings strictly for sale. Forty three percent (43%) of tree nurseries in Kisumu and 7% in Nairobi produced tree seedlings for own use but sold the surplus with a small percentage of nurseries in Kisumu (7%) producing seedlings strictly for own use with the same percentage in Nairobi producing seedlings for other uses like public tree planting functions (Table17). The reason for production goes along way in determining how much to produce and hence the quantity of the nurseries resources allocated to the production tree seedlings. Furthermore if the tree seedlings were for sale, this would determine the strategies to be followed by the nursery operator to ensure that the tree seedlings reached the intended users (farmers). Thus a marketing orientation would be followed for those producing for commercial purposes while a production orientation would be useful for own users.

Table 17: Nursery operators' intended use of tree seedlings produced in Nairobi and Kisumu.

Region	Nairobi			Kisumu		
Intended use	Dec	Cent	Total	Dec	Cent	Total
Strictly for Sale	25 (96)	1(25)	26(87)	15(56)	0	15(50)
Own use but surplus for sale	1(4)	1(25)	2(7)	10(37)	3(100)	13(43)
Own use strictly (other uses)	0	2(50)	2(7)	2(7)	0	2(7)
Total	26(100)	4(100)	30(100)	27(100)	3(100)	30(100)

Dec=decentralized, Cent=centralized **Source: Tree nursery survey 2004**

4.3.7.2 Nursery operator's perception of the demand level for tree seedlings

The study found that twenty seven percent of decentralized nursery operators and 25% of centralized nursery managers in Nairobi perceived the demand for tee seedlings to be low compared to only 22% of decentralized nursery managers in Kisumu who felt the same. Majority of centralized nursery managers (50% in Nairobi and 60% in Kisumu) thought the demand for tree seedlings to be medium compared to decentralized nursery operators (58% in Nairobi and 30% in Kisumu) in the same class of thought. High demand for tree seedlings was perceived by (15% in Nairobi and 48% in Kisumu) of decentralized nursery operators and (25% in Nairobi and 33% in Kisumu) of centralized nursery managers. All in all fifty seven percent (57%) of nursery operators/managers in Nairobi thought the demand for tree seedlings was medium compared to 33% in Kisumu while 47% in Kisumu and 17% in Nairobi thought the demand for tree seedlings was high (Table 18). The rest (26% in Nairobi and 20% in Kisumu) thought demand for tree seedlings was low.

Although the nursery operators seemed to agree on demand levels the quantity they had in mind differed. This perception could be as a result of considering the intended use of the tree seedlings produced. If the tree seedlings were intended for own use or for sale then the operators perceived demand would be a function of his needs or market needs respectively.

This would ultimately affect the nursery operator's decision on how much they put into the production process and therefore the quantity of tree seedlings available. If the tree seedlings were for sale then the operator had to be sensitive to the quality and quantity of seedlings produced by competitors (substitutes) otherwise s (he) would realize low sales volume. However production of tree seedlings for own needs may not dictate much sensitivity as it would be up to the operator to set his own quantity requirements and quality standards. The variations in quantities that refer to the same demand level just go to show the presence of informational asymmetries in the market. Thus it's up to the nursery operator to correctly read changes in the market environment and adjust accordingly. This therefore underlines the need for capacity building for nursery operators /managers and the dissemination of market information that is not only consistent but also representative of the current situation in the tree seedlings market (the species on offer).

Table 18: Nursery operator's perception on the demand level for tree seedlings in Nairobi and Kisumu.

Region		**Nairobi**			**Kisumu**	
Demand level	**Dec**	**Cent**	**Total**	**Dec**	**Cent**	**Total**
Low	7(27)	1(25)	8(27)	6(22)	0	6(20)
Medium	15(58)	2(50)	17(57)	8(30)	2(67)	10(33)
High	4(15)	1(25)	5(17)	13(48)	1(33)	14(47)
Total	26(100)	4(100)	30(100)	27(100)	3(100)	30(100)

Dec=decentralized, cent=centralized **Source: Tree nursery survey 2004**

4.3.7.3 Area under trees seedlings in the nursery

Tree nursery operators had the responsibility of deciding how much of the nurseries resources were allocated to tree seedlings production and alternative uses like ornamental plants production. The amount of resources allocated could be represented by how much of the total area of the tree nursery (irrespective of land size) was under tree seedlings.

The survey found that only Nairobi had decentralized nurseries (31%) and centralized nurseries (25%) with less than 50 % of the area under tree seedlings. Only decentralized

nurseries in Nairobi (62%) and Kisumu (48%) had between 50-80% of the area under tree seedlings. Majority of centralized nurseries in Nairobi (75%) and Kisumu (100%) had over 80% of the nursery under tree seedlings compared to decentralized nurseries in Kisumu (52%) and Nairobi (7%). All in all fifty three percent (53%) of tree nurseries in Nairobi had between 50-80% of the nursery under the tree seedlings compared to 43% in Kisumu. Fifty seven percent of tree nurseries in Kisumu had over 80% of the tree nursery under tree seedlings compared to 17% in Nairobi in the same category. Only Nairobi (30%) had tree nurseries having below 50% of the nursery under the tree seedlings (Table 19).

Table 19: Area under tree section tree nurseries in Nairobi and Kisumu

Region	Nairobi			Kisumu		
Area under tree section	Dec	Cent	Total	Dec	Cent	Total
<50% of nursery	8(31)	1(25)	9(30)	0	0	0
50%-80% of nursery	16(62)	0	16(53)	13(48)	0	13(43)
> 80% of nursery	2(7)	3(75)	5(17)	14(52)	3(100)	17(57)
Total	26(100)	4(100)	100	27(100)	3(100)	30(100)

Dec=decentralized ,cent=centralized **Source: Tree nursery survey 2004**

Since nursery operators were assumed to be rational producers, it was expected that the amount of resources allocated to tree seedlings production as indicated by the area under tree seedlings would be a function of both the intended use of the tree seedlings and the perceived demand for tree seedlings. Those nursery operators who considered tree seedling production to be risky were more likely to allocate little resources into tree seedling production as opposed to those who thought otherwise. Those with high areas under tree seedlings might be those who considered tree seedling production to be less risky, perceived high demand for tree seedlings and produced more seedlings. However this high level of production if accompanied by a laid back marketing approach would present marketing problems as there was no guarantee that all the stock would be cleared. Given fluctuating demand levels there was a likelihood of low performance for those having high quantities of tree seedlings.

4.3.8 Supply conditions

This section looks at the availability of factors of production like land, labour, capital, water, and production methods.

4.3.8.1 Land availability in the nursery

Land availability was found to affect the location of tree nurseries. All centralized nurseries in Nairobi and Kisumu were located on government trust land compared to 61% of decentralized nurseries in Nairobi and 30% in Kisumu. Thus sixty seven percent (67%) of all the tree nurseries in Nairobi were on government trust land compared to 37% in Kisumu while the rest were on private land. Land was available for all centralized nurseries and decentralized nurseries (67% in Kisumu and 23% in Nairobi). Consequently for many of the tree nurseries in Nairobi (67%) land was not available (77% decentralized). This was confirmed by the fact that majority (60%) of the nurseries in Nairobi (65% decentralized and 25% centralized) operated on a fixed portion of road reserve. In Kisumu the situation was opposite with majority (70%) having land available and consequently only 27% of nurseries (30% decentralized) operated on a fixed portion of road reserve and many of them (73%) still had scope for expansion (all centralized and 70% decentralized)(Table 20). Only 12% of decentralized nurseries in Nairobi had rented land on which the nurseries were located.

Majority (85%) of decentralized nurseries in Nairobi were located on roadsides, 11% in Backyards, 4% in open spaces and none on riverbanks compared to centralized nurseries which were all located on riverbanks. Centralized nurseries in Kisumu were mainly located on roadsides (67%) and open spaces (33%) while decentralized nurseries were mainly located on roadsides (48%) and Backyards (44%) with a small proportion (8%) in open spaces. All in all majority of nurseries in Nairobi (73%) and Kisumu (50%) were located on road reserves. While 40% of all nurseries in Kisumu were located in backyards in Nairobi only 10% of nurseries were in backyard. Ten percent of all nurseries in Nairobi and Kisumu (8%) were in open spaces with only 14% of nurseries in Nairobi on riverbanks.

Different reasons were advanced by nursery operators for their respective site choices.

Unsuitability of the land for maize farming accounted for the location of most of central nurseries (50%) in Nairobi with the rest being accounted for by access to water (25%) and training purpose (25%).Access to the market was a major determinant for the location of most of the decentralized nurseries in Nairobi (54%) with the rest being accounted for by access to water (23%), security (12%) and a small proportion by unsuitability of the land for maize farming (4%) and allocation by municipal council (8%). In Kisumu access to water was a major determinant for the location of centralized nurseries with the rest being

accounted for by training purpose. Similarly access to the market was a major determinant for decentralized nurseries in Kisumu (30%) with the rest being accounted for by security(26%),access to water (15%),unsuitability of land for maize farming(7%), allocation by municipal council (7%), availability of soil (4%), competition (7%) and site chosen by colonialists. All in all access to the market was found to be a dominant factor in site selection for nurseries in Nairobi (47%) and Kisumu (27%). Access to water was second most dominant factor with 23% in Nairobi compared to 20% in Kisumu. Security purpose was a significant factor in Kisumu (23%) and Nairobi (10%) perhaps accounting for the presence of more nurseries in backyards in Kisumu than in Nairobi (Table 20).

Table 20: Land availability issues for tree nurseries in Nairobi and Kisumu.

Region		**Nairobi**			**Kisumu**		
Approach		**Dec**	**Cent**	**Total**	**Dec**	**Cent**	**Total**
Land tenure	Private land	10(39)	0	10(33)	19(70)	0	19(63)
	Govt land	16(61)	4(100)	20(67)	8(30)	3(100)	11(37)
Land availability	Yes	6(23)	4(100)	10(33)	18(67)	3(100)	21(70)
	No	20(77)	0	20(67)	9(33)	0	9(30)
Nursery site	Roadside	22(85)	0	22(73)	13(48)	2(67)	15(50)
	Backyard	3(11)	0	3(10)	12(44)	0	12(40)
	Open space	1(4)	0	1(3)	2(8)	1(33)	3(10)
	Riverbank	0	4(100)	4(14)	0	0	0
Land status	Fixed portion on road reserve.	17(65)	1(25)	18(60)	8(30)	0	8(27)
	Still scope for expansion	6(23)	3(75)	9(30)	19(70)	3(100)	22(73)
	Rented land	3(12)	0	3(10)	0	0	0
Reason for site	Security purposes	3(12)	0	3(10)	7(26)	0	7(23)
	Access to water	6(23)	1(25)	7(23)	4(15)	2(67)	6(20)
	Training purposes	0	1(25)	1(3)	0	1(33)	1(3)
	Access to the market	14(54)	0	14(47)	8(30)	0	8(27)
	Unsuitability of land for maize farming	1(4)	2(50)	3(10)	2(7)	0	2(7)
	Allocation by municipal council	2(8)	0	2(6)	2(7)	0	2(7)
	Availability of soil	0	0	0	1(4)	0	1(3)
	Less competition	0	0	0	2(7)	0	2(7)
	Site chosen by colonialists	0	0	0	1(4)	0	1(3)
	Total	26(100)	4(100)	30(100)	27	3(100)	30(100)

Dec=decentralized, cent=centralized **Source: Tree nursery survey 2004**

4.3.8.2 Labour aspects of nurseries

Labour was available for majority of decentralized nurseries (77% in Nairobi and 74% in Kisumu) and centralized nurseries (50% in Nairobi and 33% in Kisumu). Thus For most of operators in Nairobi (73%) and Kisumu (70%) labour was available. Ninety two percent of decentralized nurseries and 75% of centralized nurseries in Nairobi were found to employ less than 10 people compared to 96% of decentralized and all centralized nurseries in Kisumu. Thus majority of nurseries in Nairobi (90%) and Kisumu (97%) were found to be employing below ten people. Twenty five percent of centralized nurseries and 4% of decentralized nurseries only in Nairobi employed over 50 people. Consequently only Nairobi was found to have nurseries (7%) that employed over fifty people. A small proportion of decentralized nurseries (4%) in Nairobi and Kisumu employed between 10-50 people.

The composition of nursery workforce varied with a majority of the tree nurseries in Nairobi (63%) having a work force consisting of mainly workers (62% decentralized and 75% centralized) with 30% consisting of mainly family members (31% decentralized and 25% centralized). In Kisumu all centralized nurseries and 33% of decentralized nurseries had only workers with 44% of decentralized nurseries employing mainly family members. However Kisumu had a higher proportion of decentralized nurseries (23%) utilising both family members and workers than in Nairobi (7%).Thus in Kisumu labour was a bit balanced with 40% of tree nurseries having either employees or family members in the work force and only 20% had a combination of both family members and workers compared to 7% for Nairobi (Table 21).

Table 21: Labour aspects in tree nurseries in Nairobi and Kisumu

Region		Nairobi			Kisumu		
Case		Dec	Cent	Total	Dec	Cent	Total
Labour	Yes	20(77)	2(50)	22(73)	20(74)	1(33)	21(70)
availability	No	6(23)	2(50)	8(27)	7(26)	2(67)	9(30)
Compositi	Family	8(31)	1(25)	9(30)	12(44)	0	12(40)
on of work	Workers	16(62)	3(75)	19(63)	9(33)	3(100)	12(40)
force	Both	2(7)	0	2(7)	6(23)	0	6(20)
Number	< 10 people	24(92)	3(75)	27(90)	26(96)	3(100)	29(97)
of	10-50 people	1(4)	0	1(3)	1(4)	0	1(3)
workers	> 50 people	1(4)	1(25)	2(7)	0	0	0
	Total	26(100)	4(100)	30(100)	27(100)	3(100)	30(100)

Dec =decentralized, cent=centralized **Source: Tree nursery survey 2004**

4.3.8.3 Water availability and main sources of water.

The survey found that all centralized nurseries and decentralized nurseries in Nairobi and Kisumu (93%) had access to water. Thus all nurseries in Nairobi (100%) and most in Kisumu (93%) had access to water. Piped water was the main source of water for most of decentralized nurseries (54%) and centralized nurseries (50%) in Nairobi compared to only 42% of decentralized nurseries in Kisumu. All centralized nurseries in Kisumu relied on river water compared to 25% of centralized nurseries and 15% of decentralized nurseries in Nairobi. While twenty five percent of centralized nurseries and 23% of decentralized nurseries in Nairobi relied on borehole water, in Kisumu only 7% of decentralized nurseries relied on the same. Other sources like springs and rain water were utilised by only decentralized nurseries in Nairobi (8%) and Kisumu (7%). Consequently piped water was the main source of water for majority of nurseries in Nairobi (53%), and Kisumu (37%). Fifty percent (50%) of nurseries in Kisumu relied on river water compared to 17% in Nairobi. Boreholes provided the second major source of water for tree nurseries in Nairobi (23%), while in Kisumu only 7% relied on them (Table 22).

Table 22: The main source of water for tree nurseries in Nairobi and Kisumu

Region		Nairobi			Kisumu		
Water aspects		Dec	Cent	Total	Dec	Cent	Total
Access to water	Yes	26(100)	4(100)	26(100)	25(93)	3(100)	28(93)
	No	0	0		2(7)	0	2(7)
Main source of water	Piped water	14(54)	2(50)	16(53)	11(42)	0	11(37)
	River water	4(15)	1(25)	5(17)	12(44)	3(100)	15(50)
	Borehole	6(23)	1(25)	7(23)	2(7)	0	2(7)
	Other sources	2(8)	0	2(7)	2(7)	0	2(7)
	Total	26(100)	4(100)	30(100)	27(100)	3(100)	30(100)

Dec=decentralized ,cent=centralized **Source: Tree nursery survey 2004**

4.3.8.4 Capital availability and main source of capital

The study found that most of the decentralized nurseries (81% in Nairobi and 88% in Kisumu) and centralized nurseries (50% in Nairobi and 33% in Kisumu) had no access to bank credit. Thus majority of nursery operators in Nairobi (77%) and in Kisumu (73%) had no access to bank credit. Majority of decentralized nurseries (92% in Nairobi and all in Kisumu) relied on family savings as their main source of capital compared to all centralized

nurseries in Nairobi and Kisumu relying on credit from banks and other financial institutions. Interestingly only a small proportion of decentralized nurseries in Nairobi were able to utilise capital from banks and other financial institutions. Consequently family savings provided the main source of capital for 80% of tree nursery operators in Nairobi and 90% in Kisumu with the rest (20% Nairobi and 10% in Kisumu) of nursery operators having access to borrowed capital from banks and other financial institutions (Table 23). The low level of access to borrowed capital (credit) for majority of these nursery operators could be attributed to their unwillingness to risk the little they had not withstanding the lack of collateral and high interest rates associated with borrowed capital or credit. Although bank credit was the main source of capital for centralized nurseries it is important to note that a significant proportion did not have access to bank credit and this could be attributed to the high level of beaurocracy involved in accessing credit especially where government nurseries are concerned.

