

SMALLHOLDER FARMERS' MARKETING CHANNELS FOR
ON-FARM TIMBER IN KENYA: A CASE OF EMBU DISTRICT. //

BY

ELIZABETH WANJIKU MWANGI

A thesis submitted in partial fulfillment of the requirements for the
award of the degree of Master of Environmental Studies (Agroforestry
and Rural Development) of Kenyatta University

2003

Mwangi, Elizabeth
*Small holder farmers'
marketing channels*



2007/302058

KENYATTA UNIVERSITY LIBRARY

DECLARATION

This thesis is my original work and has not been presented for a Degree in any other University or award.

Signature: 

Date: 14.07.03

Elizabeth Wanjiku Mwangi

This thesis has been submitted with our approval as supervisors.

Signature: 

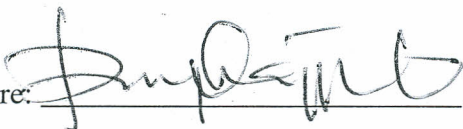
Date: 15.07.2003

Dr. James B. Kung'u

Department of Environmental Foundation

School of Pure and Applied Sciences

Kenyatta University

Signature: 

Date: 21/7/03

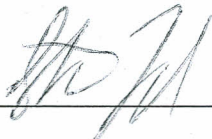
Dr. Samuel C. J. Otor

Senior Lecturer

Department of Environmental Foundation

School of Pure and Applied Sciences

Kenyatta University

Signature: 

Date: 16/7/03

Dr. Steven Franzel

Principal Economist

International Center for Research in Agroforestry

DEDICATION

This thesis is dedicated to: my dear grandmother, the late Elizabeth Wanjikũ Ngũya, her children and grandchildren, who took the responsibility to raise me up and educate me; and to my dear husband, for his sincere love.

ACKNOWLEDGEMENTS

I wish to acknowledge the contributions of numerous individuals and organizations whose efforts made this work possible. First, I express my deep gratitude to my supervisors: Dr James B. Kung'u, Dr. S. C. J. Otor and Dr. Steven Franzel for their valuable advice, and to Dr. Manfred van Eckert, for his encouragement and financial support that enabled me to start and pursue my Masters degree course. I am also thankful to African Network for Agroforestry Education (ANAFE) for funding my research work.

Great appreciation goes to World Agroforestry Centre (ICRAF) staff members working in Programmes 4 and 5 and the library, for their constant logistical and material support. I really appreciate the assistance accorded to me by the Ministry of Environment and Natural Resources (MENR) members of staff, Mr. Dedan Kivuti Nahashon, Mrs. Jayne Mugwe, Mr. James Ngũya Mwangi, and others in my data collection. I also owe a lot of gratitude to Mr. Wim Buysse, who greatly assisted me in data analysis.

My sincere gratitude also goes to members of Watchmen Prayer Ministry Israel/Africa Project, for their fervent prayers, constant encouragement and a high level of understanding. Most importantly, I wish to recognize the marvelous work of the Holy Spirit, Who greatly helped me where no human assistance was possible. His constant companionship and inner propelling strength has great and far-reaching contribution to the initiation, continuation and completion of this thesis. I am greatly indebted to Him. However, I do acknowledge responsibility of any shortcomings found in the thesis.

ABSTRACT

In response to the shrinking government-based natural and plantation forests, and the increasing population growth, smallholder farmers have turned to planting trees on their farms for commercial and domestic use. They need the cash to meet their immediate pressing needs. Improved marketing could significantly enhance tree-planting activities by smallholder farmers. Good marketing connection, therefore, is essential as a strategy to reduce poverty while simultaneously promoting conservation of the rapidly shrinking forests. The necessary marketing information to enable them to identify suitable markets for their timber trees is, however, lacking.

The main purpose of the study was, therefore, to try to understand the functioning of smallholder farmers' marketing channels for on-farm timber in Embu District. This study was conducted in Embu District, which is located in the Eastern Province of Kenya, in the period between November 2001 and May 2002. The wood industries established within the district have turned to farmers for their timber supply as a result of the government's ban on logging of natural forests, particularly Mt. Kenya, which constitutes a portion of the district. In addition, the district's population is increasing at an annual growth rate of 3.08%, increasing the demand for timber.

A market channel analysis was carried out which involved following the timber products from the farmers, to the fixed saw millers, and finally to the timber yard merchants. Various and several techniques of Participatory Rural Appraisal were widely used to collect timber marketing information. Linear regression, tables, charts, and other descriptive methods were used for data analysis using the MS Excel, Genstat, and SPSS

computer programmes. A volume model that can assist farmers in selling their trees was derived from this study.

The major problems in the existing marketing channels include low prices for timber trees at farm level, lack of ready timber markets, poor tree and timber quality, limited variety of timber tree species, and poor infrastructure.

In order to improve the returns that the farmers get from their timber trees, this study recommends that they be equipped with the appropriate practical tree management and marketing skills, such as, application of obtained knowledge of estimating the volumes of their trees as well as negotiating the appropriate prices for these trees, and further research to clarify the pending issues to guide future planning and management for improved performance.

TABLE OF CONTENTS

	PAGE
Declaration.....	(ii)
Dedication.....	(iii)
Acknowledgement.....	(iv)
Abstract.....	(v)
List of Tables.....	(xi)
List of Figures.....	(xiii)
List of Acronyms.....	(xiv)
Definition of Terms.....	(xv)
1.0 CHAPTER ONE : INTRODUCTION	
1.1 Background to the Study.....	1
1.2 Statement of the Problem.....	3
1.3 Research Questions.....	4
1.4 Objectives of the Study.....	4
1.5 Hypotheses of the Study.....	4
1.6 Scope of the Study.....	5
1.7 Justification of the Study.....	5
1.8 Significance of the Study.....	6
1.9 Research Constraints.....	7
2.0 CHAPTER TWO : LITERATURE REVIEW	
2.1 Agricultural Marketing.....	8
2.2 Market Access and Marketing Information.....	10
2.3 Market Channel Analysis.....	11
2.4 Timber Marketing in Central Kenya.....	11
2.5 Smallholder Farmers and On-Farm Timber Production.....	15

3.0 CHAPTER THREE : RESEARCH DESIGN AND METHODOLOGY

3.1 Description of the Study Area.....	17
3.1.1 Geographic Description.....	17
3.1.2 Administrative Structure of Embu District.....	17
3.1.3 Biophysical Description.....	20
3.1.4 Socio-Economic Description.....	21
3.2 Research Design.....	24
3.2.1 Nature and Sources of Data.....	24
3.2.2 Sampling Design.....	25
3.2.3 Sample Size.....	25
3.3 Methods of Data Collection.....	25
3.3.1 Participatory Rural Appraisal (PRA).....	26
3.4 Methods of Data Analysis.....	28
3.4.1 Market Channel Analysis.....	28
3.4.2 Statistical Analysis.....	29

4.0 CHAPTER FOUR : RESULTS AND DISCUSSIONS

4.1 Smallholder Farmers' Household Characteristics in the Study Area.....	31
4.2 Off-farm Sources of Income for the Farmers.....	33
4.3 The Farming Systems.....	34
4.4 Timber Trees in the Farming Systems.....	37
4.5 On-Farm Timber Marketing.....	38
4.5.1 On-Farm Timber Marketing Channels.....	40

4.5.2 Relationship Between Price and Volume of Trees Sold.....	46
4.6 Problems Faced Within the Existing Marketing Channels.....	50
4.6.1 Timber Marketing Problems Faced by Farmers.....	50
4.6.2 Timber Marketing Problems Faced by Fixed Saw millers.....	52
4.6.3 Timber Marketing Problems Faced by Timber Yard Merchants.....	53
4.6.4 Perceptions of <i>Grevillea robusta</i> by the Timber Actors.....	54
4.7 Factors Influencing On-Farm Timber Marketing	55
4.8 Approaches for Enhancing Sustainable Production and Marketing of Farm Timber.....	57

5.0 CHAPTER FIVE : SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of Findings.....	59
5.2 Conclusions.....	60
5.3 Recommendations.....	61
5.3.1 Recommendations for Immediate Application.....	62
5.3.2 Recommendations for Further Research.....	63
5.3.3 Recommendations for Medium and Long-Term Research.....	64

REFERENCES

APPENDICES

APPENDIX I: Timber Farmers' Interviewing Schedule.....	70
APPENDIX II: Farm Timber Saw Millers' Interviewing Schedule	76
APPENDIX III: Timber Yard Merchants' Interviewing Schedule.....	82

LIST OF TABLES

		PAGE
Table 1	Projected Wood Supply and Demand on Current Trends.....	16
Table 2	Selected Levels of Interviewed On-Farm Timber Market Participants in Embu District.....	26
Table 3	Smallholder Farmer Respondents Distributed by Gender in Embu District.....	32
Table 4	Number of Dependants of the Smallholder Farmers in Embu District.....	33
Table 5	Land size occupied by Food Crops in Embu District Smallholder farms.....	35
Table 6	Tree Crops per Farm in the Smallholder Farms in Embu District.....	36
Table 7	On-Farm Timber Trees per Farm in the Smallholder Farms in Embu District.....	38
Table 8	Reasons for Tree Planting as Given by Smallholder Farmers in Embu District.....	39
Table 9	Source of Farm Timber Buying Initiative.....	41
Table 10	Categories of On-Farm Timber Tree Buyers in Embu District	41
Table 11	Average Volume per Tree per Diameter at Breast Height of <i>Grevillea robusta</i> Trees Sold Standing by Smallholder Farmers in Embu District.....	44

Table 12	Average Price per Cubic Meter and per Tree per Diameter Class of <i>Grevillea robusta</i> Trees Sold Standing by Smallholder Farmers in Embu District.....	46
Table 13	Average Price per Tree per Diameter Class of Pollarded <i>Grevillea robusta</i> Trees Sold Standing by Smallholder Farmers in Embu District.....	49
Table 14	Average price per Tree per Diameter Class of Non-pollarded <i>Grevillea robusta</i> Trees Sold Standing by Smallholder Farmers in Embu District	49
Table 15	Timber Marketing Problems Faced by Smallholder Farmers in Embu District.....	52
Table 16	Reasons for Tree Cutting as Given by Smallholder Farmers in Embu District	56
Table 17	Reasons for On-farm Tree Selling as Given by Smallholder Farmers in Embu District	57

LIST OF FIGURES

		PAGE
Figure 1	Schematic View of <i>Grevillea robusta</i> Market Structure and Distribution Channels.....	13
Figure 2	Location of Embu District in its National Context.....	18
Figure 3	Administrative Boundaries of Embu District	19
Figure 4	Marital Status of Smallholder Farmer Respondents.....	32
Figure 5	Off-farm Sources of Income for the Smallholder Farmers in Embu District.....	34
Figure 6	Flow Diagram Showing the Marketing Channels of Timber From Smallholder Farmers in Embu District.....	42
Figure 7	Relationship Between Volume per Tree (m ³) and the Diameter at Breast Height (cm) of <i>Grevillea robusta</i> Trees Sold Standing by Smallholder Farmers in Embu District.....	45
Figure 8	Relationship Between Price per Cubic Meter (Kshs) and Diameter at Breast Height (cm) of <i>Grevillea robusta</i> Trees Sold Standing by Smallholder Farmers in Embu District	48

LIST OF ACRONYMS

AAS	African Academy of Sciences
AFRENA	Agroforestry Research Networks for Africa
ASALs	Arid and Semi-Arid Lands
FAN	Forest Action Network
FAO	Food and Agricultural Organization
ICRAF	International Center for Research in Agroforestry
IIED	International Institute for Environment and Development
KEFRI	Kenya Forestry Research Institute
KFMP	Kenya Forestry Master Plan
MENR	Ministry of Environment and Natural Resources
MoARD	Ministry of Agriculture and Rural Development
NRI	Natural Resources Institute
PICOP	Paper Industries Corporation of the Philippines
PRA	Participatory Rapid Appraisal
SPSS	Statistical Packages for Social Sciences
USA	United States of America

DEFINITION OF TERMS

Agroforestry: Refers to the integration of trees into farming or pastoral systems. It is a land-use system in which trees are grown on the same land for agricultural crops and/or animals either in spatial arrangement or in time sequence and in which there are both ecological and economic interactions between trees and non-tree components of the system (Nair, 1989b).

Marketing: Physical and economic processes whereby goods are transferred from the producer to the consumer (Scott, 1995).

Marketing channel: The path that goods follow from their source of original production to their ultimate destination for final use (Scott, 1995).

On-farm timber: Refers to timber that is obtained from trees that are grown within the farm.

Pollarding: Cutting back in more or less systematic fashion the crown of a tree but leaving a main trunk to 1.5m or so, with the aim of harvesting small wood and browse, of producing of regrowth beyond the reach of animals, or of reducing the shade cast by the crown (Huxley and Houten, 1997).

Smallholder farmer: A farmer owning or cultivating five hectares or less of farmland.

Sustainable development: Management and conservation of resources that achieve production sufficient to meet the needs of present and future populations, while enhancing the resources on which that production depends (Huxley and Houten, 1997).

Tree crops: Both trees and shrubs grown in farms or on communal property land, and used by local people for fuel wood, food, fodder and income.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Kenya has over 80% of its population living in the rural areas, the majority of whom practise agriculture as their main activity and source of income (Central Bureau of Statistics, 1994). In these areas, traditional export crops for smallholder production include coffee and cotton, which many farmers have now turned away from, mainly because of low producer prices and excessive delays in payment by the marketing boards that monopolize the trade. Agroforestry, has, therefore, become a popular alternative because it introduces diversity in products within the same piece of land, in terms of trees and food crops. Markets for tree products are widely thought to have great promise because of their potential for achieving a range of development objectives, such as providing a means of expanding rural employment opportunities, improving the supply of rural produce to urban markets, and providing raw materials for the development of small- and medium-scale industry (Gordon, 1997).

Wood marketing, a process which starts with a decision to produce a saleable commodity, involves all aspects of market structure, both financial and institutional, based on technical and economic considerations. It includes post harvest operations, assembling, grading, storage, transportation and distribution. It has, therefore, been realized that introduction of new tree species under agroforestry conditions should be accompanied by efficient marketing so that farmers do not face problems disposing their timber produce, otherwise, farmers will rarely change their traditional land-use system until such a process guarantees them profits (French and Blicher-Mathiesen, 1995).

Farmers in Embu, however, did not embark on planting of timber species with marketing in mind. Rather, they planted them for fuel wood supply, home construction materials, marking boundaries because of the recent acquisition of land, as well as to address the problems of droughts and high winds (Tyndall, 1996). Timber marketing has come about as a result of a series of circumstances: decline in management of plantations, closure of the forest, collapse of the coffee sector, drought and lack of alternative incomes (Holding, 1999, cited by Akinga, 1999). The prices they obtain for their trees, therefore, vary considerably, making it difficult to ascertain the farmer market share (Betser *et. al.* 1999). To ensure sustainability, agroforestry needs to be carefully developed for specific sites so that its performance can be predictable by use of models which are socially and ecologically compatible with the farmers' needs, and most importantly, the produce can be marketable (French and Blicher-Mathiesen, 1995). Increasingly, researchers are seeking to assess market potential before investing scarce research funds in the improvement of specific tree species and associated systems (Gordon, 1997).