Table 23: Nursery operators/ managers' access to and main source of capital

Region		Nairobi			Kisumu		
Capital aspects		Dec	Cent	Total	Dec	Cent	Total
Access to K	Yes	5(19)	2(50)	7(23)	6(22)	2(67)	8(27)
	No	21(81)	2(50)	23(77)	21(88)	1(33)	22(73)
Main source of capital	Family savings	24(92)	0	24(80)	27(100)	0	27(90)
	Bank or other FIs	2(8)	4(100)	6(20)	0	3(100)	3(10)
	Total	26(100)	4(100)	30(100)	27(100)	3(100)	30(100)

Dec=decentralized, cent=centralized **Source: Tree nursery survey 2004**

4.3.8.5 Nursery production method

The study found that all the decentralized nursery operators and 75% of centralized nursery managers in Nairobi utilised polythene bags compared to 96% of decentralized nurseries and all centralized nurseries in Kisumu. Only 25% of centralized nursery managers in Nairobi utilised both polythene bags and Swaziland beds with only 4% of decentralized nursery in Kisumu operators using other methods. Consequently 97% of nurseries in Nairobi and Kisumu used polythene bags while the rest used a combination of polythene bags and Swaziland beds and in some cases plastic containers (Table 24).

Different reasons were given for the preference of poly tubes as a production method.

Majority of decentralized nursery operators (62% in Nairobi and 30% in Kisumu) and centralized nursery managers (25% in Nairobi and 33% in Kisumu) preferred poly tubes because they were easy to handle and transport seedlings in them. Only 8% of decentralized nursery operators in Nairobi attributed their preference to the durability of polythene bags.

The availability of polythene bags in variable sizes was also attractive to decentralized nursery operators (19% in Nairobi and 37% in Kisumu) and centralized nursery managers (25% in Nairobi and 33% in Kisumu). Twenty five percent of centralized nursery managers and 11% of decentralized nursery operators in Nairobi attributed their preference to the affordability of polythene bags compared to only 7% of decentralized nursery operators in Kisumu. Thirty four percent of centralized nursery managers and 26% of decentralized nursery operators in Kisumu attributed their preference to a combination of various factors like ease of handling and transportation, affordability, availability in variable sizes and better space utilization. Consequently majority of nursery operators in Nairobi (57%) and Kisumu (30%) attributed their preference to the fact that polythene bags were easy to handle and transport the seedlings. The availability of polythene bags in variable sizes has helped to reduce the disadvantages associated with distribution of seedlings and hence their increased attractiveness to nursery operators (20% in Nairobi and 36% in Kisumu). Twenty seven percent (27%) of operators in Kisumu preferred the polythene bags due to a combination of various reasons like ease of handling and transportation, affordability, availability in variable sizes and better space utilization (Table 24).

Table 24: Production methods used by nursery operators in Nairobi and Kisumu.

Region		Nairobi			Kisumu		
Approach		Dec	Cent	Total	Dec	Cent	Total
Production method	Polythene bags	26(100)	3(75)	29(97)	26(96)	3(100)	29(97)
	Both (Swaziland beds & polythene bags	0	1(25)	1(3)	0	0	0
	Other methods	0	0		1(4)	0	1(3)
Reason for preference	Easy to handle and transport	16(62)	1(25)	17(57)	8(30)	1(33)	9(30)
	Durable	2(8)	0	2(7)	0	0	0
	Available in variable sizes	5(19)	1(25)	6(20)	10(37)	1(33)	11(36)
	Affordable	3(11)	1(25)	4(13)	2(7)	0	2(7)
	All of the above	0	1(25)	1(3)	7(26)	1(34)	8(27)
	Total	26(100)	4(100)	30(100)	27(100)	3(100)	30(100)

Dec=decentralized ,cent=centralized **Source: Tree nursery survey 2004**

The dominance of containerized system (polythene bags) as opposed to bare-root system (Swaziland beds) could also be attributed to the land tenure system in which case most of the operators have no security of tenure thus they prefer polythene bags since the seedlings can be moved. Many councils also forbid digging up of soil or any other interference with the land on the road reserves where most of the urban nurseries are situated making bare-root production not a feasible option for them (Muriuki, pers comm.). In addition the high value tree species raised in these nurseries also favours the containerised system.

4.4 Support from organizations in the development process

The efficiency of support systems can be measured through their impact on food security, wealth creation and environmental conservation. This section traces the attempts by the support system in Kenya to address these three key areas through a close observation of the linkages between the respective missions, objectives and how they affect the provision of both hard and soft support in the tree nursery development process.

4.4.1 Mission for organizations involved in tree nursery development

The organizations involved in tree nursery development process, in recognition of the problems arising from agricultural activities like soil erosion, soil nutrient depletion, fuel wood and timber shortages have set out to help tackle these problems through the development process (Table 25). Their missions for involvement in the development process touched on three broad areas namely research and training, poverty alleviation and environmental conservation. Research and training encompassed areas concerning tree diseases, vegetative propagation, seed storage and acquisition and tree nursery management. Poverty alleviation involved encouraging the planting of fast growing eucalyptus species, integration of Agroforestry in smallholder farms, focusing on rural enterprises and the use of trees as an entry point for community mobilization. While environmental conservation involved the production and provision of environmentally friendly lubricants, co-ordination and supervision of various environmental management activities (Table 25). These missions had an affect on growth in natural, human and social capitals which have been shown to have

an impact on nursery productivity and Agroforestry practices (Bohringer, 2002). These observations showed an attempt by the support system to have a positive impact on food security, wealth creation and environment conservation, virtues highlighted by Bohringer (2002) as indicators of efficiency in the support system.

Table 25: Missions of organizations involved in the tree nursery development process in Kisumu and Nairobi

Mission	Organization
Research and training in : - Tree diseases -Vegetative propagation -Seed acquisition& storage -Tree nursery management.	KEFRI, T B P, ICRAF
Poverty alleviation through : -Planting of fast growing high calorific eucalyptus species -Focus on rural enterprises -Integration of Agroforestry in smallholders farms -Trees -entry point for community mobilization	VI, AFRIC N, T B P , G B M, KEFRI, ICRAF
Environmental conservation through: -Provision and production of quality lubricants & fuels that are environmental friendly. -Co-ordination and supervision the various environmental management activities -Provision of necessary extension & implementing arm of NEMA	TOTAL, F D, NEMA

Note: VI=VI AGROFORESTRY, AFRIC N=AFRICA NOW, TOTAL= TOTAL KENYA LTD, FD= FOREST DEPARTMENT, GBM= GREENBELT MOVEMENT, TBP=TREE BIOTECHNOLOGY PROJECT, NM=NEMA **Source: Tree nursery survey 2004**

4.4.2 Provision of hard and soft support.

Timely supply of inputs to nursery operators affects nursery operator's production decisions and consequently the quantity of tree seedlings available in the market. Organizations influence the availability of inputs through the provision of hard support (Table 26). All the sampled organizations including those who owned or supported nursery projects used their respective purchasing departments through annual budgets and estimates to ensure timely purchasing of inputs. Further more they insured the quality of their inputs though contracting, testing of supplies and use of well versed technical personnel. For organizations involved in supporting tree nurseries, hard support strategies included the setting up of Common Interest Groups within the tree nursery groups for proper input distribution (seeds and other inputs).

In order to reduce the dependency syndrome and ensure the sustainability of nursery projects, the organizations also encouraged and trained farmers to use local materials (local seeds & seed exchange). Even though organizations collaborated in the provision of hard support there were also cases where single agents provided hard support as was observed by Bohringer in the southern African countries.

The provision of soft support involved several strategies. Some of the ways in which the latest technological findings were released to the nursery operators and other stakeholders were through three options namely: printed media, electronic media and interactive extension. The printed media included publication in newsprint, publications subscription, charts, brochures, bulletins, newsletters, booklets and adverts. The electronic media option included radio & television programs, internet and seedling documentation. Interactive extension involved training seminars, attending agricultural shows, specific capacity building approaches for CIGs and TGs through exchange visits, greenbelt safaris, field days, follow up workshops and farmer visits. Notably all the organizations were found to have used the any of the above strategies whenever the need arose or in some cases even a combination of the same. The availability and accessibility of market information was an important factor in decision making process. Thus organizations were aware that for nursery operators and other managers to make informed decisions they had to have access to the latest information. Consequently organizations had taken the initiative to use various means to provide soft support to nursery operators. However organizations have to continue with these strategies if they are to boost the awareness of both producers and consumers on available tree species in the tree nurseries.

Table 26: Organizations strategies in provision of hard and soft support**.**

Support		Strategies	Organization
Hard	Own nurseries	Timely purchasing of inputs -responsibility of respective purchasing departments through annual budgets and estimates.	KEFRI, ICRAF, AFRIC N,TOTAL, F D, G B M, VI, T B P
		Quality assurance though contracting ,testing of supplies and well versed technical personnel	
	Support nurseries	Set up of CIGs within the tree nursery group for proper input distribution.	VI, ICRAF,G B M , F D
		Encouraging and training farmers to use local materials (use of local seeds & seed exchange).	
		Collaboration with other organizations.	
Soft	Interactive extension	Training seminars , Attending agricultural shows, Specific capacity building approaches for CIGs and TGs through exchange visits, Greenbelt safaris ,Field days , Follow up workshops, Farmer visits, Discussions with local leaders	KEFRI, VI, AFRIC N, TOTAL, F D, G B M, T B P, NM
	Electronic media	Radio & TV programs, internet, seedling documentation	ICRAF, VI, TOTAL
	Printed media	Publishing in newsprint, publications subscription, charts brochures, bulletins and newsletters, booklets, adverts	KEFRI, VI, AFRIC N, TOTAL, F D, G B M, T B P, NM

Note: VI=VI AGROFORESTRY, AFRIC N=AFRICA NOW, TOTAL= TOTAL KENYA LTD, FD= FOREST DEPARTMENT, GBM= GREENBELT MOVEMENT, TBP=TREE BIOTECHNOLOGY PROJECT **Source: Tree nursery survey 2004**

4.4.3 Organizations purpose for setting up the tree nursery projects

Even with the strategies highlighted above organizations have to target a particular nursery type for the support system to be effective because tree nurseries are integral to the provision of both hard and soft support. This study found that the nursery projects set up by organizations fell under two classes. The first was the case of own nurseries established for various purposes like training, research, reforestation programmes, mass propagation and release of improved plantlets. The second was the case of support for nurseries where the projects had been set up for the purpose of improving access to tree seedlings and the introduction of welfare improving technologies. Even though these facilities were put in place for the benefit of nursery operators and not for competition, there was a possibility for market distortion if they offered the same species at subsidized prices. A good option for these organizations was to share technologies at the nursery operator's sites and only concentrate on difficult to produce species. A good example is the case of the Tree

Biotechnology Project (TBP) which had geographical differentiation of their *Eucalyptus* species products. There was *E. europhylla* for warm rainy areas like the coast, *E. nitens* for cold rainy areas (Aberdares), *E.camadulensis* for dry hot areas, *E. dunii* for dry cold areas (Nanyuki) and *E. grandis* and *E. saligna* for wet highland areas (Kericho). With further differentiation in terms of those produced from cuttings and those produced from seedlings. However it was noted that the underlying purpose for all the organizations nursery projects was to promote the planting of different tree species and inculcate in the community a culture of indigenous tree planting on public lands (Table 27).

Table 27: Organization purpose for setting up the tree nursery projects

	Objective	Organization
Own nurseries	-Demonstration , training and research purposes to induce growing of high value trees - Mass propagation and release of improved plantlets and revenue generation. -For plantation and on farm reforestation programmes	ICRAF, T B P, KEFRI, F D
Support tree nursery projects	-Promote planting of different tree species and inculcate in community culture of indigenous tree planting on public lands. -Tree nurseries used as entry point for other technologies to improve welfare -Improve access to tree seedlings for their fuel consumers	VI ,AFRIC N, TOTAL, G B M

Note: VI=VI AGROFORESTRY, AFRIC N=AFRICA NOW, TOTAL= TOTAL KENYA LTD, FD= FOREST DEPARTMENT, GBM= GREENBELT MOVEMENT, TBP=TREE BIOTECHNOLOGY PROJECT **Source: Tree nursery survey 2004**

4.4.4 Organization involved in tree nursery development process reason for preferring a particular approach.

The inter-group dynamics of the different nursery types also presents possibilities for preferential differences among organizations concerning the nursery type to work with.

In this respect this study established that most of the organizations (50%) preferred to work with individually owned nurseries than group or central nurseries with different reasons being given for their preferences. Those in favour of central nurseries advanced reasons with respect to the suitability for technological dissemination and the supply of tree seedlings for their own conservation programmes (Table 28). Supporting reasons for working with groups included ease of information dissemination through area of concentration (A.oC) and the use

of groups for other projects like food security. However the high organizational preference for individual nurseries could be attributed in part to the unsustainable nature of group nurseries in Kenya combined with the ease of distribution of materials and the market access assistance being extended to individual nurseries. These results underline the common trend in which group nurseries and central nurseries are synonymous with the provision of soft support while individual nurseries are increasingly utilized for the provision of hard support. In addition the promotion of the use of local materials and germplasm exchange highlights the attempt by the support system in Kenya to develop sustainable tree seed supply systems. Furthermore the favorable conditions provided by entrepreneurs and support organizations for the establishment of individual nurseries, are likely to lead to the establishment of more individual nurseries. This could also perhaps account for the current organization characterized by the presence of a high number of individual nurseries in Nairobi and Kisumu.

Table 28: Organizations reasons for their nursery approach preferences.

	Approach preferred	Organization
	Central	KEFRI, F D, T B P
	Group	VI, G B M
	Individual	ICRAF, AFRIC N, TOTAL, F D
Reason	Central nurseries: - For supply of tree seedlings for their own conservation programmes - Are easier to run and are used as a technology entry point. Groups nurseries : -Used to disseminate information through area of concentration (A.oC) - Women and youth groups are also used for other projects - food security Individual nurseries: -Easy to operate and distribution of materials -Groups are short lived thus unsustainable -Trying to assist nursery operators to gain access to the market (formation of associations) -Since formation of FESD move towards decentralized nurseries	

Note: VI=VI AGROFORESTRY, AFRIC N=AFRICA NOW, TOTAL= TOTAL KENYA LTD, FD= FOREST DEPARTMENT, GBM= GREENBELT MOVEMENT, TBP=TREE BIOTECHNOLOGY PROJECT **Source: Tree nursery survey 2004**

4.4.5 Constraints faced by organizations involved in tree nursery development projects.

Any support system that is faced by constraints is more likely to be inefficient in service delivery compared to one with no constraints. In this respect this study found that the constraints faced by organizations in the development process were in two categories i.e. those facing organizations owning nurseries and those concerning the support given to nursery operators (Table 29). Those constraints facing organizations that own nurseries included the lack of piped water for KEFRI nurseries, transportation and seed acquisition problems for the bulking project and new species (ICRAF), TBPs large scale production of eucalyptus species required periodic training of new labor force, while in the case of FD limited funds had resulted in nursery labor shortages. For support initiatives some of the constraints included lack of seedlings from farmers for the Total Eco Challenge Project due to disagreement over contracts with operators which have forced TOTAL to raise their own seedlings for the project to take off. The short lived nature of groups and marketing issues presents problems for organizations like GBM, VI and AFRICA Now. Limited budgets or funds have resulted in few workshops, training and follow-ups and limiting the organizations operations to priority areas only. Organizations like GBM have also cited Political interference in some cases concerning conservation issues (Table 29). Looking at these constraints and comparing them to those faced by operators we can see that limited funds in whatever form present a big hurdle in the achievement of development goals or objectives.

Table 29: Constraints faced by organizations in the development process

	Constraints	Organizations
Owned nurseries	Lack of piped water Transportation, seed acquisition problems due to no budget and emphasis on farm nurseries. Large scale production requires additional training of new labor force Lack of funds to hire more labor	ICRAF, F D, KEFRI, T B P,
Support nurseries	Water sourcing and marketing problems Group dynamics due to their short lived nature -unsustainable Lack of seedlings from farmers ,they have to raise seedlings themselves Limited funds means -They work in priority areas, - Few workshops, training and follow-ups Political interference in conservation issues.	VI, AFRIC N, TOTAL, G B M, ICRAF

Note: VI=VI AGROFORESTRY, AFRIC N=AFRICA NOW, TOTAL= TOTAL KENYA LTD, FD= FOREST DEPARTMENT, GBM= GREENBELT MOVEMENT, TBP=TREE BIOTECHNOLOGY PROJECT **Source: Tree nursery survey 2004**

4.4.6 Reason given by the organizations involved in the development process for emphasis on particular species.

Studies have shown that awareness campaigns by support organizations affect the demand for tree seedlings and therefore the tree planting impact at community and watershed levels. The promotion of tree species contributes to increase in biodiversity which is indicative of sustainable land use. This study found that apart from the tree biotechnology project and greenbelt movement who were involved in promotion of eucalyptus and indigenous species, the rest of the organizations emphasized on high value tree species that could be used for food,medicinal, fodder, fruits, timber, fuel wood and soil fertility (Table 30). A close observation of the kind of tree species found in tree nurseries in the two regions reflected a linkage between species emphasized by organizations and the species diversity within those tree nurseries. Given that nursery operators raised species according to demand, the species diversity also reflected the tree planting culture of individuals living around those nurseries, perhaps an indicator of the impact of the organizations promotional activities at the watershed level. Furthermore the multiple uses of these species also created opportunities for the promotion of other cottage industries that could be developed from raising those tree species on farms. The emphasis on these potential benefits could be used in organizations awareness campaigns to create demand for tree seedlings. Differences in markets between the two zones would mean that Kisumu operators who were project driven would be influenced more compared to their market oriented counterparts in Nairobi. However due to organizations awareness campaigns that influence the demand for tree species, it is possible that the market oriented nurseries also benefit from these efforts. These results are consistent with observations made in the Southern African countries where increased investment into the scaling up of Agroforestry resulted in not only high nursery productivity but also high demand for tree species

Table 30: Reasons for emphasizing on particular species

Reason	Organizations
High value trees -medicinal, fodder, fruits, fuel wood, timber and soil fertility	ICRAF, KEFRI, VI, AFRIC N, TOTAL, F D
Specializing in Eucalyptus species	T B P
Focus on indigenous tree species	G B M

Note: VI=VI AGROFORESTRY, AFRIC N=AFRICA NOW, TOTAL= TOTAL KENYA LTD, FD= FOREST DEPARTMENT, GBM= GREENBELT MOVEMENT, TBP=TREE BIOTECHNOLOGY PROJECT **Source: Tree nursery survey 2004**

4.4.7 Other projects that Organizations involved in tree nursery development process engage in.

In order to boost the overall efficiency of the support system, this study found that organizations were involved in other projects that were meant to enhance food security, wealth creation and overall environment conservation of participants. These projects comprised of those dealing with sourcing of tree seeds, household food security and the environment. The sourcing of tree seeds included germplasm acquisition, seed stand establishment and vegetative propagation. While farm projects for household food security and increasing sources of income included support for small holder activities like bee keeping, dairy goat, poultry, sweet potatoes and fruits trees (Table 31). The general environmental issues on the other hand included specific programmes to address areas concerning civic and environmental education, advocacy and networking. These projects show that organizations were taking serious the threat posed by the shortage of tree seeds to nursery operators on species diversity. Consequently these projects were set up in order to help boost the availability and accessibility of tree seeds through their distribution programmes. The welfare of the nursery operators was also addressed through food security and wealth creation. The general environmental activities were meant to educate the community of their rights in issues relating to the environmental conservation process. These projects underline the sensitivity of the organizations towards community welfare and the inherent potential of the high value trees they were promoting to help in the realization of these goals. A close relationship was observed between organizational projects and those for nursery operators again indicating some impact at the landscape level. But most important is the need for a concerted effort from all stakeholders for success in the conservation process.

Table 31: Other projects organizations are involved in

Other projects		Organization
Sourcing of tree seeds	Germplasm acquisition, vegetative propagation, seed stand establishment	F D ,T B P, ICRAF, KEFRI
Farm projects for household food security increasing sources of income	Bee keeping, dairy goat, poultry, sweet potatoes, and fruits trees	AFRIC N, G B M, VI
Environmental	civic and environmental education, advocacy and networking	G B M, TOTAL

Note: VI=VI AGROFORESTRY, AFRIC N=AFRICA NOW, TOTAL= TOTAL KENYA LTD, FD= FOREST DEPARTMENT, GBM= GREENBELT MOVEMENT, TBP=TREE BIOTECHNOLOGY PROJECT. **Source: Tree nursery survey 2004**

4.4.8 Organizations tree seedling market efficiency strategies

Since organizations product strategies had an affect on the supply and accessibility of tree seedlings they were likely to have an impact at the landscape level. This study found that organizations had two different product strategies relating to own tree seedling needs and the support for nursery operators to gain access to the market (Table 32). The strategies for own needs included the production of seedlings based on demand for various programs like tree planting on public lands, afforestation, reforestation, on farm and consortium needs. In cases where the organizations were involved in research and training the tree seedlings were given away during field days and farmers training seminars. Support based strategies included providing nursery operators with links to other Common Interest Groups and invitations to forums like field days and launches where they could advertise seedlings found in their tree nurseries. Other organizations like Total Kenya Ltd provided shade and stands for the tree seedlings at their pump station to improve their consumers access to tree seedlings. The provision of quality seedlings at low prices, booking, offering transportation at a cost and after sales service also goes to show the nursery operators on how to increase their market shares since the highest performance was recorded by organizations using these strategies. In addition some organizations also found it prudent to instill marketing skills in the nursery operators to help them market their tree seedlings. Thus organizations provide good management examples which if adopted by nursery operators could help them to better market their tree seedlings hence improve in their welfare.

Table 32: Organizations product strategies

Product strategies		**Organizations**
Own needs	Seedlings production based on demand for own programs: -Tree planting on public lands program -Afforestation & reforestation programs as well as on farm needs -Produce based on demand from consortium -Research then given away during field days and farmers training seminars.	G B M, ICRAF, KEFRI, F D
Support for nurseries market access.	Links with other CIGs and invitations to forums -field days and launches. Low prices, booking of tree seedlings, quality seedlings, offering transportation at a cost and after sales service. Provision of shade and stand for the tree seedlings at the pump station. Teaching individual operators marketing skills.	VI, AFRIC N, TOTAL, T B P

Note: VI=VI AGROFORESTRY, AFRIC N=AFRICA NOW, TOTAL= TOTAL KENYA LTD, FD= FOREST DEPARTMENT, GBM= GREENBELT MOVEMENT, TBP=TREE BIOTECHNOLOGY PROJECT **Source: Tree nursery survey 2004**

4.5 Tree seedling market performance

This section looks at performance of tree nurseries in terms of quantity of seedlings produced annually given the available resources compared to the annual demand for tree seedlings as a result of promotional strategies for tree seedlings and finally the performance ratio of demand over output to give seedling market efficiency (% of seedlings sold or delivered).

4.5.1 Output of seedlings per year.

The study found that Majority of decentralized nurseries (92% in Nairobi and 85% in Kisumu) and centralized nurseries (50% in Nairobi and all in Kisumu) produced less than 100000 seedlings per year. While 25% of decentralized nurseries in Nairobi produced between 100000-500000 seedlings per year. Only 8% of their decentralized nursery counterparts in Nairobi and Kisumu (11%) produced. Only 4% of decentralized nurseries in Kisumu produced over 500000 seedlings compared 25% of the centralized nurseries in Nairobi. Thus majority (87%) of nurseries in Nairobi and Kisumu produced below 100000 seedlings per year. Ten percent of nurseries produced between 100000 to 500000 seedlings per year in Nairobi and Kisumu. The rest (3%) produced over half a million seedlings per year for both regions (Table 33). It was also observed that seedling production went on throughout the year.

4.5.2 Demand for tree seedlings per year.

Majority of centralized nurseries (50% in Nairobi and all in Kisumu) and decentralized nurseries (96% in Nairobi and Kisumu) had demand of less than 50000 seedlings per year. Only 4% of decentralized nurseries and 25% of centralized nurseries in Nairobi had demand of between 50000-100000 seedlings per year. While 25% of decentralized of decentralized nurseries in Nairobi had demand of over 100000 seedlings per year, only 4% of decentralized nurseries had the same level of demand. Consequently majority of tree nurseries in Nairobi (90%) had demand below 50000 seedlings per year. Ninety seven percent (97%) of tree nurseries in Kisumu had demand of between 50000-100000 seedlings per year compared to only 7% in Nairobi in the same category. The rest (3%) had demand of over 100000 seedlings per year (Table 33). This demand was however seasonal occurring mainly during the two rainy seasons.

4.5.3 Tree seedling market efficiency.

The effect of market mix comprising of product, price, promotional and place strategies employed by nursery operators /managers are captured by seedling market efficiency (% of output that is sold or delivered). The survey found that majority of decentralized nurseries (58% in Nairobi and 74% in Kisumu) and centralized nurseries (50% in Nairobi and 33% in Kisumu) had market efficiency of between 50-80%. Only 7% of decentralized nurseries in Kisumu achieved market efficiency of over 80% compared to 25% of centralized and 3% of decentralized nurseries in Nairobi. In addition only 39% of decentralized nurseries and 25% of centralized nurseries in Nairobi achieved market efficiency of less than 50% compared to 19% of decentralized and 67% of centralized nurseries in Kisumu. Consequently many of tree nursery operators in Kisumu (70%) and Nairobi (57%) managed to sell or deliver between 50-80% of their tree seedlings annual output. Thirty seven percent (37%) of nursery operators in Nairobi and 23 % in Kisumu managed to sell or deliver below 50% of their output. Only 7% of the nursery operators in both regions managed to sell or deliver over 80% of their output of seedlings (Table 33). Hence in Nairobi centralized nurseries sold or delivered 9% more tree seedlings than decentralized nurseries. In Kisumu the opposite was true as decentralized nurseries sold or delivered 15% more tree seedlings than centralized nurseries.

Performance based on demand and supply showed that while centralized nurseries in Nairobi producing less than 100000 seedlings , sold or delivered 9% more of their output than decentralized nurseries, in Kisumu the reverse was true as decentralized nurseries producing less than 100000 seedlings sold or delivered 17% more of their output than centralized nurseries. However in the 100000-500000 seedlings per year category decentralized nurseries in Kisumu sold or delivered 18% more than decentralized and 36% more than centralized nurseries in Nairobi. In the over 500000 seedlings per year category centralized nurseries cleared their stock compared to only 33% for decentralized nurseries in Kisumu. Interestingly the same trend was observed with demand levels. Overall with the exception of tree nurseries that produced over 500000 seedlings per year and had demand of over 100000 seedlings per year, tree nurseries in Kisumu generally sold or delivered more tree seedlings than those in Nairobi. Hence the overall higher performance of 7% for

nurseries in Kisumu compared to those in Nairobi even though this variation in market efficiency was not significant (see appendix 8).

The above results strongly suggested that Kisumu had a more efficient marketing system while Nairobi had a more efficient production system. These differences could be attributed to the different market structures in Nairobi (oligopolistic competitive) and Kisumu a (monopolistic competitive). The higher performance for centralized nurseries in Nairobi could be attributed to market power resulting from distortions due to selling seedlings at subsidized prices and aggressive non price competition. While the higher performance for decentralized nurseries in Kisumu could be attributed to variation in intended use for tree seedlings produced. But most important the results revealed that the overall combined effect of both organizational and nursery operators/managers strategies is that on average only 54% of the annual tree seedlings produced are marketed and hence transplanted into the landscape (see appendix 8).

Table 33: Tree nursery performance based on demand and supply for tree nurseries in Nairobi and Kisumu.

Region		Nairobi						Kisumu					
		Dec	%	Cent	%	Total	Mp	Dec	%	Cent	%	Total	Mp
Seedlings	< 100000	24	92	2	50	26	**51**	23	85	3	100	26	**59**
output		**(51)**		**(59)**		(87)	(19.89)	(**61**)		(**44**)		(87)	(19.33)
p.a	100000-	2	8	1	25	3	**29**	3	11	0	0	3	**53**
	500000	**(35)**		**(17)**		(10)	(18.25)	(**53**)				(10)	(25.17)
	> 500000	0	0	1	25	1	**100**.	1	4	0	0	1	**33**
				(100)		(3)		(**33**)				(3)	
Seedling	< 50000	25	96	2	50	27	**50**	26	96	3	100	29	**59**
demand		**(50)**		**(59)**		(90)	(20.41)	(**60**)		(**44**)		(97)	(19.55)
p.a	50000-	1	4	1	25	2	**34**	0	0	0	0	0	0
	100000	**(50)**		**(17)**		(7)	(23.33)						
	>100000	0	0	1	25	1	**100.**	1	4	0	0	1	**33**
				(100)		(3)		(**33**)				(3)	
Market	<50%	10	39	1	25	11(37)		5	19	2	67	7(23)	
efficiency	50%-80%	15	58	2	50	17(57)		20	74	1	33	21(70)	
	>80%	1	3	1	25	2(6)		2	7	0		2(7)	
	Total	26	100	4	100	30	**51**	27	100	3	100	30	**58**
		(50)		**(59)**		(100)	(22.29)	(**59**)		**(44)**		(100)	(19.77)

Dec=decentralized, cent=centralized, Mp=mean performance **Source :Tree nursery survey 2004**

4.5.4 Tree nursery performance based on support

The survey found that 23% of decentralized nurseries and 25% of centralized nurseries in Nairobi had received support compared to 67% of decentralized nurseries and centralized nurseries in Kisumu. Consequently sixty seven percent of nursery operators in Kisumu had received support from other organization compared to 33% who didn't receive any support. In Nairobi majority of operators (77%) had received no support compared to 23% who had received support (Table 34). This highlights the differences in support provision to the two zones. Studies from the southern African region have indicated that support leads to higher performance. Decentralized nurseries in Nairobi that had received no support performed better (52%) than those who had received support (42%) compared to centralized nurseries where the opposite was true with those who had received support performing better (100%) than those who did not receive support (45%). In Kisumu the same trend was observed with decentralized nurseries that had received no support performing better (65%) than those who had received support (57%) compared to centralized nurseries where the opposite was again true with those who had received support performing better (48%) than those who did not receive support (35%).

Thus nursery operators who received support from organizations on average sold or delivered 51% of output for those in Nairobi compared to 56% for those in Kisumu. For those who did not receive support the average sales or delivery was 51% of output for those in Nairobi and 62% for those in Kisumu (Table34). Hence the provision of support seemed to have a greater impact at the centralized than decentralized level (Table34) even though the variation in market efficiency based on support was not significant (see Appendix 8). The study also observed that support in Nairobi was limited to the provision of soft support compared to Kisumu where both soft and hard supports were provided.

These results were consistent with the expectation that quality of advice affects performance as observed in the case for Nairobi. The low performance observed in Kisumu is also consistent with Bohringer's assertion that a 50% drop in productivity with first time operators. This is true as most of these nurseries that are being supported are new initiatives and as such the performance would below in comparison with their more experienced

counterparts. Since the Kisumu market is not so highly developed like the one in Nairobi these results highlight the need for increased investment in nursery operators /managers to provide own soft and hard support.

Table 34: Performance of tree nurseries based on support from stakeholders in the development process in Nairobi and Kisumu.