This study was a complement to the ongoing FAN/ICRAF/MoARD Meru timber marketing research and development programme, that seeks to characterise small farmer market chains for timber and to identify development solutions through piloting various participatory marketing methodologies. The study was carried out in Embu District.

1.2 Statement of the Problem

Many agroforestry projects which aim to reduce pressure on natural forests by planting trees on farmland, eventually fail as a result of their failure to adequately address the associated marketing needs like customer requirements, product storage, processing, grading, packaging, promotion, and pricing (Feredy *et. al.* 1997). The decision-making by farmers and development programmes is seriously constrained by the lack of existing information about such markets.

There are other decision-making factors that are related to poverty, that is, even if farmers do have this information at their disposal, they are unable to make decisions on optimal marketing possibilities due to immediate needs and the requirement to sell trees for cash. At the national level, the country has faced an imminent wood supply crisis following the ban on logging since late 1999 (Carsan and Holding, 2001). This has shifted the demand for wood from the indigenous forests and plantations to the farmers' fields.

In the study area, the major timber marketing problems facing the farmers may be that they do not know how to quantify the volumes of their trees, and they lack information on the pricing of these trees. On-farm timber production, therefore, cannot increase if the farmers lack sufficient market information in order to secure favourable prices for their timber products.

1.3 Research Questions

In view of the above stated problem, this study answered the following questions:

- (a) What are the problems faced within the existing marketing channels of farm timber?
- (b) What are the factors that influence the marketing of farm timber?
- (c) What are the approaches that could enhance sustainable production and efficient marketing of farm timber?

1.4 Objectives of the Study

The main objective of the research was to understand the functioning of smallholder farmers' marketing channels for on-farm timber in Embu District. Specifically, the research tried:

- (a) To identify the problems that are faced within the existing marketing channels of farm timber.
- (b) To identify the factors that influence the marketing of farm timber.
- (c) To come up with approaches for enhancing sustainable production and marketing of farm timber.

1.5 Hypotheses of the Study

In an attempt to answer the above questions, the following hypotheses were formulated:

- (a) The existing farm timber marketing channels are inefficient.
- (b) Farmers are not influenced by the market to sell their farm timber trees.
- (c) Efficient marketing of timber enhances the sustainability of its production.

1.6 Scope of the Study

The study entailed an attempt to understand the functioning of smallholder farmers' marketing channels for on-farm timber in Embu District. Identification of the problems that are faced within the existing marketing channels of farm timber was undertaken. An assessment of the reasons leading to buying and selling of farm timber was carried out to serve as indicators of factors that influence the marketing of farm timber. The study was conducted in three divisions, Kyeni, Runyenjes and Central, in Embu District. A total of 204 farmers, 3 fixed saw millers, and 3 timber yard merchants were interviewed.

1.7 Justification of the Study

The country has faced an imminent wood supply crisis following the ban on logging since late 1999 (Carsan and Holding, 2001), and also due to the fact that demand for timber in the country has been expanding with the growing population and new development activities (Marshall and Jenkins, 1994). Population growth and the economy are the major basic demand determinants for most of the forest products. Demand for fuel wood, pole wood, and industrial wood is rising along with the rapid growth in population.

Since the indigenous forest area is shrinking and it can no longer be relied upon as a principle source to meet the growing demand, wood must be produced in other places, particularly on the farms (MENR, 1994). Within a few years, the demand for wood by Kenya's rapidly growing population will outstrip the supply coming from the indigenous forests, forest plantations, the ASALs and the farms. Farmers are the only ones who can

close the foreseeable gap between supply and demand. Agroforestry, therefore, has the potential to take over a substantial part of the functions of indigenous forests and large-scale plantations (MENR, 1994). In addition to the supply of timber, agroforestry has the potential to greatly contribute to the conservation of these rapidly shrinking forests.

Information on marketing of tree products should be made available to the farmers, as lack of this prevents them from making maximum use of trees on their farms (Njenga, 2000). The wood industries established within the district have turned to farmers for their timber supply as a result of the government's ban on logging of natural forests, particularly Mt. Kenya, which constitutes a portion of the district. There was therefore a need for a specific study on the more efficient marketing strategies in order to assess the best options for farmers for income generation from on-farm timber. This study attempted to address this need.

1.8 Significance of the Study

The significance of this study is three-fold: to the farmers, to the policy makers, and to the researchers. The information gathered can be used to develop tools that will assist farmers to engage in market/demand-oriented production that ensures sustainable production and marketing. In addition, farmers will make informed decisions when marketing their timber, in order to obtain optimum benefits and, hence, greatly improve their living standards. Further, the farmers will be encouraged to engage more in farm forestry to supply the rising demand for timber, which will contribute to sustenance of the shrinking natural forests, as pressure to obtain timber from them will be reduced.

To the policy makers, the results of the study will provide the basis for discussions towards formulation and implementation of sustainable agroforestry systems, that adequately address the associated marketing needs.

The results of the study will advise researchers on the needs of immediate and long-term research, so as to give lasting solutions to the farmers and policy makers.

1.9 Research Constraints

It was not possible to interview all actors in the marketing channel due to the limitation of resources and time. Due to the use of public means of transport, respondents in the extreme interior parts of the district which were difficult to access were not interviewed. In addition, the mobile saw millers were not interviewed because they were reluctant to give information since their businesses are not licensed and this created suspicion in them.

CHAPTER TWO

LITERATURE REVIEW

The purpose of this study was to understand the functioning of smallholder farmers' marketing channels of farm timber in Embu District. Consequently, a comprehensive review of the relevant literature was carried out.

2.1 Agricultural Marketing

Scott (1995) refers to marketing as a summary of the physical and economic processes whereby goods are transferred from the producer to the consumer. According to Kotler (1980), marketing is a human activity directed at satisfying needs and wants through exchange processes. It is the means by which organizations identify unfulfilled human needs, convert them into business opportunities, and create satisfaction for others and profit for themselves.

According to Scott (1995), economists, planners, and policy makers have long recognized the performance of agricultural markets as a critical component in the development process. Analysis of these markets, hence, has been an on-going assignment for decades. Farmers in Africa, Asia, and Latin America have made use of agricultural markets. This use has however, intensified over the last three decades, as agriculture has become more market-oriented in virtually all developing countries. Environmentalists have shown a growing interest in agricultural marketing. This is because if particular ecologies, such as mountains, are to remain vital sources of sustenance and culture, then agricultural marketing systems linking such ecologies to adjoining environments need to be better understood, potential benefits from marketing activities more effectively exploited, and negative aspects of commercialization minimized.

The value of growing trees on tropical farms for subsistence, commercial sale and environmental stability has been increasingly recognized in recent decades. Although impressive progress has been made in identifying and promoting a wide range of tree production systems, there has been very little associated research on the market potential of these systems. Markets link suppliers with consumers; they facilitate the flow of information on the product volumes and quality characteristics available and required, and integrate inputs and services from other sectors to transform products into something consumers want to buy. If information is relayed effectively, markets can generate prices and incentives which reflect current levels of supply and demand (Scott, 1995).

Markets can be influenced by policy but market information is needed to inform the policy process. Few market studies however, have adequately done so. There has been a failure therefore, to link the design of market studies with the potential for policy change (Deweese, 1996). The key ingredient or perspective of successful marketing is understanding the needs of the marketplace and targeted consumer, then knowing how to translate or meet those needs in a synergistic relationship with a given organization's resources and capabilities in terms of manpower, finances, land geography and property among others. This differs from the often traditional business approach where the existing resources and capabilities are the driving forces (Vockins, 1999).

Rural development has traditionally lacked a business and marketing orientation. Priority was given to seeking ways of marketing what was already being produced, rather than on studying market demand to propose alternatives to production of conventional crops (Galvez and Felipe, 1999). Further, income-generating initiatives in communities are often production-oriented, with little thought given to who might use or buy the

products or services being offered (IIED 1998). Yet if any business is to succeed, it must be led by the market, and not by the skills, ideas, and production orientation of aspiring entrepreneurs and projects. If not enough people are interested in, or can afford to buy the service or product that a business is offering, then there is no market for the service or product and the business will fail.

The market prospects for tree products are favourable as a result of ongoing population and urban growth. An assessment of their market requirements, therefore, would greatly shape their production, processing, and marketing, to ensure sustainable production for ready markets, which greatly improve the living standards of the smallholder farmers.

2.2 Market Access and Marketing Information

According to Poulton and Poole (2001), experience shows that marketing can be problematic for smallholders' agricultural products. Further, Pswarayi-Riddihough and Jones (1995) state that one of the most common problems faced by small farmers in Asia and other developing regions is the lack of market information on prices and factors influencing market prices. The root causes of these market access problems are a function of poor access to information and contacts of smallholders. There are many market systems where producers and/or small-scale intermediaries are ill informed about possible market opportunities and what might be required to respond to them. Improvements in market access can thereby provide the necessary incentives for adoption of improved growing stock at the same time as improved growing stock makes increased market penetration plausible.

Establishing and sustaining effective market information systems in developing countries has long been recognized as a major challenge (Schubert, 1983, cited by Poulton and Poole, 2001). Marketing information has, therefore, become the critical element in effective marketing as a result of the trend toward national and international marketing, the transition from buyer needs to buyer wants, and the transition from price to non-price competition. Increased market information results in increased value for products, more efficient marketing, and improved production levels where further processing may become feasible (Hammet, 1998).

Informing producers about marketing channels and requirements, in addition to prices, is very important. The emphasis here is on enabling producers to make better informed planting decisions, recognizing that there is little that can realistically be done to influence the returns that they receive for crops already produced (Poulton *et. al.* 1999, cited by Poulton and Poole, 2001). An interesting area for exploration concerns the potential for new information and communication technology to assist the dissemination of marketing information in poor countries (World Bank, 2000, cited by Poulton and Poole, 2001). Further, Poulton and Poole (2001) emphasize that efforts need to be made to provide relevant market information to tree growers in an attempt to encourage greater planting and commercialization.

2.3 Market Channel Analysis

Scott (1995) defines a marketing channel as the path that goods follow from their source of original production to their ultimate destination for final use. The justification for the analysis of marketing channels, hence, is to provide a systematic knowledge of the

flow of goods and services from their origin (producer) to their final destination (consumer), by studying the participants in the process. According to Lecup and Nicholson (2000), a market channel analysis follows a product from the phase in which it is produced to the ultimate consumer. It is a tool used to identify opportunities, strengths and constraints in the market channels and to gather information about the business environment. Kotler (1980) states that a marketing channel comprises a set of institutions that perform all the activities utilized to move a product and its title from production to consumption. Marketing channels do not stay static but are characterized by continuous and sometimes dramatic change. This is because markets and the marketing environment are continuously changing and the firm must be prepared to make channel revisions. In order for this to happen, reliable marketing information is needed. Marketing research thus, is a major component of a marketing information system, which involves specific studies of market opportunities, marketing effectiveness and marketing problems (Kotler, 1980). By identifying these opportunities, strengths and constraints in advance, the on-farm timber marketing system in Embu can be improved.

2.4 Timber Marketing in Central Kenya

According to Opanga (2000), the ban on logging, which was effected in November 1999, shifted pressure for timber from government-based natural and plantation forests to the farmlands. Figure 1 shows the market structure and distribution channels of *Grevillea robusta* from the farms in Meru District, Kenya. Currently, the saw milling industry seems to be experiencing reduction in business turnovers, workforce and shifts. There is change from a formal to an informal labour force, from full-time to part-

time, and from permanent to casual. With the moratorium of government plantation logging still in place, the saw-milling sector is facing instability and uncertainty in timber business. Opanga further points out that the farmers are not aware of the value of the tree stem that they sell to the processors (mobile millers or established sawmills).

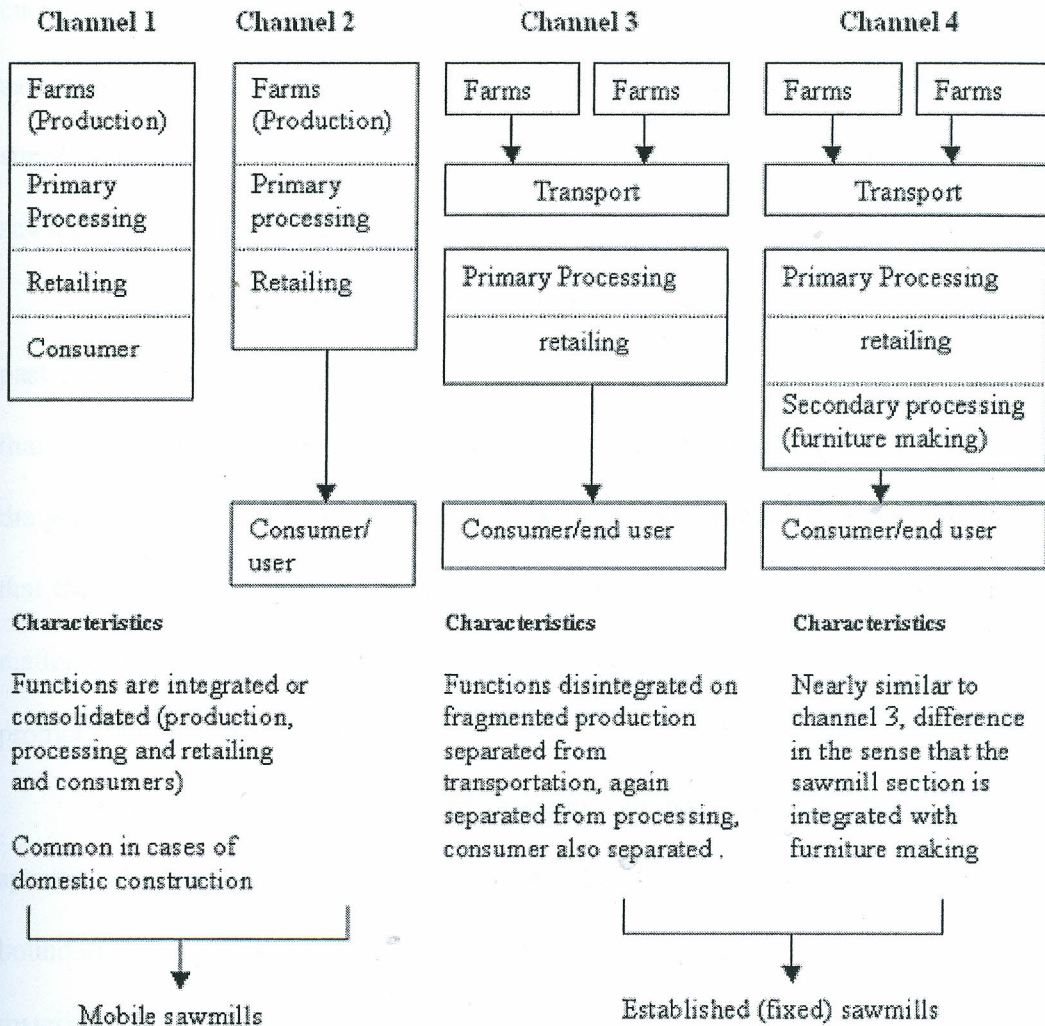


Figure 1: Schematic View of *Grevillea robusta* Market Structure and Distribution

Channels

(Source: Opanga, 2000)

He recommends that there is great need to sensitize the farmers on the importance of using market rates or royalty rates and consulting with forest departments on how stems from the farms can be graded and possibly sold in classes just as stems from the plantations. He further notes that 73% of the interviewed timber business people are currently sourcing their timber from the farms. Channels 1 and 2 above supply the mobile saw millers and primary processing is done by saw benches on site. Channels 3 and 4 supply the established or fixed sawmills where saw millers transport whole logs to the sawmills in town for processing.