Received support	Dec	%	Cent	%	Total	Mp (S.dev)	Dec	%	Cent	%	Total	Mp (S.dev)
Yes	6 (**42**)	23	1 (**100**)	25	7 (23)	**51** (24.27)	18 (**57**)	67	2 **(48**)	67	20 (67)	**56** (21.41)
No	20 (**52**)	77	3 (**45**)	75	23 (77)	**51** (22.23)	9 **(65**)	33	1 **(35)**	33	10 (33)	**62** (16.29)
Total	26 (**50**)	100	4 (**59**)	100	30 (100)	**51** (22.29)	27 **(59)**	100	3 **(44**)	100	30 (100)	**58** (19.77)

Note: Mean P= mean performance; Std. dev = standard deviation **Source: Tree nursery survey 2004**

4.6 Effect of market structure and conduct of participants on performance of tree nurseries.

Table 35: Description Of Regression Model Variables (N=60).

Variable Name	Description	Freq (Mean)	Min	Max
Market Efficiency (Dependent)	% Of Output Sold Or Delivered To Farmers	54.27*	3	100
District	District(1= Kisumu,0=Nairobi)	.50	0	1
Centralized	Approach (1=Centralized,0=Decentralized)	.12	0	1
Roadside (Ref)	Nursery Site (1=Roadside ,0=Otherwise)	.62	0	1
Backyard	Nursery Site (1= Backyard,0=Otherwise)	.25	0	1
Open space	Nursery Site (1=Openspace,0=Otherwise)	.067	0	1
Riverbank	Nursery Site(1= Riverbank,0=Otherwise)	.067	0	1
Gender	Gender Of Operator / Manager (1=Female, 0=Male)	.13	0	1
30-50 Years (Ref)	Age Of Operator /Manager (1=30-50 Years ,0=Otherwise)	.55	0	1
<30years	Age Of Operator /Manager (1= <30years , 0=Otherwise)	.20	0	1
>50 Years	Age Of Operator /Manager (1=>50 Years , 0=Otherwise)	.25	0	1
Primary (Ref)	Education Level Of Operator (1= Primary, 0=Otherwise)	.42	0	1
Secondary	Education Level Of Operator (1=Secondary,0=Otherwise)	.40	0	1
College	Education Level Of Operator (1=College\University, 0=Otherwise)	.18	0	1
Forest Extension	Source Of Skills (1=Forest Extension 0=Other Operators /Managers)	.40	0	1
50-80% (Ref)	Area Under Tree Seedlings (1=50-80 %,0=Otherwise)	.48	0	1
<50%	Area Under Tree Seedlings (1= <50 % ,0=Otherwise)	.15	0	1
>80%	Area Under Tree Seedlings (1= >80% ,0=Otherwise)	.37	0	1
10-30 Species(Ref)	Species Diversity(1=10-30 Species,0=Otherwise)	.73	0	1
>30 Species	Species Diversity(1= >30 Species, 0=Otherwise)	.083	0	1
< 10 Species	Species Diversity(1= < 10 Species,0=Otherwise)	.18	0	1
50000-100000 Seedlings	Seedling Demand (1= 50000-100000, 0= Otherwise)	.033	0	1
Over 100000 Seedlings	Seedling Demand (1=Over 100000, 0= Otherwise)	.033	0	1
<50000 Seedling (Ref)	Seedling Demand (1= <50000 ,0=Otherwise)	.93	0	1
> 500000 Seedlings	Total Output (1=Over 500000, 0=Otherwise)	.033	0	1
100000-500000 Seedlings	Total Output (1= 100000-500000 ,0=Otherwise)	.10	0	1
<100000 Seedlings (Ref)	Total Output (1= < 100000 ,0= Otherwise)	.87	0	1
Sale (Ref)	Intended Use (1=Strictly For Sale, 0=Otherwise)	.68	0	1
Own Use &Sale	Intended Use (1=Own Use But Surplus For Sale, 0=Otherwise)	.25	0	1
Own Use	Intended Use (1=Strictly For Own Use,0=Otherwise)	.067	0	1
Piped(Ref)	Main Source Of Water (1=Piped Water, 0=Otherwise)	.45	0	1
River	Main Source Of Water (1=River Water,0=Otherwise)	.33	0	1
Springs	Main Source Of Water (1=Other Sources Like Springs, 0=Otherwise)	.067	0	1
Borehole	Main Source Of Water (1=Borehole Water,0=Otherwise	.15	0	1

Table 35 continued: Description Of Regression Model Variables (N=60).

Variable Name	Description	Freq (Mean)	Min	Max
<10 Employees Ref)	Number Of Employees In Nursery (1=<10 Employees,0=Otherwise)	.93	0	1
10-50 Employees	Number Of Employees In Nursery (1=10-50 Employees, 0=Otherwise)	.033	0	1
> 50 Employees	Number Of Employees In Nursery (1= > 50 Employees,0=Otherwise)	.033	0	1
Family	Main Composition (1=Family Members Only,0=Otherwise)	.35	0	1
Both	Main Composition (1=Both Family Members And Workers, 0=Otherwise)	.13	0	1
Workers (Ref)	Main Composition (1=Workers Only,0=Otherwise)	.52	0	1
Training	Offer Training In Nursery Mgt(1=N0 ,0=Yes)	.38	0	1
Bank Credit	Main Source Of Capital (1=Bank Credit,0=Own Savings	.15	0	1
Land Availability	Land Availability (1=No, Yes)	.48	0	1
Landscaping (Ref)	Vertical Integration (1=Landscaping Services, 0=Otherwise)	.48	0	1
Sale of Horticultural Products	Vertical Integration (1= Sale Of Horticultural Products ,Honey And Vegetables,0=Otherwise)	.033	0	1
None	Vertical Integration (1=No Services Other Than Sale Of Tree Seedlings, 0=Otherwise)	.27	0	1
Extension	Vertical Integration (1=Extension Services, 0=Otherwise)	.12	0	1
Sale Manure	Vertical Integration (1=Sale Of Manure, Topsoil, Pesticides, Ornaments &Flowerpots, 0=Otherwise)	.10	0	1
Psd1	Price For Small Size Seedlings	15.93*	0	50
Psd2	Price For Medium Size Seedlings	56.92*	0	450
Psd3	Price For Landscaping Size Seedlings	235*	0	8000
Location signboards (Ref)	Promotion Strategies (1=Location And Signboards,0=Otherwise)	.37	0	1
Field Days	Promotion Strategies (1= Field Days And Free Samples,0=Otherwise)	.30	0	1
Relations	Promotion Strategies (1=Good Relations , 0=Otherwise)	.20	0	1
Quality	Promotion Strategies (1=High Quality Seedlings,0=Otherwise)	.13	0	1
Support	Received Support (1=No ,0=Yes)	.55	0	1
Constraints	Other Constraints To Nursery Pdn(1=No, 0=Yes)	.20	0	1

N =60 Is The Number Of Tree Nurseries

Freq=frequency *=Means **Source: Tree nursery survey 2004**

Table 36 : Determinants of tree seedlings market efficiency SPSS results

Variable	Coefficients	Std. Error	t	Sig.
(Constant)	35.239	14.535	2.424	.027
Kisumu	14.083	8.275	1.702	.107
Centralized	-42.809	24.310	-1.761	.096
Backyard	10.333	11.782	.877	.393
Open space	1.412	11.883	.119	.907
Riverbank	31.956	15.734	2.031	.058
Gender	-7.450	8.063	-.924	.368
<30 Years Of Age	24.522	6.805	3.604	.002
>50 Years Of Age	8.487	6.304	1.346	.196
Secondary Education	7.458	6.754	1.104	.285
College Education	16.238	6.393	2.540	.021
<50 % Under Tree Seedlings	-34.773	8.865	-3.923	.001
>80% Area Under Tree Seedlings	5.240	8.670	.604	.554
Own Use But Surplus For Sale	-0.063	8.726	-.007	.994
Own Use	27.145	15.777	1.721	.103
Offer Training In Nursery Mgt	18.183	5.617	3.237	.005
Land Availability	-11.120	6.571	-1.692	.109
Price For Small Size Seedlings (Psd1)	.949	.391	2.427	.027
Price For Medium Size Seedlings (Psd2)	-.102	.114	-.889	.386
Price For Landscaping Size Seedlings (Psd3)	-0.0099	.008	-1.223	.238
Field Days And Free Samples	-8.596	6.908	-1.244	.230
Relations	-5.195	6.860	-.757	.459
Quality	15.002	8.113	1.849	.082
Received Support	5.717	5.738	.996	.333
Other Constraints To Nursery Production	20.892	6.424	3.252	.005
Forest Extension	-1.471	6.345	-.232	.819
Bank credit	3.260	19.040	.171	.866
< 10 Species	-21.255	7.517	-2.827	.012
>30 Species	-9.123	12.821	-.712	.486
10-50 Employees	-41.451	10.368	-3.998	.001
Over 50 Employees	109.552	27.923	3.923	.001
Family Members Only	-10.483	5.232	-2.004	.061
Both Family Members And Workers	20.293	9.341	2.172	.044
Sale Of Horticultural Products,	-66.117	13.460	-4.912	.000
None	-31.863	6.289	-5.066	.000
Extension Services	-13.568	9.030	-1.503	.151
Sale Manure	-24.442	9.748	-2.507	.023
River Water	21.803	7.839	2.781	.013
Springs	-10.811	8.645	-1.251	.228
Borehole Water	3.982	8.140	.489	.631
Demand 50000-100000 Seedlings p.a.	-40.946	19.536	-2.096	.051
> 500000 seedlings p.a.	-18.316	18.894	-.969	.346
100000-500000 Seedlings p.a.	3.649	10.139	.360	.723
N	60			
F(42,17)	4.710			
R2	.921			

Reference variables include : District =Nairobi; Location =roadside; Gender=male; Age=30-50years; Education =primary; ATS=50-80%;Use=strictly for sale; offer Training =yes; Land availability=yes; Promotion=location &signboards; Received support=yes; Constraints=yes; Skills source=other operators; Main source of capital =own savings; Species diversity=10-30 species; Employees=<10; Composition=workers; Vertical integration=landscaping services; Water source=piped; Demand = <50000 seedlings p.a; Supply=<100000 seedlings pa; **Source: Tree nursery survey 2004**

The estimated model was significant (p<.05) and explained about 92% of the variation in market performance (R2=0.921). The model results show that the tree seedlings market efficiency is significantly determined by both market (4Ps) and production aspects (Table 36). The market aspects include: The product (species diversity), price (price and demand for tree seedlings), promotion (promotional strategies and vertical integration) and place (location and site of the tree nurseries). Production aspects include nursery type, management (age and education of nursery operator /manager), area under tree seedlings, intended use of tree seedlings, information flow, constraints to nursery production and access to factors of production (land, labour and water).

Market efficiency was positively correlated with district and nursery site (Table 36). More specifically market efficiency seems to increase by about 14% by shifting the location of the nursery from Nairobi to Kisumu (P<.1). Market efficiency varies significantly across sites. In relation to roadside (reference site) the market efficiency ranges from 32% for riverbank to 1% for open spaces. Interestingly nurseries located in backyards achieve efficiency levels of 10% more than those located by roadsides. However only nurseries located on riverbanks significantly performed better than those on roadsides (P<.05).

Market efficiency varies significantly with the price of tree seedlings (P<.05). With the exception of prices for medium and landscaping sized seedlings, increases of Ksh 10 above the mean prices for transplanting size seedlings would increase the market efficiency by 9.5%. Consequently a reduction in prices for both landscaping and medium sized seedlings would increase market efficiency for tree seedlings, although the variation would be insignificant.

Market efficiency varies significantly with the nurseries species diversity (P<.05). In relation to species diversity of 10-30 species the market efficiency varies from below 9% for over 30 species to below 21% for less than 10 species (Table 36). Thus it’s not economical for nurseries to stock less than 10 species or more than 30 species. However this variation between the market efficiencies for nurseries is only significant between those offering less than 10 species and those offering between 10-30 species.

Market efficiency varies significantly with both age (P<.01) and education of nursery operator /manager (P<.05). In relation to 30-50 years of age (reference age group), the market efficiency varies from 9% for those over 50years and 25% for those below 30 Years. In relation to primary education (reference education level) market efficiency ranges from 8% for secondary school leavers to 16% for university or college educated nursery operators or managers. Interestingly although market efficiency for female operators/managers is about 8% lower than their male counterparts, this variation is insignificant (Table 36). This could be attributed to the fact that tree nursery business is male dominated and women generally have poorer access to productive resources and agricultural services. With regard to age the variation shows the potential benefits to be gotten from young operators for their innovativeness and readiness to adopt new technologies. On the other hand a positive correlation between education and market efficiency shows the importance of higher education in perception and interpretation of complex market variables that are fundamental to the long-term sustainability of tree nurseries. These results also concur with other studies that have confirmed a positive relationship between education and productivity (Pudasani 1983) or education and adoption of new technologies (Lin, 1991). In addition other studies have shown that women are less risk averse and more prepared than men to accept the use of new technologies and have an inherent capacity to invest in tree germplasm business (Muriuki, 2005). Consequently, there is need for the formulation of policies that address human capital development and increased participation of women in tree nursery business for sustainable development.

Market efficiency varies significantly with type of nursery approach (P<.1). In relation to the decentralized approach (reference) the market efficiency for centralized nurseries is about 42% below their decentralized nurseries counterparts (Table 36). This generally justifies the current position that has shown a general shift from centralized to decentralized approaches in order to ensure farmers satisfaction with diverse tree species. This also accounts for the organization of the market with a high proportion of individual nurseries compared to central nurseries.

Market efficiency also varies significantly with the both the intended use (P<.1) and area under tree seedlings (P<.01). In relation to strictly for sale (reference use) the market efficiency for those producing for own use is 27% higher. This variation in market efficiency is only significant if seedlings are produced strictly for own use but when seedlings are produced for own use and surplus for sale the variation becomes insignificant (Table 36). As expected own use produces the highest market efficiency because it's not subject to market forces. In relation to 50-80% under tree seedlings (reference) the market efficiency ranges from 35% below for those with less than 50% under tree seedlings to 5% above for those with over 80% under tree seedlings. Consequently market efficiency increases with increase in area under tree seedlings. In addition there is a positive linkage between the perception of demand level and the intended use for the tree seedlings produced.

Market efficiency varies significantly with access to factors of production (P<.1). More specifically nursery operators who have access to land achieve higher market efficiency (11%) than those who don't have access to land (Table 36). In relation to access to labour, both the number and composition of employees are significant in influencing market efficiency. Thus in relation to less than 10 employees(reference) market efficiency ranges from below 42% for those having between 10-50 employees and above 110% for those with over 50 employees. This variation can be attributed to the fact that decentralized nurseries that were overstaffed performed poorer while those centralized nurseries with adequate labour actually performed better than those that were understaffed. In relation to workers (reference composition) the market efficiency ranges from 11% below for family members only and 20% above for a combination of both workers and family members (Table 36).

In relation to tap water (reference source of water) market efficiency ranges from below 11% for springs and 22% above for river water (Table 36). However the variation in market efficiency was only significant for nursery operators relying on river water. Water has been shown to be one of the most important factors of production in tree seedling production (Gachanja & Ilg, 1990). Its effect on performance has been shown in terms of reliability as it affects the quantity and quality of tree seedlings produced. Earlier results from this study have shown that with increasing competition in the tree seedlings market consumers are

increasingly sensitive to the quality of tree seedlings. Hence there is a direct relationship between performance, water source and reliability.

In addition nursery operators who had access to bank credit achieved market efficiency of 4% higher than those who relied on own savings although the variation was insignificant (Table 36). This could be attributed to the fact that majority of nursery operators generally had no access to credit from banks. Thus nursery operators should be encouraged to re-invest their profits until such a time that their enterprises develop to a level that access to bank credit is inevitable for any further meaningful development. This would help to reduce need for bank credit thus improving the sustainability of these tree nursery enterprises.

Furthermore, market efficiency varies significantly with the presence of constraints ($P<.01$). Nursery operators who had no constraints to nursery production generally performed better than their counterparts who had constraints (Table 36). More specifically nursery operators who had no constraints were able to achieve market efficiency of 21 % more than their counterparts who had constraints. This highlights the fact that addressing these constraints (production, management and security issues) is fundamental to the creation of a conducive economic environment for the sustainability of tree seedling supply system.