Akinga (1999) noted that afforestation in the Forest Department has in the recent past faced major challenges as they have a planting backlog of 20,000 ha. This means that if this situation were not addressed urgently, Kenya would have to import wood by the year 2005 (see Table 1). In order to meet the rising demand of wood, he emphasized that the solution lies with the farmers planting more trees to serve the saw millers. As a matter of urgency, mechanisms need to be set up to encourage and motivate farmers to promote tree planting on farms.

In Embu District, smallholder farmers did not embark on planting of timber species with marketing in mind. Rather, they planted them for fuel wood supply; to mark boundaries because of the recent acquisition of land; for supply of home construction materials; as well as to address the problems of droughts and high winds (Tyndall, 1996). Timber marketing has come about as a result of a series of circumstances: decline in management of plantations, closure of the forest, collapse of the coffee sector, drought and lack of alternative incomes (Holding, 1999, cited by Akinga, 1999). Limiting factors for farmer access to the formal timber market are: species selection, high transportation

costs, lack of timber management skills leading to poor quality timber, poor timber marketing information held by farmers, as well as market price and mensuration skills which are not known, making fair negotiation difficult (Betser *et. al.* 1999 and Holding *et. al.* 2001). There are other decision-making factors that are related to poverty.

That is, even if farmers do have this information at their disposal, they are not able to make decision on optimal silvicultural practices, due to immediate needs and the requirement to sell trees for cash. Akinga (1999) also reveals that farmers sell their trees at throw away prices to get space for other activities like farming, not necessarily for commercial purposes. He suggests that there is need to advise farmers to store the felled tree till potential buyers offer acceptable prices. Some saw millers were reportedly storing logs for a long time until market buyers are available. He thus suggested that farmers could copy from the saw millers, as there is no loss in storing felled log.

2.5 Smallholder Farmers and On-Farm Timber Production

At the smallholder level, the dynamics of tree product supply, market demand, and marketing channels, are poorly understood by farmers and researchers alike. The emergence of competitive local markets for farmer grown wood is likely to contribute to more satisfactory prices. By understanding market linkages and interactions, it should be possible to improve smallholder farmers' livelihoods, by focusing their agroforestry production towards market opportunities (Arnold, 1998).

Farm forestry may directly contribute to economic production of farms, meet farmers' domestic needs and increase farm asset value. Scattered trees and stands can contribute directly to on-farm production by way of farm timber, fuel wood, foliage, and

seeds. The positive impacts of shade and shelter are widely acknowledged. There is limited data, however, relating farm production to timber (Kato, 1996).

Table 1: Projected Wood Supply and Demand on Current Trends ('000 m³)

	1995	2000	2005	2010	2015	2020
<u>Wood demand</u>						
• Industrial wood	1058	1209	1378	1543	1709	1961
• Poles and posts	1219	1435	1689	1989	2335	2736
• Fuel wood	<u>20107</u>	<u>23947</u>	<u>27693</u>	<u>31720</u>	<u>35880</u>	<u>40133</u>
Total wood demand	22384	26591	30760	35251	39924	44830
<u>Accessible sustainable supply</u>						
• Indigenous forests	1942	1905	1868	1830	1793	1755
• Woodlands and bush lands	11240	11157	11074	10992	10909	10827
• Farmlands and settlements	7437	9373	11396	13406	15666	17825
• Forest plantations	<u>2121</u>	<u>2494</u>	<u>2112</u>	<u>2165</u>	<u>2281</u>	<u>2657</u>
Total sustainable wood supply	22740	24929	26450	28393	30649	33064
<u>Non-sustainable wood supply</u>	283	414	544	671	794	912
<u>Fuel wood substitutes</u>	2011	2395	2769	3172	3588	4013
<u>Total wood supply</u>	25034	27738	29763	32236	35031	37989
<u>Surplus/deficit</u>	2650	1147	-997	-3015	-4893	-6841

(Source: MENR, 1994)

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Description of the Study Area

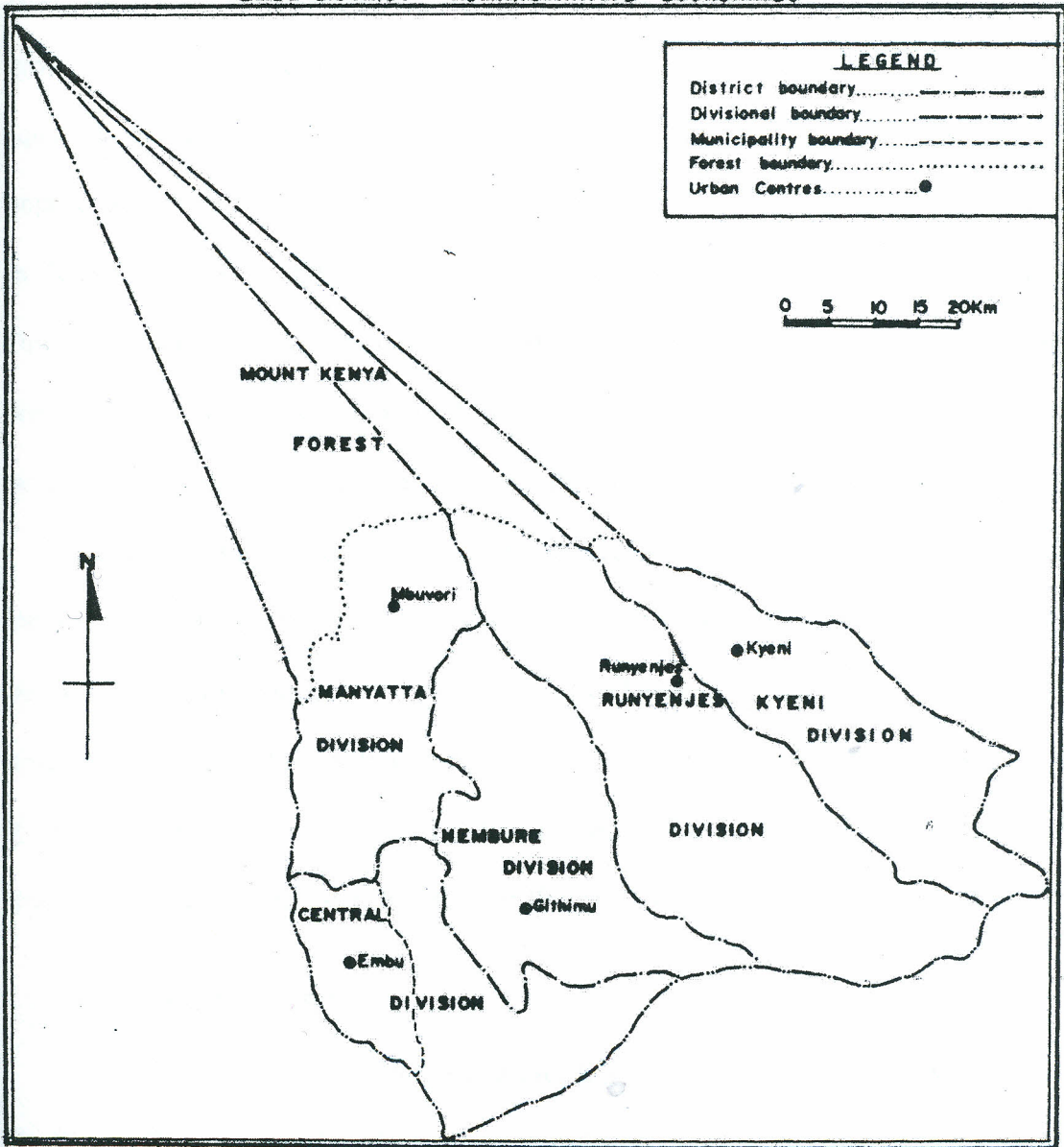
3.1.1 Geographic Description

The study was conducted in Embu District which is one of the twelve districts that make up the Eastern Province. It is bordered by Mbeere District to the east and south-east, Kirinyaga District to the west, and Tharaka Nithi to the north. It lies approximately between Latitudes $0^{\circ} 8''$ and $0^{\circ} 35''$ South and Longitudes $37^{\circ} 19''$ and $37^{\circ} 42''$ East (Figure 2). It occupies a total area of 708 square kilometres. Its altitude ranges from 1200 to 4500 metres above sea level. The Upper Highland Zone of the district constitutes a section of Mt. Kenya. The rainfall pattern is bimodal with two distinct rainy seasons. The long rains fall between March and June while the short rains are experienced from October through December. The amount received varies with altitude, but averages 1495 mm per year. Temperatures in the district range from a minimum of 12°C in July to a maximum of 27.1°C in March.

3.1.2 Administrative Structure

The district is divided into five divisions, fourteen locations and fifty two sub-locations. Figure 3 shows the administrative boundaries of the district. The district has three local authorities, namely Embu County Council, Embu Municipal Council, and Runyenjes Town Council, with a total of 26 electoral wards.

EMBU DISTRICT ADMINISTRATIVE BOUNDARIES



(Source: Jaetzold and Schmidt, 1983)

Figure 3: Administrative Boundaries of Embu District

According to the 1999 census, the district had a total population of 278,196, which was growing at an annual growth rate of 1.7%. It has a population density of 393 persons per square kilometre (Republic of Kenya, 2002). Using this rate, it is projected that this population will increase to 293,144 in 2002 and further to 303,552, 314,330, and 325,491 in 2004, 2006, and 2008, respectively. The population density is higher in Central Division than in all the other divisions largely due to its small size and to its status as the provincial and district headquarters. Manyatta Division has the least population density because 55% of the total area is under forest (Republic of Kenya, 2002).

Given the limited employment opportunities resulting from the launch of the civil service reform programme by the government, and the large number of school leavers, the informal sector continues to grow. The most widespread activities in this sector are of small scale or *jua kali* nature, like furniture making, which are a reflection of opportunities availed by the resources like timber products, and by the demand that is created by the high population (Republic of Kenya, 1997).

3.1.3 Biophysical Description

The district has an agro-ecological profile that is typical of the windward side of Mt. Kenya. The upper highlands are so wet and steep that forestry is the best land-use. The forest reserve is characterized by humid andosols which are well drained, very deep, dark reddish brown to dark brown, clay loam to clay with a thick acid humid top soil. In Central Division and lower areas of Nembure, Runyenjes and Kyeni, the volcanic foot ridges consist of humid nitrisols with an acid humid topsoil. The remaining lower areas of Nembure, Runyenjes and Kyeni Divisions have ferrasols, soils which are equally well drained and very deep (Republic of Kenya, 1997).

Out of the district's total land area of 708 square kilometres, about 70% is arable land while the remaining 30% is covered by forest. The actual cultivable land is less than 70%, considering the amount of land taken up by other uses such as, townships, market centres, and public utilities. The average farm size is about 1.2 hectares per family (Republic of Kenya, 1997). There are eight agro-ecological zones in the district, excluding the tropical alpine (TA) at the top of Mt. Kenya, which has no economic activities, and the upper highlands zone, where forestry is the main land-use.

3.1.4 Socio-Economic Description

Roads

The study area is fairly well served in terms of road transport, as it is cut across by a national trunk road which opens it up to the rest of the country. Runyenjes Division has about 31% of the total length of the road network, improving its accessibility. Conditions of most roads worsen during the rainy seasons, making most areas virtually inaccessible. Over 77% of the total road length is classified as graveled but it requires regular regravelling otherwise these degenerate back into earthroads which are impassable during the rainy seasons (Republic of Kenya, 1997).

Marketing System

The marketing system in the study area is not well developed. It is affected by poor feeder roads in most parts of the district that lead to substantial losses of commodities such as tea and milk. This reduces net income to the farmers. Marketing efficiency has been an elusive goal for most of the co-operative societies which are

characterized by delayed and erratic payments. Lack of a well-managed co-operative society for the informal sector has led to under-utilization of the existing potential, particularly in the timber industry (Republic of Kenya, 1997).

Crop Production

The main food crops in the study area include maize, beans, Irish potatoes, and cowpeas. The district's potential for the production of maize and beans is not fully utilized due to a combination of factors, namely, high prices of farm inputs, fertilizers and instability caused by complete liberalization of grain marketing. Oil seeds such as sunflower and castor are not widely grown, despite their potential to support oil processing industries. This can be attributed to lack of adequate information on production and marketing aspects. On the other hand, the main cash crops in the study area include coffee and tea. However, due to the poor market prices, much of the coffee has been neglected and even uprooted. Its returns have declined in the last one decade due to a glut on the global market, leading to low prices. The potential for tea production is not also fully utilized because of financial constraints and competition in land use (Republic of Kenya, 2002).

Agroforestry Practices

The farmers in the district have intercropped crops with trees on their farms. Such trees include tree crops like coffee, macadamia, mangoes, avocados and pawpaws. They have also planted timber trees that comprise *Grevillea robusta*, *Eucalyptus saligna*, *Cupressus lusitanica*, *Vitex keniesis*, *Pinus patula*, and *Cordia Africana*. *Grevillea*

robusta is the most dominant species on the farms in Embu District (Republic of Kenya, 1997).

Livestock Production

Livestock production activities are a significant supplementary source of income for the people of Embu District, since most of the livestock reared are of improved exotic breeds. In the study area, 81% of the farmers have improved dairy cows (Franzel et al, 1999), while 40 % have goats (Muriithi, 1998, cited by Franzel et al, 1999). The most important types of livestock kept are cattle and goats, and livestock products include milk, meat, hides, and skins. Most parts of the district have more or less equal potential for livestock due to the district's favourable climatic conditions and the availability of feeds.