With regard to information flow, offering training in nursery management affects market efficiency ($P<.01$). In relation to offering training in nursery management, operators who offer no training in nursery management generally achieve market efficiency of 18% more than those who offer training. The fact that this variation is highly significant raises fundamental questions concerning the capacity of these nurseries to offer the training. In relation to source of nursery management skills, nursery operators or managers relying on forestry extension officers for skills achieve market efficiencies of 2% less than those relying on other operators or managers although the variation is insignificant. This means that other operators are a viable source of nursery management skills and should therefore be developed to supplement information from extension officers.

In this regard the role played by support organizations in their attempt to address these constraints through the provision of hard and soft support is underlined by the higher performance achieved by nursery operators or managers who have not received support. More specifically nursery operators who have not received any support generally achieve market efficiency of 6% more than those who have received support although the variation is insignificant. This can be attributed to the variation in both the low proportion of nursery operators who have received support and the kind of support received. This raises fundamental questions concerning the targeting of the support and hence the need for concerted efforts from all stakeholders involved in the development process to ensure that their support activities are not counterproductive to a tree seedling system that is attempting to be self sustaining.

Market efficiency varies significantly with promotional strategies ($P<.1$). In relation to location and signboards (reference) market efficiency ranges from 5% below for good relations and reputation in growing seedlings to 15% above for selling high quality seedlings (Table 36). However only quality was significant with good relations, good reputation, field days and issue of free samples all being insignificant. Consequently the sale of high quality seedlings is the most effective promotion strategy followed by location and signboards with field days and issue of free samples being the least effective. This highlights the importance of product development and advertising to promote quality assurance and boost access to quality tree seedlings.

Market efficiency varies significantly with vertical integration ($P<.01$). In relation to offering landscaping services (reference) market efficiency ranges from 66% below for the sale of horticultural products, honey and vegetables, 31% below for no services, 24% below for sale of manure to 13% below for extension services. However, offering extension services was insignificant (Table 36). This can be attributed to low proportion of nursery operators or managers engaged in the same. These results highlighted the fact that offering landscaping services would contribute significantly to the nurseries market efficiency. In addition it also underlined the need for nursery operators to seriously consider not only offering other

services but also the type of service to compliment the sale of tree seedlings to avoid a counterproductive effect.

Market efficiency varies significantly with demand for tree seedlings ($P<.05$). In relation to demand of less than 50000 seedlings per annum (reference demand) marketing efficiency of 41% below is achieved by nursery operators facing demand of between 50000-100000 seedlings per annum (Table 36). However the supply for tree seedlings is insignificant in influencing market efficiency. In relation to supply of below 100000seedlings per annum (reference) market efficiency ranges from 18% below for over 500000 seedlings per annum to 4% above for supply of between 50000-100000 seedlings per annum. This shows that irrespective of how much is produced the market efficiency in the tree seedlings market is highly dependent on the demand for tree seedlings. Consequently it underlines the need for stakeholders to look for ways to foster the demand for tree seedlings.

4.6.5 Reliability of the regression models

The reliability of the above models in predicting variables that influence seedling output efficiency is reasonable given that all the models have an adjusted R square of more than .5 (Appendix 5). Based on the chow test performed and whose results showed an $F^* > F_{0.05}$, the study rejected the null hypothesis and concluded that the performance level in the two regions (Nairobi and Kisumu) differed significantly. This is consistent with results that pointed to differences in the development stages of the two markets where Nairobi was observed to have an oligopolistically competitive market structure while Kisumu had a monopolistically competitive market structure (Appendix 5).

4.7 Entrepreneurs choice of market entry level.

This section looks at the effect of market conditions on an entrepreneur's choice of market entry level in Nairobi and Kisumu.

Table 37. Factors affecting an entrepreneur's choice of market entry level in Nairobi and Kisumu.

		Estimate	Std. Error	Sig.
Threshold	[APPRDUMM = 0]	1.761	.848	.038
	PSD1	.190	.101	.059
	PSD2	-9.927E-02	.043	.020
	PSD3	-5.939E-02	.000	.
	[FACSHT=0]	2.250	1.059	.034
	[FACSHT=1]	0	.	.
Intercept	-2 log likelihood	15.716		
	Chi-Square	26.126		
Pseudo R-Square	Cox and Snell	.353		

Source: Tree nursery survey 2004

The results show that new entrants into the tree seedlings market are only two percentage points more likely to choose the centralized approach over the decentralized approach ($P<.05$) thus most entrepreneurs are likely to enter the market at the decentralized level. This decision is influenced mainly by changes in tree seedling prices and the availability of infrastructure (Table 37). More specifically an increase of ten shillings in the prices for transplanting size seedlings would increase the probability of choice by 2% while a reduction of ten shillings in the prices for medium sized tree seedlings would enhance the probability of choice by 0.1 %. In addition the availability of facilities for storage and transport would also enhance the probability of choice by 2.3%.

The influence of prices was not surprising as most of the tree seedlings produced were for sale exclusively or as surplus and as such prices played an important role as an incentive for market entry and the efficient allocation of resources. However changes in the prices for landscaping size seedlings had no influence on choice due to the specialization matrix (see table 6). The results therefore raise fundamental questions regarding the pricing mechanisms and the resultant prices especially when you consider the fact that central nurseries mostly offer tree seedlings at low prices due to subsidization thus not a true reflection of the market forces of demand and supply. The availability of transport and

storage facilities plays a crucial role in the market efficiency of central nurseries simply because it helps to bridge the location disadvantages and ensure that farmers have access to quality tree germplasm. Hence the results underline the important role played by prices and infrastructure in influencing the entry and exit decisions of entrepreneurs and therefore the tree seedlings market organization. The socio economic factors are insignificant due to the effects of tree planting culture in Kenya where tree nursery business is male dominated. However the combination of lack of access to borrowed capital and individual characteristics of the approaches eliminates most of the entrepreneurs leaving the central nurseries as the preserve of those with large networths and capable of taking large risks. In addition the high demographic pressure in Kenya and the market oriented nature of the tree seedlings market provides ideal conditions for the establishment of individual nurseries. Consequently the existing economic environment in Kenya provides ideal conditions that favor the decentralized over the centralized approach. However the market is not conducive for the formation of the rather short-lived or unsustainable group nurseries. This leaves entrepreneurs with the option of either of the two more stable options of individual or central nurseries. The entry of more entrepreneurs into the tree seedlings market at the individual level means that nursery operators have to deal with ever reducing market shares. This translates into a high level of competition which requires a potential entrant to have appropriate management skills. The ability to identify opportunities and threats in the market means that the market is unforgiving for errors due to the high competition envisaged. Consequently it also underlines the need for capacity building and provision of market information.

4.8 Nursery operator's views

Nursery operators respond to changes in their market environment in different ways. They expressed views on what should be done to improve the current seedling market environment as presented below.

4.8.1 Requirements to Improve Skills

Having recognized the need for skills in tree nursery production the study found that fifty percent (50%) of sampled operators in Nairobi and 30% in Kisumu needed training in

grafting, budding and seed collection. A significant number of sampled operators in Kisumu (60%) and Nairobi (37%) expressed the need for field days and training seminars in tree nursery management. The rest were either in favour of enhanced information exchange (10% in Nairobi and 3% in Kisumu) or the provision of finances to purchase better equipment (Table 38).

4.8.2 Capital Requirements

Given the fact that most (87%) of nurseries in Nairobi and Kisumu were individually owned, the study found that majority (87%)of nursery operators expressed the need for formation of microfinance institutions that will formulate appropriate financial packages since most of them have had to rely on family savings for operational capital. Thirteen percent (13%) of operators in Nairobi and 7% in Kisumu expressed the need for increased budget allocations for nurseries especially in the case of central nurseries. A small percentage (6%) of operators in Kisumu suggested the use of income from other enterprises when the funds are not available (Table 38).

4.8.3 Water Requirements

Most of tree nurseries in both regions had at least some access to water but their suggestions varied. In Nairobi majority of nurseries were found to rely on tap water and as such its reliability was not assured so 23% of operators recommended the provision of a reliable supply of piped water compared to 7% in Kisumu. Majority (37%) of operators in Kisumu and Nairobi (20%) expressed the need for the construction and purchase of water storage tanks. A significant number of nursery operators in Nairobi (43%) and Kisumu (33%) required nothing to be done about access to water (Table 38). This may be as a result of the fact that having known the importance of a reliable water supply to their nurseries most of them had taken steps to make sure the supply was reliable.

Table 38: Nursery operators views on what is needed to improve skills in Nairobi and Kisumu

	Views	Nairobi		Kisumu	
		No.	%	No.	%
Skills	Organize training in grafting, budding and seed collection	15	50	9	30
	Exchange information	3	10	1	3
	Organize field days and training seminars	11	37	18	60
	Provide finances for purchasing better equipment and tools	1	3	2	7
Capital	MFIs - appropriate financial packages	26	87	26	87
	Increase in budget allocation for the nursery.	4	13	2	7
	Use income from other enterprises.	0	0	2	6
Water	Construction and purchase of water storage tanks	6	20	11	37
	Construction of boreholes	0	0	4	13
	Avail reliable piped water supply	7	23	2	7
	Find alternative cheaper sources of water	4	13	3	10
	Nothing	13	43	10	33
Future	Improve output and quality of tree seedlings	25	83	17	57
	Increase species diversity in the nursery	4	13	9	30
	Shift to commercial production	0	0	3	10
	None	1	3	1	3
	Total	30	100.0	30	100.0

Source: Tree nursery survey 2004

4.8.4 Future plan for Nursery

The study found that majority of operators in Nairobi (83%) and Kisumu (57%) hoped to increase their output and improve the quality of tree seedlings they were producing (Table 38). Thirty percent (30%) of nurseries in Kisumu had below 10 species explaining why 30 % of operators expressed the fact that they hoped to increase the species diversity in the nursery compared to only 10% in Nairobi. Differences in the two regions were apparent as shown by the fact that while 10% of sampled operators in Kisumu were hoping to shift to commercial production in Nairobi they all were already commercial. A small percentage (3%) had no apparent future plan for the nursery. These results show that the nursery operators view the economic environment they operate in through different eyes. Consequently they have different plans, an issue that is bound to affect the availability and accessibility of tree seedlings and therefore the planting of trees.

4.8.5 Future plans for organizations involved in the development process.

The future plans for organizations still provide a lot of hope for the development process as those who own nurseries and those who support have different plans for the foreseeable future. For those who own nurseries one of the initiatives they have is to expand their nurseries and the establishment of distribution nurseries in many parts of the country. This will go along way in increasing access to quality germplasm. For those concerned with supporting the operators have plans that prioritize the nursery operator's welfare and promoting species which should help to boost knowledge and therefore increase demand for tree species. Welfare issues are to be addressed through the establishment of cottage industries, provision of piped water, increasing the number of nurseries and farmers involved in projects and to continue providing necessary support for sustainable improvement of operator's welfare especially in Kisumu (Table 39). Species promotion and market creation will include continuing to press for preservation and planting of indigenous trees and encouraging the formation of associations as a form of exit strategy for nursery operators in Nairobi. Furthermore there is hope that the Social Forestry Extension Model (SOFEM) will have a better impact through equipping the inhabitants of semi arid areas in Kenya with appropriate techniques for local residents to plant and manage trees by establishing farm forests. These plans show that there is a lot of goodwill from organizations concerning environmental conservation issues. But the ultimate success in the development process lies with collaboration between stakeholders and the harmonization of their efforts towards development goals.

Table 39: Future plans for organizations involved in the development process.

	Future plans	Organizations
Own nurseries	Need to expand the nursery	T B P, KEFRI
	Establish distribution nurseries in many parts of country	
Support nurseries	Help in the establishment of cottage industries and	VI, AFRIC N
	Increase the number of nurseries and farmers involved in projects	TOTAL, F D
	To continue providing necessary support for sustainable improvement of operators welfare	G B M, ICRAF
	Promotion of other tree species	
	Continue to press for preservation and planting of indigenous trees	
	Encourage the formation of Associations -exit strategy	
	Hopes to have a better impact with SOFEM	

Note: VI=VI AGROFORESTRY, AFRIC N=AFRICA NOW, TOTAL= TOTAL KENYA LTD, FD= FOREST DEPARTMENT, GBM= GREENBELT MOVEMENT, TBP=TREE BIOTECHNOLOGY PROJECT **Source: Tree nursery survey 2004**

4.8.6 Ideas to Improve Business

Majority of nursery operators in Nairobi (90%) and Kisumu (63%) were of the view that the creation of better marketing links and collaboration between organizations would create awareness and boost the sales of tree seedlings. In Kisumu (17%) operators were of the view that either improved awareness on available species or better training and refresher courses in nursery management could do a lot in improving the business and therefore the overall efficiency of the market. Seven percent (7%) of nursery operators in Nairobi and 3% in Kisumu were of the opinion that proper trade licensing of market participants was needed (Table 40). Even though the removal of license barriers presented operators with the option of free entry into the market it has also presented problems with the establishment of tree nurseries every where. This has considerably increased competition which while increasing access to tree seedlings for consumers has meant low profits for operators due to ever declining market shares. In addition the unlicensed tree seeds vendors often supply low quality tree seeds which result in heavy losses while operators have no reprieve over the matter. Even though the license matter was raised by a small fraction its worthwhile consider this option as low quality seeds translate to low quality seedlings and consequently reduced planting of trees.

Table 40: Nursery operator's views on what can be done to improve the tree nursery business.

Ideas	Nairobi		Kisumu	
	No.	%	No.	%
Create better marketing links and collaboration	27	90	19	63
Proper trade licensing of market participants	2	7	1	3
Improve awareness on available species	0	0	5	17
Better training and refresher courses for nursery management	0	0	5	17
None	1	3	0	0
Total	30	100.0	30	100.

Source: Tree nursery survey 2004

4.8.7 Organizations views on the way forward regarding their continued participation in the tree nursery development process.

In order to foster the development process, the sampled organizations recommendations on the way forward touched on four main areas concerning training, projects, inputs and networking (Table 41).

The training area requires intensified follow ups, provision of transport facilities, more focused training modules, development of resource centers within the communities, interactive extension training on record keeping and marketing skills.The project area requires the allocation of more funds for tree nursery development projects, project intensification and availability of more species. The input area on the other hand recommends more research on inputs and field trials in many parts of country, the reworking of contracts and discussions with operators and the consideration of alternate sourcing of tree seedlings from private nurseries. While the networking option calls for collaborations with other governmental and non governmental organizations.

The above options bring to light the attempt by organizations to try to tackle issues that have been raised by stakeholders in the development process. The training and project options are more relevant to the Kisumu region since its where the hands on approach is applicable with more organizations directly involved in trying to encourage more people to set up tree nurseries and participate in the development process. The inputs option is more relevant to the Nairobi market which is slightly more developed than the Kisumu market. In view of the highly developed market structure in Nairobi the hands off approach has been used by organizations to reduce the dependency syndrome and ensure that tree nursery enterprises are sustainable. The networking option is applicable to markets in the two zones as the recognition that more collaboration and agreeing on the agenda by various organizations is needed order to harness the benefits of tree nursery development efforts. Furthermore the organization of target areas into zones and targeting institutional strengthening, business development and capacity building have been billed as sure ways of effective extension work. Thus there is consensus on the way forward for the establishment of a sustainable tree seedling supply system that will ensure increased availability and accessibility of tree germplasm.