Forestry

Due to its location on the windward side of Mt. Kenya, there are favourable conditions for forestry and agroforestry activities in Embu District. The forests occupy an area of about 22,264 hectares, representing 30% of the district's total area. Irangi Forest which constitutes part of Mt. Kenya Reserve is gazetted and occupies approximately 18,393 hectares. An additional area of 3,871.1 hectares has been approved and demarcated as forest land, but it is yet to be gazetted. Apart from the gazetted forest areas, there are approximately 600 hectares under forest plantations in Njukiini, Maranga, and Nduuri. Irangi Forest has natural vegetation cover consisting of various valuable tree species which include *Ocotea usambarensis*, and *Arundinaria alpina*. It has the potential

of supporting industries using indigenous hardwood timber. On the plantations, pine and eucalyptus are the main tree species. These provide the district with exotic timber requirements though cypress timber species has to be imported from other districts (Republic of Kenya, 1997).

3.2 Research Design

The research design adopted for this study was mainly surveys. Individual farm visits were conducted in Kyeni and Runyenjes divisions, while the market survey was conducted in Central and Runyenjes divisions of the district.

3.2.1 Nature and Sources of Data

The purpose of this study was to understand the functioning of smallholder farmers' marketing channels of farm timber in Embu District. Consequently, a comprehensive survey was carried out where primary and secondary data were collected. Secondary sources of data consisted of published information such as review of relevant literature. These included reports, theses, textbooks, journals, and abstracts, obtained from libraries, government offices, and the internet. Primary sources of data, on the other hand, included Participatory Rural Appraisal (PRA) involving key informant interviews and discussions, farm surveys/visits, market surveys, observations and empirical field measurements.

3.2.2 Sampling Design

In this study, the sampling unit comprised on-farm timber market actors who included the timber farmers, fixed saw millers, and timber yard merchants. A multistage purposive sampling procedure with stratified random selection was used to select the on-farm timber market actors for the farm and market surveys in the study site (Lee-Ann and Buzar, 1997). Purposive sampling was carried out where only smallholder farmers who had sold their trees for timber or split timber to construct their own houses were selected in the survey. Stratified random sampling was used where selected levels of on-farm timber market participants along the marketing channel were chosen, each constituted a stratum.

3.2.3 Sample Size

A total of 204 on-farm timber farmers, 3 fixed saw millers, and 3 timber yard merchants were interviewed, as shown in Table 2 below.

3.3 Methods of Data Collection

The respondents were identified through the assistance of an Extension Forestry Officer who works in the area and hence was familiar with on-farm timber cutting, buying, and selling activities within the district. Due to easy accessibility by use of public transport means, the farmer survey was carried out in two divisions, namely, Kyeni and Runyenjes. The following methods were used.

Table 2: Selected Levels of Interviewed On-Farm Timber Market Participants in Embu District

Level of Timber Participants	On-farm Market	Sample Areas (Division)	No. of Respondents Interviewed	Total Number of Respondents
Timber farmers		Runyenjes	121	204
		Kyeni	83	
Saw millers		Central	3	3
Timber yard merchants		Central	2	3
		Runyenjes	1	

3.3.1 Participatory Rural Appraisal (PRA)

Participatory Rural Appraisal (PRA) is a technique used for gathering information on community resources and needs for use in literacy and community development programmes (Wilde and Vainio-Mattila, 1995). The approach was used to collect basic data on farm enterprises, timber farming and timber marketing. This approach enabled the respondents to interact freely with the researcher and exchange views, ideas, experiences and knowledge regarding timber farming and marketing in the district.

Semi-Structured Interviewing Schedule

An appropriate semi-structured interviewing schedule was administered to obtain information from each category of the different respondents (Wilde and Vainio-Mattila, 1995).

Farm Visits

Individual farm visits were conducted and the main instruments applied were farm walks and discussion with farmers. As Table 2 shows, 204 timber farmers were interviewed. During the farm visit, the researcher and her team introduced themselves, the purpose of the visit, and the planned activities. The first step was to ask if the farmer had sold timber trees and/or split timber trees for his/her own home construction use. Appendix I was used to enhance the dialogue between the farmers and the researcher in order to collect the required data. Other than timber trees, data on other trees, crops, and livestock production enterprises were collected. Specific reasons for tree planting, cutting and selling were discussed with the farmers. They gave information on the buyers of their trees, the prices they obtained, as well as the problems they faced in the marketing of their timber trees. A total of 204 farmers (121 from Runyenjes Division and 83 from Kyeni Division) were interviewed.

Market Surveys

The study population comprised of saw millers and timber yard merchants (see Appendix II and III for their respective interviewing schedules). The target population consisted of the owners of these premises or their employees who gave the required

information. They were interviewed individually within their premises. They gave information regarding where they sourced their timber or timber trees, prices, their customers, the problems they face, the current state of timber marketing and their opinion on what can be done to improve timber marketing. A total of 3 fixed saw millers and 3 timber yard merchants were interviewed.

Empirical Field Measurements

During the farm walks, tree heights were estimated by observing the trees, and diameter at breast height, measurements were taken by use of a diameter tape for standing trees. These measurements were used to quantify the parameters for those trees that were similar to those that had been sold for timber. Timber production and utilization measurements were taken on the number of trees that were cut and the quantity of timber that was obtained by the farmers for home use. Timber measurements were taken in terms of their different sizes of length, breadth and width.

3.4 Methods of Data Analysis

The data collected were analyzed for the entire group of 204 farmers, 3 fixed saw millers, and 3 timber yard merchants, and from the point of view of gender, marital status and number of dependants. The following methods were used.

3.4.1 Market Channel Analysis

On-farm timber marketing channel analysis was conducted in order to identify the channels that timber follows from its production to its consumption stage. Prices of

timber trees and timber were recorded at three different timber market participants' stages, namely, farmers, fixed saw millers, and timber yard merchants.

3.4.2 Statistical Analysis

Descriptive statistics were used to determine why farmers sell their trees, and the problems faced by the timber market participants at the three different stages. Linear regression was used to examine the relationships between independent variable, diameter at breast height and dependent variable, volume per tree (Figure 7); and independent variable, diameter at breast height and dependent variable, price per cubic meter (Figure 8). In order to fit and observe the relationships, the values of diameter at breast height (dbh), volume per tree (voltr), and price per volume (price per m³), were transformed into their natural logarithms, namely, $\ln dbh$, $\ln voltr$, and $\ln price \text{ per } m^3$.

The regression equation (4.1) fitted on the data set takes this form:

$$\text{Equation 4.1} \quad Y = A + BX$$

Where:

Y = the observation on the dependent variable,

A = the predicted value for the dependent variable when X is 0,

B = the slope,

X = observation on the independent variable.

Volume of *Grevillea robusta* Trees Sold in the Study Area

The volume per tree of the sold *Grevillea robusta* trees, the most dominant tree species, was calculated using the tree height and diameter at breast height measurements that were gathered during the farm walks. The following formula was applied:

$$\text{Equation 5.1} \quad V(m^3) = \pi d/2 h 0.5$$

Where:

$V(m^3)$ = Volume in cubic meters

π = constant

d = diameter at breast height of the tree

h = height of the tree

Appropriate Statistical Packages for Social Sciences (SPSS), Genstat, and MS Excel computer packages were utilized for the data analysis.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

From the analysis of the data that were collected, the following results and discussions were derived.

4.1 Smallholder Farmers' Household Characteristics

Results on smallholder farmers' characteristics in the study area are presented in Tables 3 and 4 and Figure 4. It will be noted that the households are generally headed by men. The results further indicate that most of the households consist of married couples of 5 persons per household and that women have a longer lifespan than men. The dominance of men in heading the households observed in the present study agrees with the findings of Kimenye, (1997), which indicated that men, controlled the production resources and farm derived income inspite the women managing more farms. This explains the high percentage of male respondents (71%), as compared to female respondents (29%). Regarding their marital status, 78% of the respondents are married, 2% are widowers, 17% are widows, while 3% are unmarried. Seventy-eight per cent of the households are male-headed, hence the further increase in the number of male respondents. Further, the results revealed that 22% of the respondents have no dependants, 68% had between 1-5, 8 % had between 6-10, and 2% had between 11-15. The presence of dependants within the household is an influencing factor to the farmers to sell their timber trees because of the associated cash needs, namely, school fees, hospital bills and household needs among others. Results show that the highest percentage of respondents, 68%, have between 1 and 5 dependants.

others. Results show that the highest percentage of respondents, 68%, have between 1 and 5 dependants.

Table 3: Smallholder Farmer Respondents in Embu District Distributed by Gender

Category of gender	Male	Female	Total
% of Total respondents	71	29	100

Key:

% = Percent

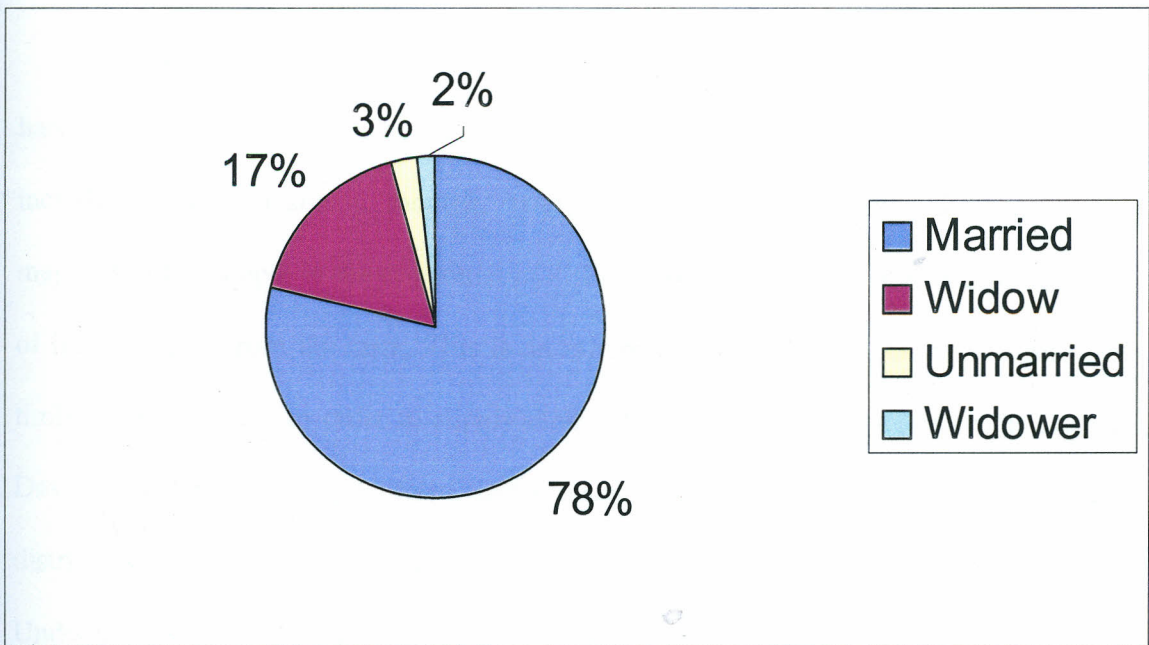


Figure 4: Marital Status of Smallholder Farmer Respondents in Embu District

(N = 186)

Key:

% = Percent

N = Number of respondents

Table 4: Number of Dependants of the Smallholder Farmer Respondents in Embu**District**

Number of Dependants	None	1-5	6-10	11-15	Total
% of total Respondents	22	68	8	2	100

Key:

% = Percent

4.2 Off-farm Sources of Income for the Farmers

All the products from the farm are a source of income to the farmers in terms of hard cash or cash in kind. The farmers also have other sources of off-farm income that include, pension, business, monthly salary, and retirement benefits (Figure 5). The majority of the people in the community (72%), however, do not have alternative sources of income apart from the farm. This is an influencing factor to the farmers to sell their timber trees for cash in order to supply their pressing needs. As reported in the District Development Plan, the agricultural sector accounts for 60% of the local incomes. The district experiences high unemployment levels due to lack of employment opportunities. Underemployment and low wages render a high percentage of the population unable to provide for all their needs (Republic of Kenya (2002).

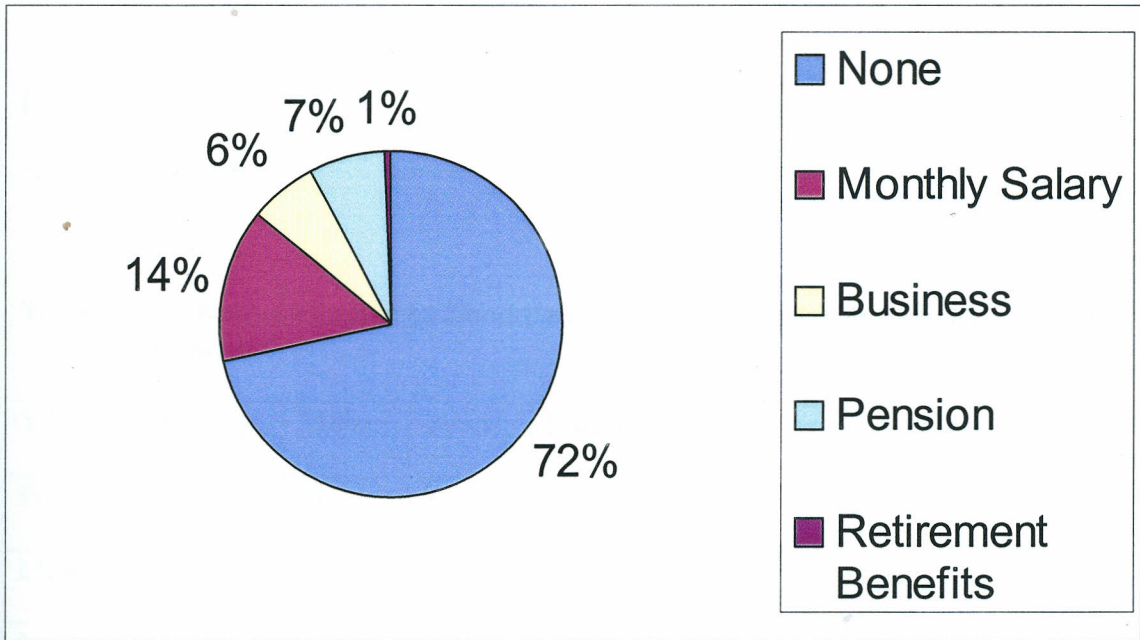


Figure 5: Off-farm Sources of Income for the Smallholder Farmers in Embu District (N = 154)

Key:

% = Percent

N = Number of farmers

4.3 The Farming Systems

The size of farms visited in Embu District ranged from 0.1 to 4.1 hectares, with a mean of 1.3 hectares. The farmers practice mixed farming where they grow cash crops, food crops, trees and rear livestock on the same piece of land. The main types of livestock include cows, goats, sheep and poultry. The study area is characterized by mixed farming systems where woody crop perennials are coffee and tea, and they are the main cash crops. The main food crops in the study area are maize, beans, bananas, and

potatoes (Table 5). The tree crops include macadamia, avocado, mango, and pawpaws as shown in (Table 6).

Table 5: Land-size Occupied by Food Crops in Embu District Smallholder Farms in Hectares

Type of food crop	Maize	Beans	Bananas	Potatoes	Land size owned
Per cent	81	80	75	76	100
Minimum	0	0	0	0	0.1
Maximum	1.6	0.8	0.4	0.7	4.1
Mean	0.3	0.2	0.1	0.01	1.3
Std.	0.3	0.1	0.1	0.1	0.9

Key

Per cent = Percentage of the total farmers with the food crop

Minimum = Minimum Land size occupied

Maximum = Maximum Land size occupied

Mean = Mean land size occupied by food crops among growers

Std. = Standard Deviation

N = Number of respondents

Maize is grown by most farmers, (81%), and it occupies the largest mean land size (0.3 hectares) (Table 5). Farmers attributed this to its favourable growing conditions as compared to other crops like potatoes and beans. Some farmers were unable to give estimates of the land that they planted with maize while others grew it on leased land

which is not considered as part of the farmer's land in this study. Bananas, on other hand, were said to occupy large areas of the farm which is already small in size.

Table 6: Tree Crops per Farm in the Smallholder Farms in Embu District

Type of tree crop	Coffee	Tea	Macadamia	Mango	Avocado	Pawpaw
Per cent	96	95	95	95	95	95
Minimum	0	0	0	0	0	0
Maximum	4500	10500	700	81	30	200
Mean	446.7	598.2	18.4	6.1	3.8	3.3
Std.	455.3	1288.7	55.4	9.4	3.8	15.5

Key:

Per cent = Percentage of total farms with the tree crops

Minimum = Minimum number of tree crops per farm

Maximum = Maximum number of tree crops per farm

Mean = Mean tree crops per farm among growers

Std. = Standard deviation

Table 6 presents results on tea and coffee which have the largest mean number of trees per farm, 598 and 446 stems respectively, since they are the main cash crops. The district relies heavily on them for income earnings. The incomes earned from them to a large extent determine the economic livelihood of the people in the district. Farmers in the study area emphasized preference for tea to coffee because of the low coffee prices

that have resulted from the collapse of the coffee sector. Due to the poor market prices, much of the coffee has been neglected and even uprooted. Its returns have declined in the last one decade, due to a glut in the global market (Republic of Kenya, 2002).

4.4 Timber Trees in the Farming Systems

In the study area, the main on-farm timber trees comprise *Grevillea robusta*, *Eucalyptus saligna*, *Cupressus lusitanica*, *Vitex keniesis*, *Pinus patula*, and *Cordia africana* (Table 7). *Grevillea robusta* is the most dominant tree species on the farms in Embu District, with a mean of 81 trees per farm (Betser *et. al.* 1999). The farmers attributed its high preference to its fast growth, compatibility with other crops on the farm, source of fuel wood, source of timber and rafters as construction materials, as well as soil fertility improvement. Due to its availability in large numbers on the farms, *Grevillea robusta* is currently the main source of timber in the district. The main ornamental trees include *Spathodea nilotica* and *Jacaranda mimosifolia*.

Table 7: On-Farm Timber Trees per Farm in the Smallholder Farms in Embu**District**

Type of Timber tree	<i>Eucalyptus saligna</i>	<i>Grevillea robusta</i>	<i>Pinus patula</i>	<i>Vitex keniesis</i>	<i>Cordia africana</i>
%	40	86	4	14	8
Minimum	0	0	0	0	0
Maximum	150	1000	30	38	20
Mean	6.3	81.8	0.4	1.0	0.3
Std.	18.7	104.5	2.6	3.8	1.7

Key:

%	=	Percentage of total farms with the on-farm timber trees
Minimum	=	Minimum number of timber trees crops per farm
Maximum	=	Maximum number of timber trees per farm
Mean	=	Mean timber trees per farm among growers
Std.	=	Standard deviation

4.5 On-farm Timber Marketing

Results in Table 8 show that farmers in the study area planted trees for other reasons apart from marketing as a priority. The reasons for planting trees in the study area included fuel wood supply (91%), source of construction materials (89%), and boundary marking (18 %). Planting trees in order to sell later on comprises only 7 % of the total

reasons for planting. In the male-headed households, the males dominate in the selling of the timber while their wives have little or hardly any information regarding the quantity sold and the selling prices. The women gave information on timber sale only in female-headed households, that is, where husbands are not living in the homestead, and women had assumed leadership.

Tyndall (1996) emphasizes that supply of firewood and construction materials are major reasons for farmers planting and keeping trees on their farms in the study area. He further points out that farmers planted *Grevillea robusta* trees to mark land boundaries when they first settled on the land. Consequently, the farmers do not obtain adequate information regarding the appropriate tree management practices, namely, proper spacing, pruning, thinning, and harvesting age, in order for their trees to meet the market requirements. In addition, they lack information on the best market opportunities that exist for them to obtain good returns from selling their trees (Holding, *et. al.* 2001).

Table 8: Reasons for Tree Planting as Given by Smallholder Farmers in Embu District (N = 196)

Reasons for Planting Trees	*% of Total Farmers
For fuel wood supply	91
For fencing	4
For boundary marking	18
For home construction	89
For sale of timber	7
For micro-climate modification	3
For soil improvement	2
For fruits' production	1

Key:

% = Percent

N = Number of farmers

* = Percentages do not sum up to 100% because farmers gave more than one response

4.5.1 On-Farm Timber Marketing Channels

Table 9 shows that eighty-four percent of the time, the buyer takes the initiative of going to the farmer who has timber trees, negotiates the price with the farmer, and cuts down the tree if both parties are agreeable. It is only in rare cases (16%), when the farmer takes the initiative of looking for the buyer to purchase his trees. In both cases of buyer or farmer initiative, the buyer is the one who organizes for and bears the cost of transporting the logs from the farm to his/her premises. As shown in Table 10, and Figure 6, the main buyers of timber trees from the farmers are the neighbouring people, and fixed saw millers outside the district, who constitute 48% and 41% of the buyers respectively. The neighbouring people purchase the trees mainly for their own home construction whereas the fixed saw millers outside the district buy for sawing. These fixed saw millers mainly contract local agents who identify the trees and negotiate the price with the farmers in advance. Once they are agreeable, the fixed saw millers come with the portable power saws and cut down the trees into logs. They then transport them as logs to their sawmills for further processing.

During the interviews, the farmers indicated their preference for selling their timber trees to fixed saw millers outside the district than selling to their neighbours, local fixed saw millers, timber yard merchants, and carpenters. The reason is that the fixed saw millers outside the district leave behind the tree branches as well as the off-cuts and the farmer uses them as fuel wood, construction material, or even sells them, unlike the other buyers who carry everything from the tree. Apart from one farmer, all the others sell their trees as standing trees or logs since they cannot afford the additional labour costs for sawing and processing into timber.

Table 9: Source of Farm Timber Buying Initiative (N = 204)

Source of Initiative	Buyer	Farmer	Total
% of Total respondents	84	16	100

Table 10: Categories of On-Farm Timber Tree Buyers in Embu District (N = 95)

Type of On-Farm Timber Buyer	*% of Total Buyers
Local fixed saw millers	3
Timber yard merchants	13
Carpentry workshops	3
Saw millers outside the district	41
Neighbours	48
School	2
Coffee society	1

Key:

% = Percent

N = Number of on-farm timber tree buyers

* = Percentages do not sum up to 100% because farmers gave more than one response

Mobile saw millers, on the other hand, move from village to village looking for trees to be felled. They mainly offer services to builders who approach them after buying trees from farmers. This emerging scenario is likely to cut off the market share of fixed saw millers, since mobile saw millers have better access and manoeuvrability in the farmlands. They have also firmly consolidated and integrated the production, processing and marketing aspects into one unit, while fixed saw millers experience increased production costs due to fragmentation of production and sales units.

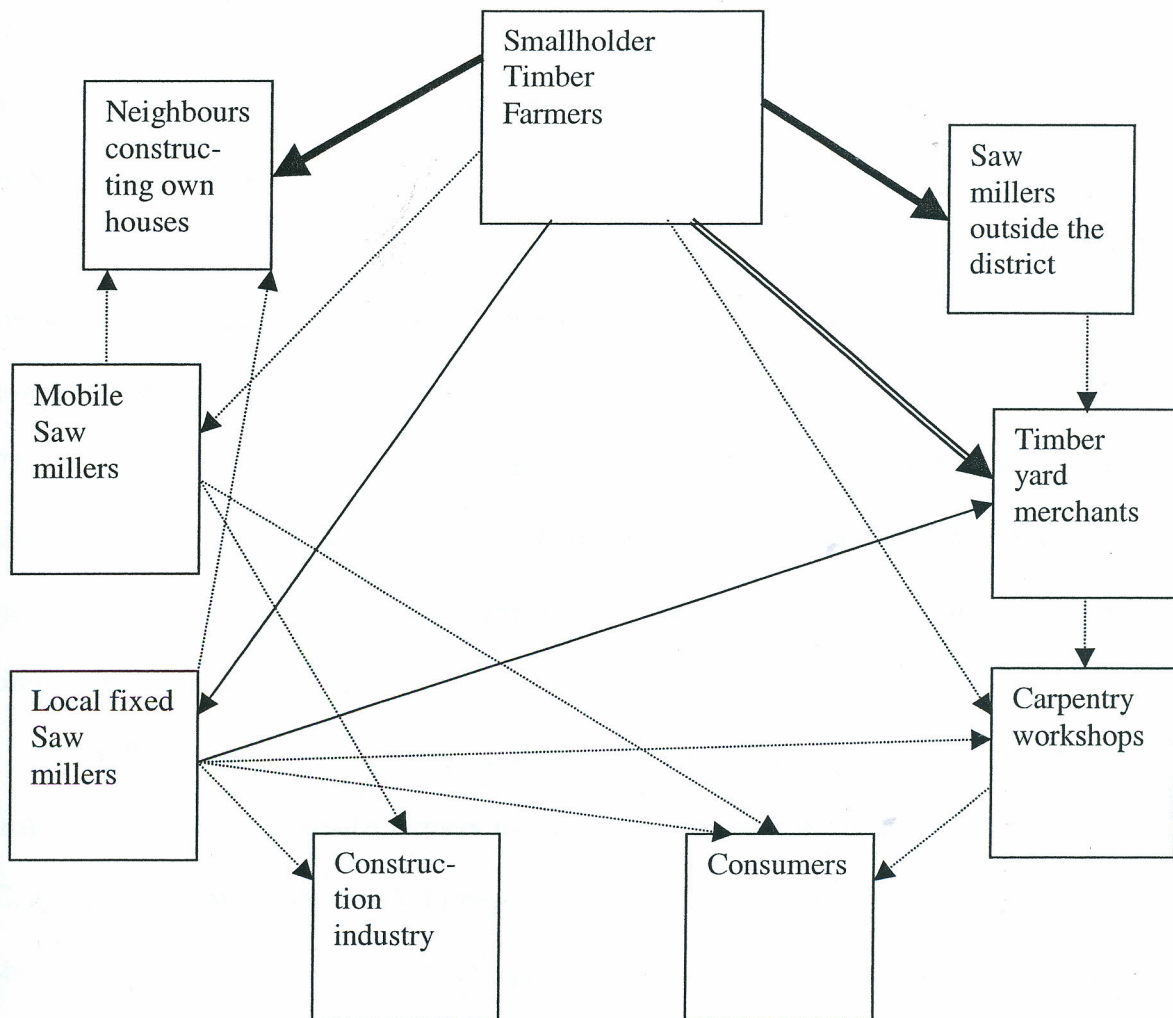


Figure 6: Flow Diagram Showing the Marketing Channels of Timber From Smallholder Farmers in Embu District

Key:

- ▶** Marketing channel with more than 40% of the buyers
- =====>** Marketing channel with 11 - 39% of the buyers
- ▶** Marketing channel with 1 - 10% of the buyers
-▶** Marketing channel to participants not studied

They enjoy easy access to the raw materials and ready markets, whereas the fixed saw millers have to pick the logs and transport them back to saw mills for processing and retailing (Opanga, 2000).

Opanga (2000) refers to carpentry workshops as intermediate consumers. He reports that carpenters indicate that the demand for *Grevillea robusta* products had been low but since the ban was effected, the market share for *Grevillea robusta* has increased. The scarcity of *Cupressus lusitanica* in the market has greatly enhanced the use of *Grevillea robusta* by the carpenters in furniture making. In the study area, the carpenters mainly obtain their timber from the farmers, local fixed saw millers, and also from the timber yard merchants.

Although there is a lot of data on *Grevillea robusta*, there exists no volume tables that could act as guidelines to farmers in quantifying the volume of their trees for sale. Consequently, farmers are unable to negotiate for good prices from their trees. Table 11 shows the average volume per tree (m^3) per diameter at breast height (cm) of *Grevillea robusta* tree sold standing. From the table, results show that it is possible to estimate the volume of a tree, given its diameter at breast height.

Table 11: Average Volume per Tree per Diameter at Breast Height of *Grevillea robusta* Trees Sold Standing by Smallholder Farmers in Embu District

DBH (cm)	Ln(dbh)	Average Volume per Tree (m ³)	Ln(voltr)	Lower boundary of 95% confidence interval of the mean (m ³)	Upper boundary of 95% confidence interval of the mean (m ³)
30	3.401	0.29	-1.2	0.26	0.32
40	3.689	0.57	-0.5	0.53	0.60
50	3.912	0.96	-4.1	0.92	1.01
60	4.094	1.48	0.4	1.40	1.56
70	4.248	2.13	0.8	1.98	2.29
80	4.382	2.92	1.1	2.67	3.20
90	4.500	3.87	1.4	3.48	4.30
100	4.605	4.96	1.6	4.39	5.60

Figure 7 shows a fitted and observed relationship between volume per tree (m³) sold and the diameter at breast height (cm) of *Grevillea robusta*, the most dominant tree species. The response variable is the natural logarithm of volume per tree (lnvoltr) while the natural logarithm of diameter at breast height (lndbh) is the explanatory variable. The model of the relationship is: $\text{Ln}(\text{Volume per tree}) = -9.296 + 2.3662 * \text{Ln}(\text{dbh})$. The linear regression explains 90.3% of the variation. It is evident that the volume per tree is directly proportional to its diameter at breast height. Such information would be very vital to farmers who are selling timber since estimation of wood volume is a more accurate method than crude scaling of whole trees i.e., estimating wood value by mere observation of the whole tree (Betser *et. al.* 1999). This method can be helpful to most

smallholder farmers, even those who are not highly educated. The lower and upper boundary 95% confidence intervals indicate the range within which the estimated volumes would vary. Selling timber by crude scaling of whole trees as utilized by farmers in the study area, however, is an inaccurate method of estimating wood volume (Macgale-Macandog *et. al.* 1999).