Table 41: Way forward for organizations involved in the development process

	Way forward	Organizations
Projects	Allocate more funding to tree nursery development projects Project intensification and availability of more species	KEFRI, VI
Training	Intensified follow ups , Provision of transport facilities, More focused training modules, Development of resource centers within the communities, Interactive extension training on record keeping and marketing skills.	ICRAF, AFRIC N
Inputs	More research on inputs and field trials in many parts of country Reworking of contracts & discussions with operators Alternate sourcing of seedlings from private nurseries	T B P, TOTAL, F D
Networking	Collaborations with other GOs and NGOs	KEFRI, VI, G B M, ICRAF, AFRIC N, T B P, TOTAL, F D

Note: VI=VI AGROFORESTRY, AFRIC N=AFRICA NOW, TOTAL= TOTAL KENYA LTD, FD= FOREST DEPARTMENT, GBM= GREENBELT MOVEMENT, TBP=TREE BIOTECHNOLOGY PROJECT **Source: Tree nursery survey 2004**

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The survey revealed that Nairobi had an oligopolistically competitive market structure where central nurseries controlled most of the output and utilised non price competition like product development and advertising and sold tree seedlings at low (subsidised) prices. However all nursery managers /operators utilised the cost based pricing mechanism but there was no market leader for price leadership. Kisumu had a monopolistically competitive market structure comprising of several or many nursery operators /managers each producing similar but slightly differentiated tree seedling species. Each nursery operator /manager can set tree seedling prices on the basis of cost, demand and market without affecting the tree seedling market as a whole. Both markets comprised of a high proportion of decentralized nurseries managed mainly by men aged between 30 to 50 years with primary or secondary education. All decentralized nurseries specialised in all the three sizes of tree seedlings with central nurseries specializing in only the transplanting size with the exception of Kisumu where they also offered medium sized tree seedlings. However tree seedlings were more expensive in decentralized nurseries in Nairobi compared to Kisumu. The main barrier to entry into the tree seedling market was access to capital while other constraints like production (sourcing of soil, manure, seeds, poly tubes and implements) and management constraints (pest and disease control and funding shortages) continue to plague the production of tree seedlings. Most of tree nurseries offered between 10-30 tree species with Nairobi having higher species richness on the basis of total species but the same species richness as far as dominant species were concerned. In addition fruit tree seedlings were to be found in decentralized nurseries only. Main promotional strategy for tree nursery operators in Nairobi was location of nursery and signboards while in Kisumu nurseries in Kisumu utilised announcement in chief's *barazas,* field days, shows, exhibitions and issue of free samples. While majority of decentralized nursery operators offered landscaping services, the centralized nursery mangers offered extension services in both areas. Other nursery operators are a basic source of nursery skills. Most decentralized nursery operators produced seedlings strictly for sale while most centralized nursery mangers produced for own use but surplus for sale. A higher proportion of nurseries in Nairobi had 50-80% under tree seedlings while in Kisumu a higher proportion

had over 80% of nurseries under tree seedlings. In addition most nursery operators in Nairobi perceived the demand for tree seedlings to be medium while their counterparts in Kisumu thought it was high, even though the amounts they had in mind differed significantly. Most of the nurseries in were located on road reserves. Most nursery operators employed less than ten people comprising of only workers. All nurseries had access to water with most nursery operators in Nairobi relying on tap water while those in Kisumu relied on river water. Own savings were main source of capital for decentralized nursery operators while bank credit was the main source of credit for centralized nursery managers. The containerized system (polythene bags) was the main production system for tree seedlings in most nurseries. Hard support for own nurseries was provided through timely purchasing and contracting while for support nurseries was thorough encouraging the use of local materials and collaboration. Soft support was provided through interactive extension, printed and electronic media. Some of the constraints faced by organizations include transportation, lack of funds, water and seed problems. However, most organizations prefer to work with individual nurseries and emphasize on high value, eucalyptus and indigenous tree species. Other projects for organizations include sourcing of tree seeds, farm projects for food security and environmental conservation. While majority of nurseries produce 100000 seedlings per annum they face annual demand of 50000 seedlings. All nurseries in Nairobi have a market efficiency of 51% while those in Kisumu have a market efficiency level of 58%. However the combined effect of both organizational and nursery operator/manager strategies is a market efficiency level of only 54%.Even though majority of nursery operators received no support , support had a better impact at the centralized than decentralized level. The regression results showed that nursery performance was influenced by marketing mix and production aspects while organization was influenced by prices and the availability transport and storage facilities.

5.2 Conclusion

Based on the results we reject the null hypotheses and conclude that market structure and conduct of market participants do have an effect on the performance of tree nurseries and organization of the tree seedlings market. Organizational support has an important role to play in the overall efficiency of the market as shown in the figure below. Hence it is

important for all stakeholders to collaborate to ensure that their activities are not counterproductive to the development process. Thus the underlying socio- economic, cultural, and demographic conditions in Kenya provide an economic environment that favours the establishment of the decentralized over the centralized approach. Even though the location of and the species diversity in these tree nurseries presents them as excellent access points to tree germplasm for farmers, only about fifty percent of their output reaches the ultimate consumers. This perhaps is an indicator of the potential threat posed by dead stock to the establishment of a sustainable tree seedling supply system. Furthermore, the low performance level observed also highlights the fact that previous investments in the development process may have yielded considerable increases in nursery productivity while little change has occurred with marketing. Consequently the establishment of a sustainable tree seedling supply system depends on how well stakeholders address issues concerning the provision of infrastructure, market information, access to credit, security and capacity building opportunities for entrepreneurs. The similarity observed between constraints facing the marketing of tree seedlings and other agricultural products shows that tackling these constraints from the tree seedlings point of view is likely to benefit participants involved in other agricultural product markets.

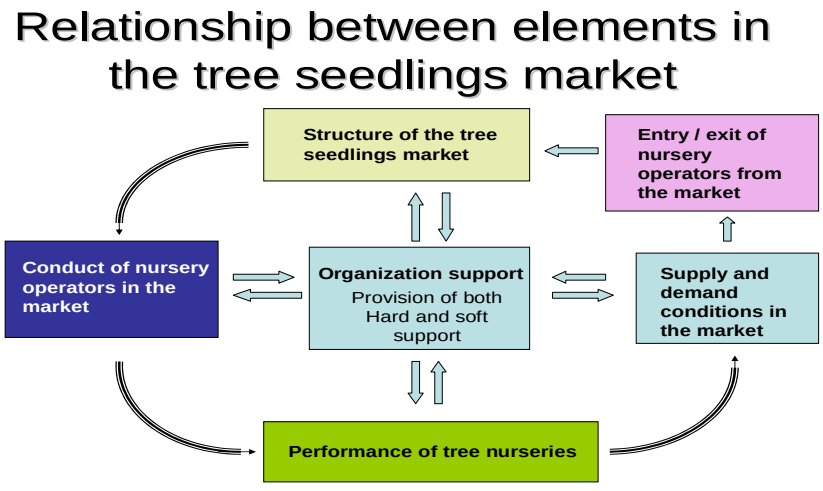


Figure 4: Relationship between elements in the tree seedlings market.

5.3 Recommendations

This market creation may be made possible with the following approaches.

Direct creation of tree seedling demand through:

- Government organizations should consider sourcing tree seedlings for their conservation programmes from private nursery operators.
- The tree biotechnology project should consider divesting from seedling production and concentrate on production of clones from cuttings while acting as agents (seed vendors) because they have the machinery for quality checking and links with suppliers who deal with eucalyptus seeds. In line with their future plan for the establishment of distribution nurseries all over the country would provide good access points for eucalyptus seeds for nursery operators.

Indirect creation of demand through:

- The allocation of more funds for nursery projects will help to increase the scope of provision of both hard and soft support from support organizations. This should lead to increase in natural and human capitals which have been shown to have positive impacts on production of high quality seedlings leading to high demand.
- Formulation of appropriate financial packages by the micro finance institutions for nursery operators will help boost access to credit which in turn will increase the purchasing power for these nursery operators and their ability to promote the tree species products available in their nurseries.
- Formulation of policies that will guarantee nursery operators security both at the general and land tenure level to ensure increased investment into the tree seedlings market.
- Formulation of policies that will ensure that nursery operators have a cheaper access to piped water; protection of rivers and their sources; increased investment into the drilling of boreholes that will ensure nursery operators /managers have access to stable water supply.
- Provision of basic infrastructure like transport and storage facilities for central nurseries.
- Increased use of mass media like radio, television, internet and newsprint by stakeholders to increase awareness not only about what is on offer in the tree

nurseries but also the quality assurance that individual nursery operator's ability to supply high quality seedlings.

- The awareness campaigns should also include information about how farmers can best utilize the potential uses of the tree species that are grown on their farms which should result in other agro based industries.
- Proper trade licensing of market participants. With the evolvement of tree seedling markets the quality of seedlings is increasingly important as such the need for quality tree seeds requires proper licensing of seed vendors which will help guarantee operators of the supply of tree germplasm hence the quality of seedlings produced.
- The current marketing chain should be expanded to include middlemen who can concentrate only on the marketing of tree seedlings since most operators resources limit them to production only with no funds left over for promotional activities.
- More focused joint concerted efforts that have an agreed agenda so that no organization activities are counter productive in support provision.

Areas for further research:

- The identification of price as an important factor influencing the market entry/exit. There is need for more marketing studies to into the price setting mechanisms in the tree seedlings market to ensure that efficient prices are set that would encourage entrepreneurs to enter the market at the centralized level other than decentralized nurseries as is now the case.
- The calculation of nursery performance based on tree seedlings only could be misleading to some point considering that these nursery enterprises are involved in the production of ornamentals which have an effect on resources allocated to tree seedlings production. Thus future studies incorporating other nursery enterprises may be helpful in determining the decision making process at the nursery operators/managers level.

In view of the encroachment onto fragile areas in search of cropping land due to the increasing demographic pressure and on the basis of the pessimistic and opportunistic hypotheses. It's expected that land will become scarcer and therefore the need for increased investment into the conservation process. With this increase in demographic pressure we also expect that group nurseries which have served to provide merely a transition point between

the two stable nursery types through crucial human capital required for successful operation of these enterprises will become more sustainable as was observed in countries like Malawi. Even though the results from this study seem to agree with critics of the SCP model like E.G. Nourse who contended that firms conduct and performance were functions primarily of the individual idiosyncrasies of the firms managers. This study however also supports the contention that there is some sort of causal relationship in which structure determines performance but the relationship is both ways. It's hoped that the implementation of the above recommendations will help in the formulation of policies that will help in creating a more conducive environment for the establishment of a sustainable and efficient tree seedling supply system that will ensure the availability and accessibility of tree seedlings to farmers.

REFERENCES

Aalbaek, A. (2001). Access to Planting Material as a Major Constraint to Farmer tree planting: A National Investigation of Farmer Tree Planting and Nursery Production in Tanzania. PhD Dissertation, Department of Economics and Natural Resources, Royal Veterinary and Agricultural University.

Ackello–Ogutu, A.C. (1976). The Marketing of Poultry Meat and Eggs in Nairobi. Msc.Thesis, University of Nairobi.

Ainebyona, W. M. (1988). The Structure and Conduct of the market for cooking bananas in Kampala City, Uganda. Unpublished Msc. Thesis. University of Nairobi.

Ayieko, M. W. (1995). Analysis of Marketing Efficiency and Price Spreads: A Case of Kisii Cooking Bananas to Nakuru Municipality, Kenya. Unpublished Msc. Thesis. Egerton University.

Ahmed, I. (Ed.), (1985). Technology and Rural Women: Conceptual and Empirical Issues. George Allen and Unwin, London.

Alemu, Tekie. (1999). Land Tenure and Soil Conservation: Evidence from Ethiopia. Ekonomiska Studier (92). Goteborgs Universitet (Kompendiet –Goteborg).

Azhar, R.A., (1991). Educational and Technical Efficiency during the Green Revolution in Pakistan. *Economic Development and Cultural Change*, Vol. **39**, No. 3, pp.651-665.

Basweti, C., Jaenicke, H., Lengkeek, A., & Prytz, L. (2000). Tree Nursery Trade in Urban and Peri-Urban Areas. Report of a Survey of Nairobi and Kiambu Districts, Kenya. RELMA Research Report. Regional Land Management Unit, Nairobi, Kenya 25pp.

Bain, J.S. (1941). The Profit Rate as a Measure of Monopoly Power. *Quarterly journal of economics* **55**:271-293.

Bain, J.S. (1959). Industrial Organization. New York: John Wiley & sons Inc.

Bain, J.S. (1968). Industrial Organization. 2nd Edition, New York: John Wiley & sons Inc.

Berger, M., DeLancey,V.& Mellencamp, A.,(1984). Bridging the Gender Gap in Agricultural Extension. International Centre for Research on Women, Washington, D.C.

Biodiversity Analysis Package, (2003). World Agroforestry Centre (ICRAF).

Bohringer, A., Ayuk, E.T., Katanga, R. & Ruvuga, S. (2002). Farmer Nurseries as a Catalyst for Developing Sustainable Land Use Systems in Southern Africa. Agricultural Systems **77**,187-201.

Bohringer, A., Katanga R., Makaya, P.R., Moyo, N. & Ruvuga, S. (1999). Planning for Collaboration in Agroforestry Dissemination in Southern Africa. Southern Africa Agroforestry Development Series No.1. International Centre for Research in Agroforestry, Makoka, Malawi.

Bonnard, P. & Scherr, S., (1994). Within Gender Differences in Tree Management: Ss Gender Distinction A Reliable Concept? , *Journal of Agroforestry Systems* Vol**. 25**, pp. 71-93.

Boserup, Esther. (1965). Conditions of Agricultural Growth: The Economies of Agrarian Change under Population Pressure. New York: Aldine Publishing Co.

Bressler, P.G. & King, R.A. (1970). Market Prices and Interregional Trade. Uliley.

Caves, R. (1982). American Industry: Structure, Conduct and Performance.*5th* Edition. Englewood Cliffs.NJ, USA: Prentice Hall.

Chamberlain, E. H. (1933). The Theory of Monopolistic Competition, Cambridge Mass: Harvard University Press.

Clay, D.C. & Reardon T. (1992). Determinants of Farm Level Conservation Investments in Rwanda. In: Issues in Agricultural Competitiveness: Markets and Policies. International Association of Agricultural Economists, USA.

Cleaver, K. & Schreiber, G., (1992). The Population, Agriculture and Environment Nexus in Sub Saharan Africa. Africa Region, World Bank, Washington D.C.

Colchester, M. & Lohmann, L.(Eds.),(1993). The Struggle for Land and the Fate of the Forests. Zed Books Ltd, London.

Cruz, M.C., Meyer, C.A., Reppetto, R. & Woodward, R., (1992). Population Growth Poverty and Environmental Stress: Frontier Migration in the Philippines and Costa Rica. World Resources Institute, Washington D.C.

Daniel, W.W. & Terrell, C.J. (1975). Business Statistics, Basic concepts and Methodology. Houghton Miffin Company, Boston.

Davidson, J. (Ed.), (1988). Agriculture Women and Land: The African Experience. Westview Press, Boulder, Colorado.

Davies ,A.& Cline ,T.,(2005). A consumer Behavior Approach to Modeling Monopolistic Competition . Journal of Economic Psychology 26: pp 797-826.

Deininger, Klaus & Gershon Feder., (1998). Land Institutions and Land Markets. A Paper Prepared as a Background for the Coming Handbook on Agricultural Economics World Bank, Washington D.C.

Devine, P.J., N. Lee, R. M. Jones & W. J. Tyson. (1984). An Introduction to Industrial Organization. 5th Edition. London, UK: George Allen and Unwin.

Dewees, P.A. (1995a). Forestry Policy and Wood Fuel Markets in Malawi. Natural Resources Forum **19**(2), 143-152.

Dewees, P.A. (1995b). Trees on Farms in Malawi: Private Investment, Public Policy, and Farmer Choice. World Development 23(7), 1085-1102.

Feldstein, H.S. & Poats, S.V.(Eds). (1989). Working Together: Gender Analysis in Agriculture, Vol.1, Case Studies. Kumarian Press., West Hartford.

Fortmann, L. & Rocheleau, D. (1985). Women and Agroforestry; Four Myths and Three Case Studies. *Agroforestry Systems* Vol. **2**: 253-272.

Francis, K.J. (1995). The Use of PRA in Monitoring Forestry Projects: Experiences From Tanzania. Ann. For.**3** (2), 105-114.

Frank, Knight, (1921). Risk, Uncertainty, and Profit.

Friends of Nairobi Arboretum (FONA), (2001). Nairobi Arboretum the Place of Trees.

Gavian, S. & Fafchamps, M. (1996). Land Tenure and Allocative Efficiency in Niger. *Americana Journal of Agricultural Economics*, **78**(2), 460-471.

Gachanja, S.P& Ilg, P. (1990). Fruit tree nurseries. Ministry of Agriculture, Soil and Water Conservation Branch. Industrial Printing Works, Kenya.

Gans, J., King, S., Stonecash, R. & Mankiw, N.G.(2003).Principles of Economics .Thomson Learning .ISBN 0-17-0114414.

Gould, J.P. & C.E. Ferguson. (1980). Micro Economic Theory. 5th Edition. Homewood, IL, USA: Richard D. Irwin, Inc.