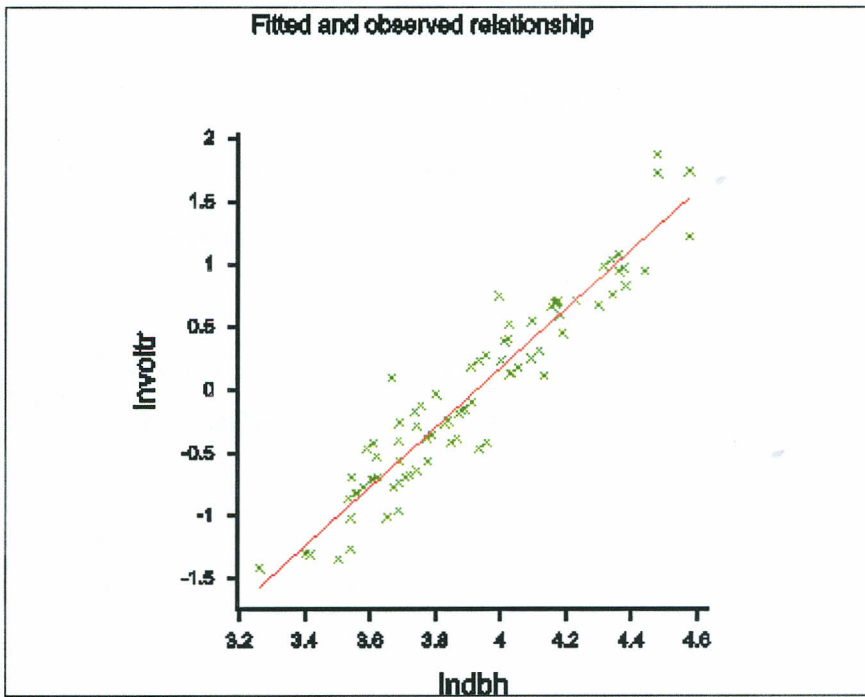


Figure 7: Relationship Between Volume per Tree (m^3) and the Diameter at Breast Height (cm) of *Grevillea robusta* Sold Standing by Smallholder Farmers in Embu District

4.5.2 Relationship Between Price and Volume of Trees Sold

To be able to improve the income from timber trees, knowledge of the current prices that the farmers are getting for their *Grevillea robusta* trees is vital. Table 12 shows the prices obtained by the farmers per cubic meter per diameter class over a seven-year period.

Table 12: Average Price per Cubic Meter and per Tree per Diameter Class of *Grevillea robusta* Trees Sold Standing by Smallholder Farmers in Embu District

Diameter Class	Number of Observations	Average Price per m ³ (Kshs)	Average Price per Tree (Kshs)	Ln (Price per m ³)
26 – 35	9	1120	361	7.0
36 – 45	30	882	488	6.8
46 – 55	19	821	668	6.7
56 – 65	20	445	703	6.1
66 – 75	5	671	1440	6.5
76 – 85	7	376	979	5.9
86 – 95	2	411	2500	6.0
96 - 105	2	207	1000	5.3

Table 12 and Figure 8 show that the price per cubic meter decreases with increasing diameter at breast height, while the price per tree increases with increasing diameter at breast height. Possible reasons for the decline include:

4.5.2 Relationship Between Price and Volume of Trees Sold

To be able to improve the income from timber trees, knowledge of the current prices that the farmers are getting for their *Grevillea robusta* trees is vital. Table 12 shows the prices obtained by the farmers per cubic meter per diameter class over a seven-year period.

Table 12: Average Price per Cubic Meter and per Tree per Diameter Class of *Grevillea robusta* Trees Sold Standing by Smallholder Farmers in Embu District

Diameter Class	Number of Observations	Average Price per m ³ (Kshs)	Average Price per Tree (Kshs)	Ln (Price per m ³)
26 – 35	9	1120	361	7.0
36 – 45	30	882	488	6.8
46 – 55	19	821	668	6.7
56 – 65	20	445	703	6.1
66 – 75	5	671	1440	6.5
76 – 85	7	376	979	5.9
86 – 95	2	411	2500	6.0
96 - 105	2	207	1000	5.3

Table 12 and Figure 8 show that the price per cubic meter decreases with increasing diameter at breast height, while the price per tree increases with increasing diameter at breast height. Possible reasons for the decline include:

- 1) Bigger trees are more frequently pollarded and as such they receive lower prices because a certain portion of the log has to be discarded due to rotting. Pollarded trees tend to be above 35 years of age since they had been planted to mark boundaries when land was being subdivided after 1960 (Tyndall 1996), and they have large diameters. During this time, many farmers pollarded their *Grevillea robusta* trees without knowing its side effects. The main reasons that they give for pollarding includes among others, supply of fuel wood and construction materials, reducing above ground competition, and to allow increment of the tree diameter. This explains why the trees with smaller diameter at breast height measurements, (i.e. 26 – 55 cm), obtained higher prices than those with larger diameters at breast height measurements, (i.e. 56 – 105 cm). A comparison of prices obtained from pollarded and non-pollarded *Grevillea robusta* trees is shown in Tables 13 and 14.
- 2) With the crude scaling method that is currently being used, farmers may have underestimated the volumes of trees at greater diameters, hence obtaining lower prices for them.
- 3) The farmers may have sold the trees with larger diameters earlier on when the prices were lower, since the selling prices obtained were for a seven-year period.

The study also revealed that farmers are getting different prices per tree for the same diameter class. This largely depends on the farmers bargaining power with the buyer, and the year that the sale was made. The farmers who negotiate better for their trees may have obtained higher returns for their trees. The availability of market information such as price and demand is important to the farmers' welfare. Limited

access to market information leads to their exploitation by traders or middlemen (Carandang, 1994).

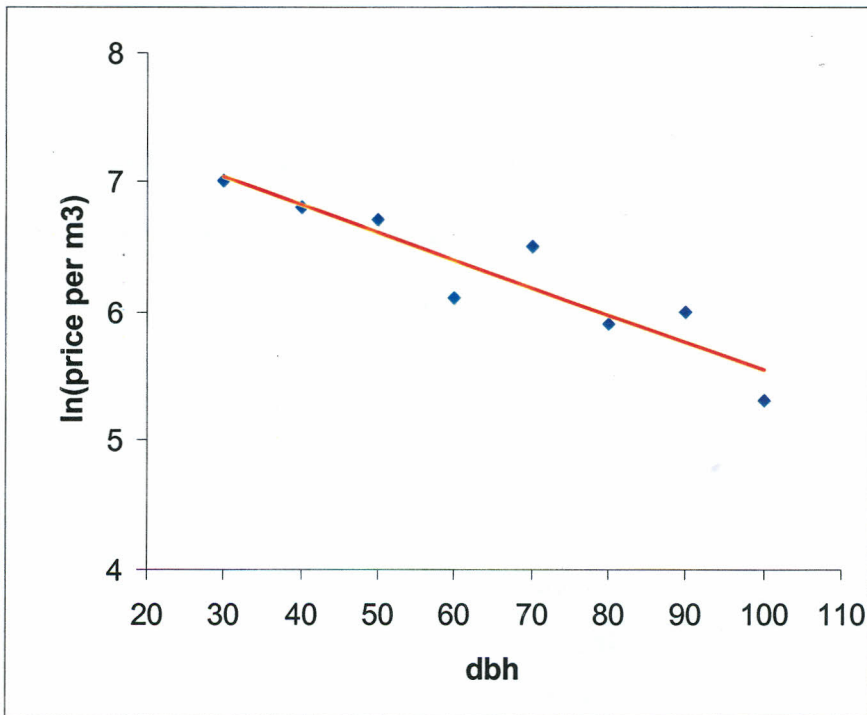


Figure 8: Relationship Between Price (Kshs) per Cubic Meter and Diameter at Breast Height (cm) of *Grevillea robusta* Trees Sold Standing by Smallholder Farmers in Embu District

Figure 8 shows the relationship between price per cubic meter and diameter at breast height of *Grevillea robusta* trees sold standing. The price per cubic meter is decreasing with increasing diameter at breast height of the tree. The model of the above relationship is: $\text{Ln}(\text{Price per m}^3) = 7.6726 - 0.0213(\text{dbh})$. The linear regression explains 24.5% of the variation. Based on the above fitted model, it is possible to estimate the price per cubic meter, given specific diameters at breast height of trees. In this way, it is

more useful for a farmer who will be interested to know what price per cubic meter he/she can get for the trees from his/her farm that he/she wants to sell.

Table 13: Average Price per Tree per Diameter Class of Pollarded *Grevillea robusta* Trees Sold Standing by Smallholder Farmers in Embu District

Diameter Class (cm)	Average Tree Height (m)	Average Price per Tree (Kshs)
31 - 40	4.5	350.00
41 - 50	3.6	450.00
51 - 60	9.0	400.00
61 - 70	8.1	400.00
71 - 80	9.0	600.00
81 - 90	9.0	550.00

Table 14: Average Price per Tree per Diameter Class of Non-Pollarded *Grevillea robusta* Trees Sold Standing by Smallholder Farmers in Embu District

Diameter Class (cm)	Average Tree Height (m)	Average Price per Tree (Kshs)
31 - 40	9.6	1,200.00
51 - 60	13.5	1,300.00
61 - 70	11.4	1,300.00
71 - 80	10.5	3,000.00
81 - 90	21	3,000.00

4.6 Problems Faced Within the Existing Marketing Channels of Farm Timber

4.6.1 Timber Marketing Problems Faced by Farmers

The first objective of the study was to identify the problems that are faced within the existing marketing channels of farm timber. The study found out that the marketing problems faced are different for the three different categories of respondents: at the farmers' level, at the saw millers' level, and at the timber yard merchants' level. Farmers indicated various problems that they face in the marketing of their timber trees (Table 15). Ninety-six per cent of the farmers cited low prices as the major timber tree marketing problem. As cited by Holding, *et. al.* (2001), the major problem facing farmers currently is that they don't know a volume method to help them estimate volumes of their trees as well as value them. Onchieku (2001) reported that farmers who are currently the main suppliers of timber are under exploitation by timber dealers who pay them very low prices for their timber. He attributes this to farmers' limited technical and marketing knowledge of trees. In addition, Pswarayi-Riddihough and Jones (1995) reported that farmers rarely process their products before marketing, which could earn them an added income.

Six per cent of the farmers in the study area cited lack of ready markets when they cut their trees as another problem, since they do not know where to sell their timber. Hammett (1998) observes that many agroforestry farmers are not aware of available markets as well as the means of getting their products to these markets. The result is that they often receive lower prices, are not aware of new or different market opportunities, or have little information to use for planning.

Poor timber quality due to lack of appropriate silvicultural skills could have led to low prices of timber. A few farmers, 4%, have pollarded their *Grevillea robusta* trees in search of firewood and to reduce above ground competition, but this has led to the deteriorating of the timber quality. Pollarding allows rainwater to pass down the tree, causing it to rot. This is another major reason that causes farmers to get low prices for their trees.

Other farmers, 2%, indicated theft of trees as another problem they face. They also reported that planted seedlings are sometimes stolen from their farms leading to frustration on their planting efforts. In addition, they said that the cost of the seedlings is high and that many of them cannot afford to buy. The cost of *Grevillea robusta* seedlings is Kshs. 5.00 per plant, while that of *Eucalyptus saligna* is Kshs. 6.00 per plant.

As a result of rapid harvesting of mature *Grevillea robusta* trees, farmers are left with immature trees whose prices are lower than those obtained from selling the mature trees. Consequently, the farmers sell many more trees in order to obtain a reasonable amount of cash to address their pressing needs.

Poor transport infrastructure contributes to low tree prices since the buyers incur extra costs in carrying logs from difficult sites like very steep slopes to accessible areas, and from farmers who are highly scattered over wide areas. The tree buyers therefore offer low prices to the farmers for their trees. According to Pswarayi-Riddihough and Jones (1995), poor infrastructure and high costs of transportation are barriers for potential market entrants and act as disincentives to increased production, leading to a less competitive market environment.

Table 15: Timber Marketing Problems Faced by Smallholder Farmers in Embu**District (N = 53)**

Type of Problem Faced	*% of Total Farmers
Poor quality of timber	4
Low prices of trees	96
Lack of ready market	6
Theft of trees	2
Low supply of timber	2
Poor infrastructure	2
Theft of seedlings	2
High cost of seedlings	2

Key:

% = Percent

N = Number of farmers

* = Percentages do not sum up to 100% because farmers gave more than one response

4.6.2 Timber Marketing Problems Faced by Fixed Saw Millers

The two fixed saw millers cited four major timber marketing problems. Limited variety of timber tree species limits the saw millers to only a few species like *Grevillea robusta* that are available in large quantities. *Eucalyptus saligna*, *Pinus patula*, *Vitex keniesis*, as well as *Cordia africana*, are currently available in very low quantities from the farms unlike previously when they were obtaining them from the forests. This results in low sales and hence low income as compared to when they could get a wide variety of timber trees from the forest before the ban on logging.

Poor infrastructure constrains the fixed saw millers from accessing trees that are situated down the valleys and on steep slopes (Holding *et. al.* 2001). The trees purchased from a difficult to access area are more expensive than trees obtained from an easy to

access area since more labour is required to move them to where they could be easily accessed by the transporting vehicles.

Fixed saw millers also indicated that they incur timber losses due to sawing immature *Grevillea robusta* trees that are currently available, since the old mature trees have been heavily exploited. They are also faced with the problem of damage by weevils that attack *Grevillea robusta* trees, which also contributes to losses.

4.6.3 Timber Marketing Problems Faced by Timber Yard Merchants

The three timber yard merchants also reported a number of problems that they face. The study revealed that they make low sales due to poor quality timber, especially from *Grevillea robusta* trees that are easily infested by weevils and easily break when harvested from immature trees. The poor quality timber has come about as a result of farmers' failure to manage their trees for timber sale purposes, in terms of proper spacing, thinning, pruning and harvesting them at a mature age (Holding, *et. al.* 2001). Low sales are also attributed to the nationwide deteriorating economy that leaves the buyers with little to spend on purchasing of timber. In addition, they reported that their individual sales are low because of the increased number of sellers of timber. The increase in the number of sellers results from the increased number of mobile saw millers who use portable power sawing machines. Due to their mobility, they are able to access even the difficult areas that fixed saw millers and timber yard merchants cannot penetrate.

4.6.4 Perceptions of *Grevillea robusta* by the Timber Actors

A main problem faced by saw millers and timber yard merchants in the study area is that *Grevillea robusta*, the main species available, is not appreciated by the buyers. Consumers claim that it has the following problems:

- (a) It is very susceptible to insects' attack, mainly weevils when still on the farm, and termites when it has been used for construction purposes. Opanga (2000) and Tyndall (1996) reported similar findings.
- (b) Other consumers dislike it on the basis of unattractive appearance. This is attributed to its rough grains that are irregularly arranged, compared to those of *Cupressus lusitanica* and *Ocotea usambarensis*.
- (c) It is also reported to break easily and this is mainly in instances where the timber is split from immature *Grevillea robusta* trees, or where the farmer has pruned large branches that leave scars on the tree. Such scars interfere with the arrangement of wood grains, thereby weakening it.

Tyndall (1996) reports, however, that the saw millers feel that *Grevillea robusta* timber has been misunderstood by the public. This is because it serves well in products that must not split in wet conditions. It is therefore used to make dhows at Kenya's coast, as well as coffee driers which must withstand frequent rains in the coffee growing regions. In addition, Opanga (2000) reports that all furniture makers interviewed indicated that mature *Grevillea robusta* of over 20 years is quite good. *Grevillea robusta* timber is ranked as moderately durable and moderately resistant (Bryce 1967, cited by Opanga, 2000). His results confirm that *Grevillea robusta* timber is easily sawn and nailable, with moderately

splitting and medium nail holding power. On seasoning, it dries slowly with slight distortion. He reported its use in place of softwood for building and shuttering, and plywood industry in Tanzania.

4.7 Factors Influencing On-farm Timber Marketing

Objective two of the study was to identify the factors that influence the marketing of farm timber. Results in Table 16 show the reasons that influence the farmers to cut down their trees. From the table, it is clear that selling of timber is the highest priority, comprising of 59%. Despite the farmers having not planted trees for marketing (Tyndall, 1996), the study showed that currently the major reason for cutting trees is to sell for timber.

Further, the study revealed that farmers are influenced by various factors to sell their trees for timber. As Table 17 shows, addressing immediate cash needs is a major factor, accounting for 90%. This has come about as a result of lack of sufficient sources of income to address farmers' pressing and immediate cash needs. Amongst the needs are school fees, hospital bills, household needs, farm inputs, and clearing of debts; which are similar to those listed by farmers from a related study in Claveria, Northern Mindanao, Philippines (Macgale-Macandog *et. al.* 1999).

Boundary disputes arise as a factor where the neighbouring farmer complains of the shading effect on crops and, hence, low production. Tyndall (1996) mentions that farms that have recent and specific land disputes plant fewer *Grevillea robusta* trees to avoid exacerbating the dispute, and in some cases they are forced to cut those that are already existing on the farms.

Security purposes refer to where the farmer is influenced to cut down and sell trees to avoid hiding places for thieves. In other situations, the farmers sell trees to avoid house damage especially for trees that have grown around the homestead. The Kenya Power and Lighting Company also requires the farmers to cut their trees along the routes where they are connecting electricity transmission lines.

From the timber buyers' side, on-farm timber marketing has come about due to the serious scarcity of wood resources in Kenya, resulting from the ban on logging in government forests (Holding, *et. al.* 2001). The scarcity is so much that the government has zero-rated timber importation into the country. This has accelerated the utilization of wood from farmlands, private sources such as individual farms, trust land and group farms (Onchieku 2001). They are left, therefore, with no option except for farmers to supply their timber need.

Table 16: Reasons for Tree Cutting as Given by Smallholder Farmers in Embu District (N = 199)

Reasons for Cutting Trees	*% of Total Farmers
For fuel wood supply	13
Clearing of land for farming	7
Due to boundary disputes	2
For home construction	56
For sale of timber	59

Key

% = Percent

N = Number of farmers

* = Percentages do not sum up to 100% because farmers gave more than one response

Table 17: Reasons for On-Farm Tree Selling as Given by Smallholder Farmers in Embu District (N = 123)

Reasons for Selling On-Farm trees	*% of Total Farmers
For immediate cash need	90
Availability of favourable timber market	8
To clear off mature trees	6
Due to boundary disputes	2
To prevent house damage	1
For security purposes	2
Pleading of the buyers	3
Requirements for electricity transmission	1

Key:

% = Percent

N = Number of farmers

* = Percentages do not sum up to 100% because farmers gave more than one response

4.8 Approaches for Enhancing Sustainable Production and Marketing of Farm Timber

The third objective of the study was to come up with approaches for enhancing sustainable production and marketing of farm timber. The results of the study indicate that interpretation of a model that shows the relationship between price per cubic meter or price per tree on one hand, and diameter at breast height on the other hand, could be useful in assisting smallholder farmers to estimate the volumes of their trees. Having the tree volume values, they can then calculate appropriate prices based on the prevailing unit market prices per given volume of trees. A volume model is a more reliable tool to disseminate to the farmers since volume does not fluctuate frequently like prices do. Such a marketing tool can be disseminated by the government through the extension agents, in order to promote awareness and equip farmers with appropriate market skills that will

enable them to effectively target and cope up with the existing dynamic markets for their trees and tree products.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

This study has availed very vital information on the functioning of smallholder farmers' marketing channels for on-farm timber in Embu District, Eastern Province, Kenya. Specifically, the study has identified the problems that are faced within the existing marketing channels of farm timber; the factors that influence the marketing of farm timber; and finally proposed suitable approaches for enhancing sustainable production and efficient marketing of farm timber.

5.1 Summary of Findings

Results of the study reveal that:

1. The major problem facing smallholder farmers in Embu currently is that they are not aware of any volume calculation method that can help them to estimate volumes and values of their trees.
2. Smallholder farmers in Embu are influenced by pressing immediate cash needs to market their farm timber.
3. Smallholder farmers in Embu need to be equipped with the knowledge of a volume calculation method, to help them estimate the volumes and values of their trees, in order to effectively target and cope up with the existing dynamic markets for their trees and tree products.

5.2 Conclusions

From the preceding results and discussions, the following conclusions have been reached.

- (a) Planting of timber trees in smallholder farms brings additional income to farmers in terms of cash revenue. This has the potential to improve the farmers' economic situation, as well as enhance the quality of the environment.
- (b) Smallholder farmers in Embu District have resulted to selling off their on-farm timber trees to obtain income. This has come about as a result of lack of stable alternative sources of income, especially with the collapse of the coffee sector which was their main source of income. In addition, they provide ready wood to the farmers who utilize it for their own home construction and in this way save the money that they could have spent on purchasing timber.
- (c) Timber dealers have turned to relying on the farmers for the supply of their timber requirements. This has been as a consequence of the closure of government forests that were previously their main source of timber supply.
- (d) There exists ready markets for the farmers' on-farm timber trees as well as a ready source of timber supply for the timber dealers. However, the necessary efficient marketing linkages between the two groups, namely, producers and buyers, are lacking.
- (e) Currently, the farmers are not able to estimate the volume of their trees in order to negotiate for the highest possible prices, hence they express dissatisfaction with the prices that they are receiving for their timber trees. They also lack the appropriate timber marketing information like specific customer requirements, which is vital in their supply of timber that meets the consumer demands.

- (f) It is evident that farmers lack the appropriate tree management skills like proper spacing, pruning, thinning, and the proper harvesting age. They have also learned from experience and from timber buyers that pollarding of *Grevillea robusta* trees deteriorates their quality for timber. This is because they obtain low prices for the pollarded trees compared to the non-pollarded ones. In cases where they are splitting timber for their own home use, they have to lose part of the log because of rotting.
- (g) The smallholder farmers sell their timber trees on individual basis to the buyers who approach them and the price that the farmers obtain depends on their bargaining skills. They also sell them as standing trees. The volume model derived from this study will enable farmers to estimate the volumes of their trees by relating with their diameters at breast height. Given the current tree prices per volume, they will obtain appropriate prices for their timber trees.
- (h) The timber tree buyers are from within and outside Embu District. They are mainly constrained by a limited variety of timber species that are scattered over wide areas and poor infrastructure.

5.3 Recommendations

Based on the preceding results, discussions and conclusions, the following recommendations for immediate application and further research are made.

5.3.1 Recommendations for Immediate Application

- (a) The government and non-governmental organizations should work closely with the smallholder farmers to promote agroforestry, which is the only solution to close the foreseeable gap between supply and demand of timber and to enhance the quality of the environment. Smallholder farmers need to be trained and equipped with the appropriate marketing skills in order for them to maximise benefits from the existing timber markets.
- (b) There is need for the farmers to be trained and equipped with silvicultural skills for proper tree management, in order for them to produce high quality timber that will fetch them higher prices. For instance, farmers need to avoid allowing growth of large branches and harvesting immature trees that are meant for timber, in order to avoid timber splitting. They also need to be educated on tree volume measurements and tree pricing information, so that the tree buyers will not move away to buy from them while they are not informed on the same.
- (c) It is also necessary to train extension agents on the volume calculation model and avail tree pricing information, in order for them to disseminate this information to the farmers through the media, pamphlets, brochures, or scheduled formal meetings.
- (d) Timber farmers need to organize themselves into timber marketing organizations / societies / co-operatives to gain more bargaining power. Such organizations will be able to negotiate for higher and uniform prices and possibly process their timber to add value to them instead of selling unprocessed trees/logs at low prices.

5.3.2 Recommendations for Further Research

- (a) Research institutions need to identify and introduce a wide variety of timber species that grow fast and produce high quality timber to attract consumers and increase the range of choices from which consumers can choose timber to suit their requirements.
- (b) There is need for research to guide government intervention to improve transport infrastructure so that buyers can access the timber trees wherever they are available at minimum costs.
- (c) Research is urgently required to guide the farmers in forming efficient and effective co-operative societies that will help in solving the problem of assembling trees from widely scattered farmers and difficult to access areas, to specified sale centres. This will ensure that they sell their trees at a collectively agreed upon price amongst themselves and at the same time secure ready markets from where the buyers can readily contact them.
- (d) The ongoing FAN/ICRAF/MoARD Meru timber marketing research and development programme is seeking to characterize small farmer market chains for timber. The volume model derived from this study may be refined by data derived from actual measurements of the involved parameters and then disseminated by the extension agents to the smallholder farmers in Meru District, who are currently lacking mensuration and valuation skills.
- (e) The current timber pricing and marketing information need to continually be updated through research and availed to the farmers frequently, to

enable them to value their timber trees according to the prevailing market prices.

5.3.3 Recommendations for Medium and Long-Term Research

- (a) The current survey was mainly carried out from a farmers' perspective, where adequate information was obtained. It was also carried out on a smaller scale from fixed saw millers' and timber yard merchants' perspective due to the limited resources and time within which this survey had to be finished. In future, a larger sample of saw millers and timber yard merchants needs to be interviewed to obtain information on: costs of buying and cutting trees, costs of transporting trees, costs of transformation of round wood into timber products, as well as prices obtained for each timber product. Such information will be helpful to calculate marketing margins and, hence, establish recommended buying and selling prices for timber trees and their products.
- (b) Many people suspect that farmers are exploited by the tree buyers. A specific study on assessment of prices from all the timber actors needs to be conducted, to ascertain whether the prices are due to the high costs incurred or above normal profits.
- (c) The different methods of providing tree pricing information suggested above, namely, media, pamphlets, brochures, or scheduled formal meetings, need to be tested for their effectiveness in delivering the information to the farmers.

REFERENCES

- Akinga, W. 1999. Timber Marketing Activity Planning Seminar July 26-27, 1999. Proceedings of FAN/ICRAF/ MoARD Meru Timber Marketing Research and Development Programme Seminar, Kenya: ICRAF.
- Arnold, M. 1998. Trees as Out-grower Crops for Forest Industries: Experience from the Philippines and South Africa. Nottingham, United Kingdom. Russell Press Limited.
- Betsler, L., Mugwe, J. and Muriuki, J. 1999. On-farm Production and Marketing of High-Value Tree Products in the Central Highlands of Kenya. *In: Temu, A. B. et al. 2000. Off-forest Tree Resources of Africa. Proceedings of a Workshop Held at Arusha, Tanzania, 1999. The African Academy of Sciences (AAS).*
- Carandang, A.P. 1994. Market Analysis for Small-Scale Multipurpose Trees and Shrubs Production. *In: Raintree J.B. and Francisco H.A. Marketing of Multipurpose Tree Products in Asia. Proceedings of an International Workshop in Baguio City, Philippines, December 6-9, 1993. Bangkok, Thailand. Winrock International.*
- Carsan, S. and Holding, C. 2001. 2nd Meru Timber Marketing Stakeholders' Workshop, June 25-26, 2001. Proceedings of FAN/ICRAF/ MoARD Meru Timber Marketing Research and Development Programme Workshop, Nairobi, Kenya. ICRAF.
- Central Bureau of Statistics, 1994. Statistical Abstract. Office of the Vice-president and Ministry of Planning National Development, Kenya.
- Deweese, P. A. 1996. Policies and Markets for Non-timber Tree Products. Discussion Paper No. 16. Washington D.C.: World Bank.

- Feredy, N., Gordon, A., and Oji, G. 1997. Domestic Market Potential for Tree Products from Farms and Rural Communities: Experience from Cameroon. NRI Socio-economic Series 13. Chatham, UK: Natural Resources Institute.
- Franzel, S., Arimi, H., Muriithi, F., and Karanja, J. 1999. *Calliandra calothyrsus*: Assessing the early stages of adoption of a fodder tree in the highlands of Central Kenya. AFRENA Report No. 127. Nairobi, Kenya: ICRAF.
- French, J.H. and Blicher-Mathiesen, U. 1995. Summary Report of the International Workshop on Agroforestry Investment, Production and Marketing. 17-26 September, 1995. Asia-Pacific Agroforestry Network Report No. 20. India.
- Galvez, O. and Felipe, C. 1999. Identifying and Assessing Market Opportunities for Small Rural Producers. Series note: Tools for Decision Making in Natural Resource Management. Cali, Colombia: Centre International de Agricultura Tropical.
- Gordon, A. 1997. Domestic Markets for Non-Timber Tree Products: Methodological and Strategic Issues. NRI Socio-economic Series 14. Chatham, UK: Natural Resources Institute.
- Hammet, A. L. 1998. Improving Markets for Farm Forestry Products. Morrilton, USA. Winrock International.
- Holding, C., Njuguna, P., and Gatundu, C. 2001. Farm Sourced Timber: The Restructuring of the Timber Industry in Kenya – Opportunities and Challenges. Proceedings of FAN/ICRAF/ MoARD Meru Timber Marketing Research and Development Programme, Nairobi, Kenya. ICRAF.
- Huxley, P. and Houten, H. 1997. Glossary for Agroforestry. Nairobi, Kenya. ICRAF.