Green, W .H. (2000). Economic Analysis. 4th Edition by Prentice Hall Inc. Upper Saddle River New Jersey 07458.

Guggenberger, C., Ndulu, P. & Shepherd, G. (1989). After Ujamaa: Farmer Needs Nurseries and Projects Sustainability in Mwanza, Tanzania. The Overseas Development Institute (Agricultural Administration Unit), London.

Haug, R., (1999). Some Leading Issues in International Agricultural Extension, a Literature Review. *The Journal of Agricultural Education and Extension* **5**(4), 263-274.

Hirschmann, D., (1993). Democracy and Gender: A Practical Guide to USAID Programs. Genesys Special Studies No. 9. USAID and Futures Group, Washington D.C.

Holden, S. & Yohannes, H., (2001). Land Redistribution, Tenure Security and Intensity of Production: A Study of Farm Households in Southern Ethiopia. Capri Working Paper No.21, Washington D.C: International Food Policy Research Institute.

Holding, C. & Omondi, W. (1998). Evolution of the Provision of Tree Seed Extension Programmes. Case Studies for Kenya and Uganda. Regional land Management Unit, Nairobi, Kenya.

ICRAF (1996) Annual Report 1995, Nairobi, Kenya; ICRAF.

Ishak, H. O. (1988). Market Power, Vertical Linkages and Government Policy: The Malaysian fish industry. Ph.D. Diss., University of Anglia, East Anglia, UK.

Jacobs, S., (1991). Land Resettlement and Gender in Zimbabwe: Some Findings. *The Journal of Modern African Studies*, Vol. **29**, No.3, pp.521-528.

Jaenicke, H. (1999). Good Tree Nursery Practices: Practical Guidelines for Research Nurseries. International Centre for Research in Agroforestry, Nairobi, Kenya.93pp.

Jaenicke, H. (2001). Innovative Strategies for Research on Small-scale Tree Nursery Development. International Centre for Research in Agro Forestry, Nairobi, Kenya.17pp.

Jamison, D.T & Lau, L.J., (1982). Farmer Education and Farm Efficiency in Nepal, John Hopkins University Press, Baltimore Maryland.

Jamison, D.T. & Moock, P.R., (1984). Farmer Education and Farm Efficiency in Nepal: The Role of Schooling, Extension Services and Cognitive Skills. *World Development* Vol.**12**, No.1, pp.66-86.

Jones, N. (1993). Essentials of Good Planting Stock. Forests and Forestry Technical Bulletin Number 2.Washington D.C. USA: World Bank /AGRNR.7pp.

Kangasniemi, J. & Reardon T., (1991). Demographic Pressure and the Sustainability of Land Use in Rwanda in: Issues In Agricultural Competitiveness: Markets and Policies. International Association of Agricultural Economists, USA.

Kaur, R., (1991). Women in Forestry in India. Working Paper No.714. Women in Development Division, Population and Human Resources Department World Bank, Washington D.C.

Kaysen, C. & Turner, D.F., (1959). Antitrust Policy .Cambridge: Harvard University Press.

Kidanu, A. & Alemu ,T., (1994). Rapid Population Growth and Access to Farm Land: Coping With Strategies in Two Peasant Associations in North Shoa. In Land Tenure and Land Policy in Ethiopia after the Derg. Ed. Dessalegn Rahmato. (1994a).

Kumar, N., (1988). The Role of Women in Forestry and Natural Resource Management .Consultant Report, PHRWD, World Bank, Washington D.C.

Kwesiga, F., Beniest, J., (1998). Sesbania Improved Fallows for Eastern Zambia: An Extension Guideline. International Centre for Research in Agroforestry, Nairobi, Kenya.

Kailikia, P.M. (1992). The Structure and Conduct of the Animal Feeds Industry in Kenya: Case of Situation in Kiambu District and Nairobi Province. Unpublished Msc. Thesis. University of Nairobi.

Koch, J.V. (1980). Industrial Organization and Prices. Prentice Hall Inc., Englewood Cliffs.

Koutsoyiannis, S.A (1977). Theory of econometrics .2nd Edn.New York: Harper and Row.

Kosura, O. (1995). Land Tenure and Agricultural Development in Kenya: Ministry of Agriculture, Livestock and Development and Marketing.

Lerner, A.P. (1934). The Concept of Monopoly and the Measurement of Monopoly Power. *Review of economic studies* **1**:157-75.

Lin, J.Y., (1991). Education and Innovation Adoption in Agriculture: Evidence from Hybrid Rice in China. *American Journal of Agricultural Economics*, Vol.**73**, No.3, pp.713-723.

Maxwell, D. & Weibe, K.,(1999). Land Tenure and Food Security: Exploring Dynamic Linkages. *Development and Change,* **30** (4): 825-849.

Mehra, R., (1997). Women's Land Rights and Sustainable Development in: Issues in Agricultural Competitiveness: Markets and Policies. International Association of Agricultural Economists, USA.

Molnar, A. & Schreiber, G., (1989). Women and Forestry: Operational Issues .Working Paper No 184. Women in Development Division, Population and Human Resources Department World Bank, Washington D.C.

Myers, N., (1991). The Worlds Forests and Human Populations: Environmental Interconnections. In: Davis, K. and Bernstam, Msc (eds), Resources, Environment and Population: Present Knowledge, Future Options, Oxford Press For Population And Development Review, London.

Muriuki, J. & Jaenicke, H., (2001). Tree Nurseries Under Individual and Group Management .A Case Study from Meru District, Kenya. Submitted to Forests, Trees and Livelihoods.

Muriuki, J. & Carsan, S., (2004). Assessing the merits of community level seedling production and distribution. In Ngamau, C., Kanyi, B., Epila-Otara, J., Mwangingo, P. and Wakhusama, S. (2004). Towards optimizing the benefits of clonal forestry to small-scale farmers in East Africa. ISAAA Briefs No. 33. ISAAA: Ithaca, New York, USA.

Muriuki, J., (2005). Informal tree seed quality and supply systems. A case study of peri-urban Nairobi, Meru and Western Kenya. Unpublished M. EnvS Thesis. Kenyatta University

Mwichabe, S., (1996). A Proposal for National Land and Land -Use Policy in Kenya. In: People, Land, Laws and Environment, KENGO/UNEP.

Nduati, G.J. (1993). Structure, Conduct and Performance of the Marketing System for Cutflowers in Kenya.Unpublished Msc. University of Nairobi.

Ngigi, M.W., (1988). Structure, Conduct and Performance of Egg Marketing Between Kiambu and Nairobi. Unpublished Msc. Thesis. University of Nairobi.

Ngigi, M.W., (2002). An Evaluation of the Impacts of Transaction Costs and Market Outlets, Risks on Market Participation of Smallholder Dairy Farmer in Central Kenya. Unpublished PhD. Thesis, University of Nairobi.

Ngugi, A.W. & Brabley, P.N., (1986). Agroforestry, Soil Conservation and Wood Fuel in Murang'a District. Nairobi, the Beijer Institute.

O'Connor, N., (1997). Constraints and Solutions to Small Scale Tree Nursery Management in the Coffee Based Land Use Systems of Murang'a District, Central Highlands, Kenya. Msc. Thesis University College Dublin, Ireland .105p

Otsuka, K. & Hayami, Y., (1988). Theories of Share Tenancy - A Critical Review. *Journal Of Economic Development and Culture Change* .Vol.**57**, pp.31-88.

Palmer, I., (1985).The Impact of Agrarian Reform on Women. Kumarian Press, West Hartford, Connecticut.

Panayatou, T., (1993). Green Markets: The Economics of Sustainable Development. International Centre for Economic Growth, San Francisco.

Papandreou, A.G., (1949). Market Structure and Monopoly Power. *American Economic Review* **39**:883-97.

Pinckney, C.T., (1992). Does Education Increase Agricultural Productivity In Africa? in: Issues In Agricultural Competitiveness: Markets And Policies. International Association of Agricultural Economists, USA.

Place, F. & Hazell, P., (1993). Productivity Effects of Indigenous Land Tenure Systems in Sub-Saharan Africa. *American Journal of Agricultural Economics.*

Place, F. & Dewees, P.A., (1999). Policies and Incentives for the Adoption of Improved Fallows. *Agroforestry Systems* **47**(1-3), 323-434.

Place, F. & Otsuka, K. (2001). Tenure, Agricultural Investment and Productivity in the Customary Tenure Sector of Malawi. *Economic Development and Cultural Change* **50**(1), 77-99.

Pomeroy, R.S. (1989). The Economics of Production and Marketing in a Small-scale Fishery: Matalom, Leyte, Philippines. ICLARM.

Pudasani, S.P., (1983).The Effects Of Education in Agriculture: Evidence from Nepal. *American Journal of Agricultural Economics*, Vol.**65**, No.3, pp.509-515.

Rathgeber, E.M., (1990). WID, WAD, GAD: Trends in Research and Practice. *Journal of Developing Areas* **24**(7): 489-502.

Rothschild, K.W.,(1942). The Degree of Monopoly Power. *Economica* 9:24-40.

Rosenbluth, G., (1955). Measure of Concentration, National Bureau of Economic Research Conference Report. Princeton University Press.

Shanks, E. & Carter, J., (1994). The Organization of Small-scale Tree Nurseries. Rural Development Forestry Study Guide 1.Overseas Development Institute, London. UK. 144 pp.

Scherr, S.J. (1994). Meeting Household Needs: Farmer Tree Growing Strategies in Western Kenya in: Arnold, J.E.M. & Dewees, P.eds. Trees in Farmers Strategies: Response to Agricultural Intensification. Oxford University Press, Oxford.

Scherer, F.M., (1980). Industrial Market Structure and Economic Performance. 2nd Edition. Chicago, IL, USA: Rand McNally College Publishing Co.

Scott, G.J., (1995). Prices, Products and People. Analysing Agricultural markets in developing countries. Lynne Rienner Publishers Inc, Boulder, Colorado.

Smith, L.R., (1981). The Economics of Milkfish Fry and Fingerling Industry of the Philippines. ICLARM Technical Reports I. International Centre for Living Aquatic

Resources Management, Manila and Aquaculture Department (ICLARM). Southeast Asian Fisheries Development Centre Iloilo, Philippines.

Staudt, K, A., (1982). Women Farmers And Inequalities In Agricultural Services ,In Bay ,E. (Ed.), Women And Work In Africa ,Westview Press ,Boulder ,Colorado.

Sosnick, S.H., (1981). Operational Criteria for Evaluating Market Performance In: L.R.

Tomek, W.G. & K.L. Robinson. (1981). Agricultural Product Prices. 2nd Edition, Ithaca, NY, USA: Cornell University press.

USAID (United States Agency for International Development).,(1993). Gender and the Environment: Crosscutting Issues in Sustainable Development. Office of Women in Development, USAID, Washington D.C.

Venkatesan, V., Kampen, J., (1998). Evolution of Agricultural Services in Sub-Saharan Africa: Trends and Prospects. World Bank Discussion Paper No.39. The International Bank for Reconstruction and Development. Washington D.C.

Wightman, K., (1999). Good Tree Nursery Practices: Practical Guidelines for Community Nurseries. International Centre for Research in Agro Forestry, Nairobi, Kenya. 96pp.

Wynter, P., (1990). Property, Women Fishers and Struggle for Women's Rights in Mozambique, *Sage*, Vol**. 7**.pp.33-37.

APPENDIX

Appendix 1: Survey questionnaire for nursery operators

Title: Tree nursery development approaches and their sustainability in Kenya

Questionnaire for nursery operators
Questionnaire No._____

A General data;

1. District: _____ division _____ location _____
2. Sub location _____ date of interview _____
3. Land tenure system: _____
4. Type of nursery approach: Private / individual ☐ Group ☐ Central ☐
5. Nursery site: roadside ☐ backyard ☐ open space ☐ other:_____
6. What made you to choose this particular site or location:
   _____
   _____
   _____
   _____
7. Name of institution linked to the nursery: _____

B BIODATA

8. Name of respondent _____sex: Male ☐ Female ☐
9. Designation in nursery management: owner ☐ manager ☐ worker ☐
10. Age of the nursery manager? _____
11. Level of education of the nursery manager?
    Primary school ☐ Secondary school ☐ College/university ☐
12. Experience in tree nursery management?

    First timer ☐ previous experience ☐
13. If previous experience, where did you acquire the skills

    Other farmers ☐ group nurseries ☐ forestry extension ☐
14. Do you think skills and experience have any impact on the nurseries production of seedlings? Yes ☐ No ☐

15. Please comment?

_____
_____
_____
_____

16. Have you improved your skills by engaging in tree nursery production?

Yes ☐ No ☐

17. Please comment?

_____
_____
_____

18. What should be done to improve the skills in nursery production?

_____
_____
_____

C NURSERY PRODUCTIVITY

19. What is the proportion of trees to ornamentals in your nursery? _____

20. How many different tree species do you raise in your nursery? _____

21. Please name some of the main species (those in high demand or produced in large quantity)?

Tree species	No. of seedlings	Size of seedling	Price per seedling

22. What is the demand level for your seedlings?

Low ☐ Medium ☐ High ☐ Please give an approx No._____

23. Do you consider the demand level when deciding the output level? Yes ☐ No ☐

24. Please comment?

_____
_____
_____
_____

25. What is your annual production of seedlings? _____

26. What is the intended use of the seedlings?

Strictly, for sale ☐ strictly for own use ☐

Own use but surplus for sale ☐ other. ☐

27. If other please comment? _____

28. When choosing species to raise in your nursery do you consider the following?

Raising difficulty	☐	Length of nursery cycle	☐
The need for specialized treatment	☐	Input requirements	☐
All the above	☐	None	☐

29. Which nursery method do you use in your nursery?

Swaziland raised beds ☐ polythene bags ☐ both ☐ other ☐

30. Please give a reason for choice.

_____

_____

31. Do you have access to water? Yes ☐ No ☐

32. What is your main source of water?

Tap water ☐ rain ☐ river ☐ borehole ☐ other_____

33. In your opinion what needs to be done with respect to access to water?

_____

_____

_____

_____

34. Is labor for nursery management activities available? Yes ☐ No ☐

35. Please comment.

_____

_____

_____

_____

36. How many employees do you have working in your nursery? _____

37. What is the main composition? Family ☐ workers. ☐ Both ☐

38. Do you offer any training in nursery management to those who might be interested?

Yes ☐ No ☐

39. Please comment?

_____
_____
_____
_____

40. Is capital available for running of the nursery? Yes ☐ No ☐

41. What is your main source of capital?
Group members' ☐ Family savings ☐ Bank or other FIs. ☐

42. What should be done to increase the access to capital?

_____
_____
_____
_____

43. Is land available for tree nursery establishment? Yes ☐ No ☐
44. Please comment?

_____
_____
_____
_____

45. Do you offer any other services apart from the sale of seedlings?
Yes ☐ No ☐
46. Please comment

_____
_____
_____
_____

47. Do you have facilities for storage handling and transportation of seedlings?
Yes ☐ No ☐
48. Please comment

_____
_____
_____
_____

49. Please comment on your Prices for seedlings?

_____
_____

_____
_____

50. What is your basis of pricing seedlings? Demand ☐ cost ☐ competition ☐ market ☐

51. What are some of your promotional strategies to increase demand for your seedlings?

_____
_____
_____
_____

52. Do you have any security concerns for your nursery? Yes ☐ No ☐

53. Please comment

_____
_____
_____
_____

54. Are you aware of any other approaches to tree nursery development?

Yes ☐ No ☐

55. What made you to choose this approach?

_____
_____
_____
_____

56. Do you think this approach is sustainable in the long run? Yes ☐ No ☐

57. Please comment?

_____
_____
_____
_____

58. Have the community aspects like tree-planting culture had any influence on the kind of species that you raise in the nursery? Yes ☐ No ☐

59. Please comment?

_____
_____
_____
_____

60. Have you received any support in regards to tree nursery development?
Yes ☐ No ☐

61. If yes, have you received material inputs such as tree seed, innoculum, tools and fencing? Yes ☐ No ☐

62. If yes, please name some of the organizations that support your nursery?

_____
_____
_____
_____

63. Have you received any information, training and backstopping advice?
Yes ☐ No ☐

64. If yes, please name some of the organizations that support your nursery in this regard?

_____
_____
_____
_____

65. Do you have any other constraints that you face in tree nursery production?

Yes ☐ No ☐

66. Please comment

_____
_____
_____
_____

67. What is your plan for this nursery?

_____
_____
_____
_____

68. Do you have any ideas on how your business could be improved?

_____
_____
_____
_____

Thank you very much, for taking time to answer the questions, have a good day.