- IIED, 1998. Understanding Market Opportunities. Participatory Learning Action Notes 33. London, UK: International Institute for Environment and Development.
- Jaetzold, R. and Schmidt, H. 1983. Farm Management Handbook of Kenya. Volume II. Natural Conditions and Farm Management Information. Vol. II/C. Eastern Kenya. GTZ, Nairobi, Kenya.
- Kato, T. 1996. Towards Sustainable Treefarming by Small Farmers: Key Factors Derived from the Experience of PICOP. Paper prepared for the International Conference on Community Forestry as a Strategy for Sustainable Forest Management, Manila, Philippines, 24 - 26 May 1996.
- Kimenyi, L. 1997. Improving the Dissemination of Technologies and Utilisation by Women Farmers: Results of a Study on Technology Transfer from Embu Regional Research Centre to Farmers in Embu and Mbeere Districts, Kenya. *In*: Curry, J. et al. 1998. **Institutionalising Gender in Agricultural Research: Experiences from Kenya**. Proceedings of the Gender Conference held at KARI Headquarters, Nairobi, Kenya, 1998.
- Kotler, Philip. 1980. Marketing Management: analysis, planning, and control. Englewood Cliffs, New Jersey. Prentice-Hall.
- Lecup, I. and Nicholson, K. 2000. Community-based Tree and Forest Product Enterprises: Market Analysis and Development. Italy, Rome. FAO.
- Lee-Ann, C. Hayek and Buzar A. Martin 1997. Surveying Natural Populations. New York. Columbia University Press.

- Macgale-Macandog, D., Menz, K., Rocamora, P., and Predo, C. 1999. Smallholder Timber Production and Marketing: The Case of *Gmelina Arborea* in Claveria, Northern Mindanao, Philippines. *International Tree Crops Journal*, Volume 10. Great Britain. A B Academic.
- Marshall, N.T. and Jenkins, M. 1994. *Hard Times for Hardwood, Indigenous Timber and The Timber Trade in Kenya*. Cambridge, UK. TRAFFIC International.
- MENR, 1994. *Kenya Forestry Master Plan: Development Programs*. Nairobi, Kenya. Ministry of Environment and Natural Resources.
- Nair, P. K. R. (1989b). *An Introduction to Agroforestry*. Kluwer Academic Publishers, Netherlands. *In: Njenga, A. 2000. Role of Tree Crops in Farming Systems of Some Humid and Semi-arid Areas in Kenya*. Masters Thesis, Kenyatta University, Nairobi. Kenya.
- Njenga, A. 2000. *Role of Tree Crops in Farming Systems of Some Humid and Semi-arid Areas in Kenya*. Masters Thesis, Kenyatta University, Nairobi. Kenya.
- Onchieku, J. 2001. *Assessment of Sawn Timber Yields (recovery rates) of Grevillea robusta from Farmlands in Meru Central District, Kenya*. Survey Report for FAN/ICRAF/ MoARD Meru Timber Marketing Research and Development Programme, Nairobi. Kenya.
- Opanga, P. 2000. *Emerging Markets for Grevillea robusta Farm Timber in Igoki and Ntakira Locations of Meru Central District*. Survey Report for FAN/ICRAF/ MoARD Meru Timber Marketing Research and Development Programme, Nairobi. Kenya.

Poulton, C. and Poole, N. 2001. Poverty and Fruit Tree Research: Issues and Options Paper. Kent, UK. Imperial College at Wye.

Pswarayi-Riddihough, I. and Jones, N. 1995. Some Marketing Problems Faced by Agroforestry Farmers in Asia. Washington D.C., USA. World Bank.

Republic of Kenya, 1997. Embu District Development Plan 1997 – 2001. Nairobi, Kenya. Government Printer.

Republic of Kenya, 2002. Embu District Development Plan 2002 – 2008. Nairobi, Kenya. Government Printer.

Scott, G. J. 1995. Prices, Products, and People: Analyzing Agricultural Markets in Developing Countries. Lima, Peru. International Potato Centre.

Tyndall, B. 1996. The Socio-Economics of *Grevillea robusta* within the Coffee Land Use System of Kenya. Nairobi. Kenya. ICRAF.

Vockins, K. 1999. Experiences, Challenges and Factors Affecting Success of Marketing Research and Development. Paper prepared for Workshop on the Cornerstones for Marketing Research and Development, September 16-17, 1999. Nairobi, Kenya. ICRAF.

Wilde, V. and Vainio-Mattila, A. 1995. Gender Analysis and Forestry: How To Use Rapid Rural Appraisal (RRA) To Develop Case Studies. Rome, Italy. FAO.

APPENDICES

APPENDIX I : TIMBER FARMERS' INTERVIEWING SCHEDULE

Division..... Location..... Village.....

Sub-location..... Interview date..... Duration on the farm (yrs)

Name..... Sex: Male Female

Relation to the farm owner: Owner Husband Wife Son
 Daughter Relative Employee

Marital status: Married Divorced Widower Widow

Number of children.....

1. Dist. from main road / shopping centre.....(kms)

2. Land-size owned.....(acres)

3. Major enterprises on the farm:

Livestock:

Livestock Type	No.	Age

Crops:

Type of crop	No. of acres

Tree species on the farm:

Species	Age	Total Number	Seedlings planted per season	Trees cut per season
1.				
2.				
3.				
4.				

Tree management practices undertaken:

Species	Seedlings' source	Seedlings' cost (Kshs)	Pruning cost/tree/year (Kshs)	No. of pruned trees/year	Total cost (Kshs)
1.					
2.					
3.					
4.					
5.					
6.					

4. Off-farm income sources:

.....

5. What reasons led you to plant trees on your farm the last 5 years?

- Fuel wood supply Fencing Boundary marking
Home construction Sale of timber

6. What has been contributing to your cutting of trees from your farm?

- Fuel wood supply Land clearing for farming Boundary marking
Home construction Sale of timber

7. If you cut trees for sale of timber, what led you to do this?

- Immediate cash need Existence of favourable prices for timber
Need to get rid of mature tree(s) from the farm
Other, specify.....

8. Who gets involved in tree planting and management on your farm?

- Husband Wife Children Workers

9. Number of *Grevillea robusta* trees on the farm that are pollarded -----

Are you aware that pollarding affects the quality of *Grevillea robusta* trees for timber?

- Yes No

If yes, how did you get this information?

- Personal knowledge From the timber buyers
From the forestry extension officers

Where,

DBH*- Diameter at Breast Height

BD*—Bottom Diameter

TD*--- Top Diameter

AD*---- Average Diameter

12. How does the buyer get information that you have trees that you want to sell?

Farmer's initiative Buyer's initiative

Who are your buyers of trees for timber?

Saw millers Timber yard merchants Carpentry workshop
owners

Do you have specific buyers to whom you sell your trees for timber?

Yes No

If yes, how many are they and how did you establish business contract / agreements with them?

What are your terms of operation with them?

If it is farmer's initiative, who incurs costs of transporting the trees to your buyers?

Farmer Buyer

If farmer, how much do you incur?

13. How do you determine the price at which to sell your trees for timber?

Forestry Dept. guidelines Buyer's decision
Farmer's decision Negotiating with the buyer
Tree size Tree age
Cash urgently required

At what age do you consider *Grevillea robusta* trees mature to sell for good quality timber?

Between 5-10 years Between 10-15 years Between 15-20
years Other(s), specify.....

Does the buyer of your trees communicate to you in advance of his/her requirements of trees for timber?

If yes, are you able to meet those requirements and how do you do that?

If no, why is it not possible for you to meet them?

14. If you seek guidance from the Forestry Department, how effective is it?
Very effective Effective Not effective

15. If you don't seek guidance from the Forestry Department, what are the reasons for this?

- Lack of awareness that such guidelines exist
- Forestry officers are out of my reach
- Other reason(s), specify.....
-
-
-

16. How do you compare the income obtained when you use Forestry Department guidelines and when you don't use them to sell your trees for timber?

- More income on use of the Forestry guidelines
- Less income on use of the Forestry guidelines
- No difference between them

17. Do you associate with other farmers in order to sell your trees collectively?

- Yes No

18. If yes, how many are you in the association with and what other activities do you conduct together?

19. If no, what are the reasons for this?

20. How can you rate the demand for *Grevillea robusta* trees within your locality?

- Increasing

What do you think are the reasons for this?

- Closure of the forest
- Easy accessibility and availability
- Good quality

- Decreasing

What do you think are the reasons for this?

21. What do you think is your role in coping with the above situation?

- Planting more trees
- Other(s), specify.....

22. What problems do you face in the marketing of your trees for timber, especially *Grevillea robusta*?

- Poor quality of the timber from the trees
- Low prices
- Lack of ready market
- Poor transport infrastructure
- Stiff competition from other timber species
- Other(s), specify.....

23. What are your recommendations to ensure sustainable production and efficient marketing of farm timber species?

APPENDIX II : FARM TIMBER SAWMILLERS' INTERVIEWING SCHEDULE

Division..... Location..... Village.....

Sub-location..... Interview date..... Duration on the farm (yrs)

Name..... Sex: Male FemaleRelation to the sawmiller: Owner Husband Wife Son
 Daughter Relative EmployeeMarital status: Married Divorced Widower Widow

Number of children.....

1. License charges per year (Kshs).....

2. Education level.....

3. Skills on saw milling technology acquired.....

4. Major tree species handled, their source, and reasons for handling them:

Tree Species	Source	Buying Unit	Unit price(Kshs)	Total Buying price (Kshs)	Specific reasons for Handling Them

5. If you have obtained timber trees from the farm, for how long has this been?

6. How do you obtain information on where to buy them?

 Saw miller's initiative Farmer's initiative Other, specify

7. If it is your initiative, what are the costs that you incur for this?

Agent

Type of Agent	Number	Wages/day (Kshs)	Salary/Month (Kshs)	Total Payment (Kshs)

Transportation Costs per trip

Loading & or Unloading (Kshs/person)	No. of persons	Total cost (Kshs)	Car Hire/Day (Kshs)	Own Car (Fuel Costs/Day) (Kshs)	Total Transportation Costs (Kshs)

Average transportation costs

Trips at peak season	Trips at off-peak season	Av. No. of trips	Total Costs incurred (Kshs)

8. How is the buying price determined?

- Forestry Dept. guidelines Buyer's decision
 Farmer's decision Negotiating with the buyer
 Tree size Tree age
 Other, specify.....

9. Do you have contracts with the farmers that you buy from?

- Yes No

10. If yes, what are the terms of the contract?

11. Do you associate with other saw millers in order to purchase and transport the timber to your premises?

- Yes No

12. If yes, how many are you in the association and what are your main activities?

13. If no, what are the reasons for this?

14. Cost of Logs

18. Which machines do you use for sawing wood?

Power saw

Bench saw

Circular saw

19. Timber recovery rates:

Tree species	Log volume	Machine used	Volume of sawn wood		%Recovery	%Wastage
			Size	No. of pcs.		

20. Cost of machine(s):

Type of machine	Year bought	Buying price (Kshs)	% Depreciation	Maintenance costs/year (Kshs)	Size of machine

21. How much does it cost you to fell and saw timber trees in terms of fuel?

Fuel	Ltrs./tree	Price/Ltr.	Cost/tree (Kshs)	No. of trees/trip	No. of trips/month	No. of months	Annual Costs (Kshs)

22. Who are your main buyers of timber?

Timber yard merchants
constructors

Carpenters

Building

Other(s), specify.....

23. From where do you obtain information about the market prices?

Forestry department

Saw millers

Timber yard merchants

Carpenters

Other(s), specify.....

24. Do you have business contracts with them?

Yes

No

25. If you do, what are the terms of your operations?

26. What are the advantages and disadvantages of having a business contract?

27. If you do not have, what are the reasons?

28. Who are your main business competitors?

28. How do you survive the competition in the timber market?

- Reducing prices Selling better quality timber
Other(s), specify.....

30. Do you purchase sawn wood from other saw millers?

- Yes No

31. If yes, how often and under what circumstances?

- Always Frequently Occasionally

Reasons?

32. Which criteria do you use determine which trees to buy?

- Price Maturity(age) Size(DBH)
Timber size wanted

33. How do you differentiate a mature from an immature farm timber trees?

- Rough bark Large branches Dark leaves

34. At what age are farm timber trees regarded as mature?

35. What are the advantages of using mature farm timber trees in contrast to immature trees?

36. How often do you use the mature farm timber trees?

- Always Frequently Occasionally

If not always, what are the reasons?

37. What preservation measures do you undertake to prevent *Grevillea robusta* from pests' infestation and how effective are they?

- Application of kerosene
Other methods, specify.....

38. How do you deal with the fuel wood that emanates from the purchased timber trees?

Left with the farmer

Selling it

If you sell, to whom and how often?

Does your supply meet the demand sufficiently? Yes

No

What are the units of sale and how much income do you obtain?

Unit of sale	Price per unit (Kshs)	Frequency of sales	Total sales (Kshs)

39. What is the demand trend of farm timber trees for timber in the locality?

Increasing

Decreasing

If it is increasing, what suggestions can you give that would ensure sustainable production and marketing?

39. Which problems do you face in the marketing of farm timber trees?

How do you try to solve them?

What do you think can be done to solve them more effectively?

6. Sawing costs of timber per month:

Timber species	Dimensions	Length (ft)	Sawing cost/ft (Kshs)	Qty. sawn/month	Total sawing costs (Kshs)

7. Buying costs of timber per month:

Timber species	Dimensions	Length (ft)	Buying cost/ft (Kshs)	Qty. bought/month	Total buying costs (Kshs)

8. Selling prices of timber per month:

Timber species	Dimensions	Length (ft)	Selling price/ft (Kshs)	Qty. sold/month	Total Amount (Kshs)

9. From where do you obtain information about the market prices?

- Forestry department Saw millers Timber yard merchants
 Carpenters

10. How do you obtain your timber for selling?

- Purchasing logs for sawing
 Purchasing from a sawmill
 Purchasing from other timber yard merchants

11. If you purchase logs, from where and how do you source them?

- Farmers' initiative
 Through agents

12. If through agents, how much do you pay them?

13. What are the costs of felling and sawing the logs?

Felling cost/tree (Kshs)	Dimensions	Sawing cost/ft(Kshs)	Length	No. of pieces	Total Cost (Kshs)

14. Transport costs:

What are the costs of loading and unloading wood into the vehicle?

15. How do you transport the wood from the source to your premises?

Use of personal vehicle to transport

Hired vehicle

16. If you hire a vehicle, how much do you pay to transport the wood from the source to your premises?

17. What preservation measures do you undertake to prevent *Grevillea robusta* from pests' infestation and how effective are they?

Application of kerosene

Other methods, specify.....

18. What problems do you face in the marketing of farm timber, especially *Grevillea robusta*?

19. What are the timber preferences for your clients and what reasons do they give for this?

Are you always able to meet their requirements?

If yes, how?

If no, what are your reasons for this?

20. According to you, how is the demand trend for farm timber species, particularly for *Grevillea robusta*?

Increasing

Decreasing

21. What recommendations would you give that could ensure sustainable production and marketing of farm timber species?