Appendix 2: Questionnaire for organizations survey

Title: Tree nursery development approaches and their sustainability in Kenya: case of organizational strategies in the development process.

Questionnaire for organizations involved in the development process

1. Name of District: Nairobi ☐ Kisumu ☐
2. Name of organization _____ Inception Year: _____
3. Name of respondent _____ Designation: _____
4. What is your mission:
   _____
   _____
   _____
   _____
5. How many tree nursery development projects have you initiated since inception?
   _____
6. How many of these nursery projects are still operational currently? _____
7. Please name at least 6 contact nurseries that you work with?
   _____
   _____
   _____
   _____
8. What is your main objective for setting up the tree nursery project?
   _____
   _____
   _____
   _____
9. What strategies have you put in place to ensure that the tree nursery project receives the basic inputs of production on time in required quantity and quality?
   _____
   _____
   _____
   _____
   _____

10. What strategies have you put in place to ensure that the nursery manager or operator receives up to date information that can be used in decision-making process of nursery management?

_____
_____
_____
_____
_____
_____

11. What strategies have you put in place to ensure that the produced seedlings actually reach the intended users?

_____
_____
_____
_____
_____

12. Are there other organizations that you link with in providing support to your nurseries to ensure success?

_____
_____
_____
_____

13. Which approach to tree nursery development do you prefer? Central ☐

    Group ☐ Individual ☐

14. Please comment

_____
_____
_____
_____

15. Do you think this approach that you have been using has been effective and sustainable in tree seedling supply?

_____
_____
_____
_____
_____

16. Do you emphasize on any particular tree species production in the tree nursery development projects you have initiated? Yes ☐ No ☐

17. Please comment?

_____
_____
_____
_____

18. Do you feel that you have achieved your intended objectives through the tree nursery development projects?

_____
_____
_____

19. What are some of the positive or negative effects that have contributed to your success or failure?

_____
_____
_____
_____
_____

20. What are some of the constraints that you encounter in everyday running of these tree nursery development projects?

_____
_____
_____
_____
_____

21. What do you think should be done to improve the sustainability of these projects?

_____
_____
_____
_____
_____

22. What are some of the other projects that you are engaged in?

_____
_____
_____
_____

23. Are the tree nursery development projects major or minor projects in your calendar?

_____
_____
_____
_____

24. What are your futures plans regarding your involvement in tree nursery development projects?

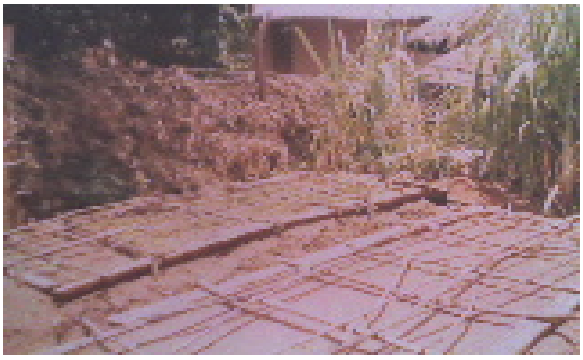
_____
_____
_____
_____
_____

Thank you very much, for taking time to answer the questions, have a good day.

Appendix 3: Sample Photos from tree nursery survey

Tree biotechnology project –central nursery

Tree biotechnology project –central nursery



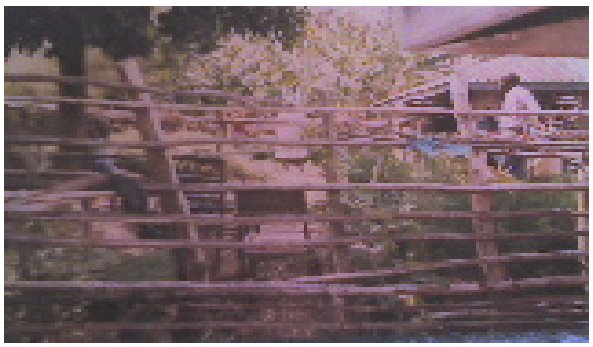
Swaziland Bed –individual nursery -Maseno

Central nursery in western Kenya

KEFRI central nursery in Maseno

Individual nursery in Kisumu (Roadside)

Tree nursery shade in Kisumu (total Kenya)



home backyard nursery in Kisumu

Appendix 4: Data reliability for the sample data

In order to establish the reliability of the sample data, a reliability coefficient was estimated following Daniel *et al.* (1975).

Test of data reliability for sample data collected.

Test Variable	N	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Age of Respondents	60	40.52	11.62	1.50	26.998	59	.000

The t value of 26.998 is greater than the critical value of 1.96 thus the level of confidence of sample data reliability is over 95%. The sample mean and sample standard deviation were used because the population mean and variance are not known.

Appendix 5: Chow test

Test of equality between coefficients obtained from different samples **(Chow test)**

Model		Sum of Squares	df	Formula
POOLED	Regression	3284.598	1	
	Residual	18146.226	49	Q1
	Total	21430.824	50	
1	Regression	8544.787	6	
	Residual	1997.675	19	R1
	Total	10542.462	25	
2	Regression	5897.480	4	
	Residual	3374.520	20	R2
	Total	9272.000	24	
		5372.195	39	Q2=R1+R2
		12774.031	10	Q3=Q1-Q2
	2.08			F= (10/39)-at 5%
	9.2734			F*=(Q3/df)/(Q2/df)

Appendix 6: Species diversity analysis results

Results for Species Richness Based On Total Number of Tree Species in Sampled Tree Nurseries.

SPECIES RICHNESS FOR NURSERIES IN NAIROBI (natural log)

NURSERY APPROACH	Mean	N	Std. Deviation	Variance	Std. Error of Mean
individual	2.8221	26	.5221	.273	.1024
central	2.8152	4	1.4597	2.131	.7298
Total	2.8212	30	.6748	.455	.1232

ANOVA Table

		Sum of Squares	df	Mean Square	F	Sig.
SPECIES * NURSERY APPROACH	Between Groups (Combined)	.000	1	.000	.000	.985
	Within Groups	13.206	28	.472		
	Total	13.206	29			

SPECIES RICHNESS FOR KISUMU (natural log)

NURSERY APPROACH	Mean	N	Std. Deviation	Variance	Std. Error of Mean
individual	2.2901	25	.5746	.330	.1149
group	2.7607	2	.6479	.420	.4581
central	2.7432	3	.4592	.211	.2651
Total	2.3668	30	.5768	.333	.1053

ANOVA Table

		Sum of Squares	df	Mean Square	F	Sig.
SPECIES * NURSERY APPROACH	Between Groups (Combined)	.882	2	.441	1.359	.274
	Within Groups	8.766	27	.325		
	Total	9.648	29			

SPECIES RICHNESS FOR NAIROBI AND KISUMU COMPARED (natural log)

REGION	Mean	N	Std. Deviation	Variance	Std. Error of Mean
Nairobi	2.8212	30	.6748	.455	.1232
Kisumu	2.3668	30	.5768	.333	.1053
Total	2.5940	60	.6632	.440	8.562E-02

ANOVA Table

		Sum of Squares	df	Mean Square	F	Sig.
SPECIES * REGION	Between Groups (Combined)	3.097	1	3.097	7.861	.007
	Within Groups	22.854	58	.394		
	Total	25.951	59			

Analysis for species diversity based on the dominant species in nurseries in Nairobi and Kisumu.

Species diversity statistics for Nairobi

Index	central	decentralized
Shannon H' Log Base 2.718	1.96725	2.380769231
Shannon Hmax Log Base 2.718	1.98925	2.415884615
Shannon J'	0.98475	0.985576923
Species richness (avg)	9.5	11.96

ANOVA

	Source of variation	df	SS	MS	F	P-value
Shannon index for nurseries in Nairobi	Among groups	1	0.592794	0.592794	2.805817	0.105058
	Within groups	28	5.915645	0.211273		
	Total	29	6.508439			

ANOVA

	Source of variation	df	SS	MS	F	P-value
Species richness for nurseries in Nairobi	Among groups	1	21.00513	21.00513	0.877877	0.356796
	Within groups	28	669.9615	23.9272		
	Total	29	690.9667			

SPECIES DIVERSITY STATISTICS FOR KISUMU

Index	central	decentralized
Shannon H' Log Base 2.718	2.276	2.189666667
Shannon Hmax Log Base 2.718	2.299333333	2.250481481
Shannon J'	0.99	0.973037037
Species Richness	10	10.14

ANOVA

	Source of variation	df	SS	MS	F	P-value
Shannon index for nurseries in Kisumu	Among groups	1	0.020124	0.020124	0.148187	0.703183
	Within groups	28	3.802508	0.135804		
	Total	29	3.822632			

ANOVA

	Source of variation	df	SS	MS	F	P-value
Species richness in Kisumu	Among groups	1	0.059259	0.059259	0.005037	0.943924
	Within groups	28	329.4074	11.76455		
	Total	29	329.4667			

	Source of variation	df	SS	MS	F	P-value
Shannon compare zones	Among groups	1	0.243207	0.243207	1.365394	0.247385
	Within groups	58	10.33107	0.178122		
	Total	59	10.57428			

Variation in species richness based on highest produced species in nurseries in Nairobi and Kisumu

Source of variation	df	SS	MS	F	P-value
Among groups	1	33.75	33.75	1.918303	0.171348
Within groups	58	1020.433333	17.59368		
Total	59	1054.183333			

Appendix 7: Seedling price differentials for all sampled nurseries

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
PRICE FOR SMALL SIZE SEEDLINGS * Kisumu district	60	100.0%	0	.0%	60	100.0%
PRICE FOR MEDIUM SIZE SEEDLINGS * Kisumu district	60	100.0%	0	.0%	60	100.0%
PRICE FOR LANDSCAPING SIZE SEEDLINGS * Kisumu district	60	100.0%	0	.0%	60	100.0%
PRICE FOR SMALL SIZE SEEDLINGS * DECENTRALIZED APPROACH	60	100.0%	0	.0%	60	100.0%
PRICE FOR MEDIUM SIZE SEEDLINGS * DECENTRALIZED APPROACH	60	100.0%	0	.0%	60	100.0%
PRICE FOR LANDSCAPING SIZE SEEDLINGS * DECENTRALIZED APPROACH	60	100.0%	0	.0%	60	100.0%

PRICE FOR SMALL SIZE SEEDLINGS PRICE FOR MEDIUM SIZE SEEDLINGS PRICE FOR LANDSCAPING SIZE SEEDLINGS * Kisumu district

Report

Kisumu district		PRICE FOR SMALL SIZE SEEDLINGS	PRICE FOR MEDIUM SIZE SEEDLINGS	PRICE FOR LANDSCAPING SIZE SEEDLINGS
Nairobi	Mean	21.53	83.00	409.00
	N	30	30	30
	Std. Deviation	11.76	83.71	1462.21
Kisumu	Mean	10.33	30.83	61.00
	N	30	30	30
	Std. Deviation	7.45	23.31	91.40
Total	Mean	15.93	56.92	235.00
	N	60	60	60
	Std. Deviation	11.28	66.36	1042.02

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
PRICE FOR SMALL SIZE SEEDLINGS * Kisumu district	Between Groups	(Combined)	1881.600	1	1881.600	19.411	.000
	Within Groups		5622.133	58	96.933		
	Total		7503.733	59			
PRICE FOR MEDIUM SIZE SEEDLINGS * Kisumu district	Between Groups	(Combined)	40820.417	1	40820.417	10.812	.002
	Within Groups		218984.2	58	3775.589		
	Total		259804.6	59			
PRICE FOR LANDSCAPING SIZE SEEDLINGS * Kisumu district	Between Groups	(Combined)	1816560	1	1816560.000	1.693	.198
	Within Groups		62245740	58	1073202.414		
	Total		64062300	59			

Measures of Association

	Eta	Eta Squared
PRICE FOR SMALL SIZE SEEDLINGS * Kisumu district	.501	.251
PRICE FOR MEDIUM SIZE SEEDLINGS * Kisumu district	.396	.157
PRICE FOR LANDSCAPING SIZE SEEDLINGS * Kisumu district	.168	.028

PRICE FOR SMALL SIZE SEEDLINGS PRICE FOR MEDIUM SIZE SEEDLINGS PRICE FOR LANDSCAPING SIZE SEEDLINGS * DECENTRALIZED APPROACH

Report

DECENTRALIZED APPROACH		PRICE FOR SMALL SIZE SEEDLINGS	PRICE FOR MEDIUM SIZE SEEDLINGS	PRICE FOR LANDSCAPING SIZE SEEDLINGS
CENTRALIZED	Mean	7.57	5.00	.00
	N	7	7	7
	Std. Deviation	1.81	13.23	.00
DECENTRALIZED	Mean	17.04	63.77	266.04
	N	53	53	53
	Std. Deviation	11.54	67.57	1106.14
Total	Mean	15.93	56.92	235.00
	N	60	60	60
	Std. Deviation	11.28	66.36	1042.02

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
PRICE FOR SMALL SIZE SEEDLINGS * DECENTRALIZED APPROACH	Between Groups	(Combined)	554.095	1	554.095	4.624	.036
	Within Groups		6949.639	58	119.821		
	Total		7503.733	59			
PRICE FOR MEDIUM SIZE SEEDLINGS * DECENTRALIZED APPROACH	Between Groups	(Combined)	21359.300	1	21359.300	5.195	.026
	Within Groups		238445.3	58	4111.126		
	Total		259804.6	59			
PRICE FOR LANDSCAPING SIZE SEEDLINGS * DECENTRALIZED APPROACH	Between Groups	(Combined)	437632.1	1	437632.075	.399	.530
	Within Groups		63624668	58	1096977.033		
	Total		64062300	59			

Measures of Association

	Eta	Eta Squared
PRICE FOR SMALL SIZE SEEDLINGS * DECENTRALIZED APPROACH	.272	.074
PRICE FOR MEDIUM SIZE SEEDLINGS * DECENTRALIZED APPROACH	.287	.082
PRICE FOR LANDSCAPING SIZE SEEDLINGS * DECENTRALIZED APPROACH	.083	.007

Appendix 8: Market efficiency differentials

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
Market efficiency * Kisumu district	60	100.0%	0	.0%	60	100.0%
Market efficiency * DECENTRALIZED APPROACH	60	100.0%	0	.0%	60	100.0%
Market efficiency * RECIEVED SUPPORT (reference)	60	100.0%	0	.0%	60	100.0%

Market efficiency * Kisumu district

Report

Market efficiency

Kisumu district	Mean	N	Std. Deviation
Nairobi	50.73	30	22.29
Kisumu	57.80	30	19.77
Total	54.27	60	21.19

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Market efficiency * Kisumu district	Between Groups	(Combined)	749.067	1	749.067	1.688	.199
	Within Groups		25744.667	58	443.874		
	Total		26493.733	59			

Measures of Association

	Eta	Eta Squared
Market efficiency * Kisumu district	.168	.028

Market efficiency * DECENTRALIZED APPROACH

Report

Market efficiency

DECENTRALIZED	Mean	N	Std. Deviation
CENTRALIZED	52.14	7	27.47
DECENTRALIZED	54.55	53	20.54
Total	54.27	60	21.19

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Market efficiency * DECENTRALIZED APPROACH	Between Groups	(Combined)	35.744	1	35.744	.078	.781
	Within Groups		26457.989	58	456.172		
	Total		26493.733	59			

Measures of Association

	Eta	Eta Squared
Market efficiency * DECENTRALIZED APPROACH	.037	.001

Market efficiency * RECIEVED SUPPORT (reference)

Report

Market efficiency

RECIEVED	Mean	N	Std. Deviation
no	54.12	33	21.00
yes	54.44	27	21.82
Total	54.27	60	21.19

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Market efficiency * RECIEVED SUPPORT (reference)	Between Groups	(Combined)	1.552	1	1.552	.003	.954
	Within Groups		26492.182	58	456.762		
	Total		26493.733	59			

Measures of Association

	Eta	Eta Squared
Market efficiency * RECIEVED SUPPORT (reference)	.008	.000