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# AN INVESTIGATION OF WOOD PRODUCTS CONSUMPTION IN KISUMU TOWN, KENYA: IMPLICATIONS FOR SUSTAINED TREE PLANTING.

BY

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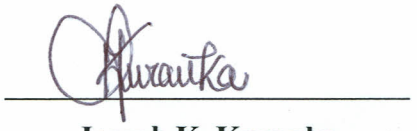
A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF ENVIRONMENTAL STUDIES (SCIENCE) OF KENYATTA UNIVERSITY.

**Declaration**

This thesis is my original work and has not been presented for award of a degree in any other University



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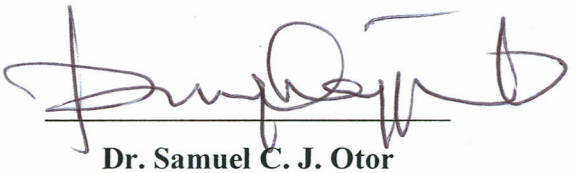

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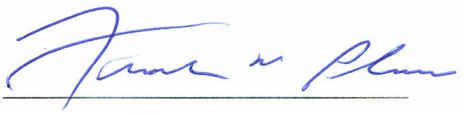

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***Dedication***

***To Kurauka family.***

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**May the Lord shower all with ample blessings.**

## Abstract

The crisis of declining availability of wood products and their link with environmental degradation through wanton destruction of forests, continues to influence extensive investment in on-farm wood production and the promotion of new forms of forestry management. Although numerous programmes have been started in Kenya to increase the supply of wood products, namely, planting wood lots, agroforestry, and improvement of the extension services, wood product shortages continue to be severe especially in the Kenyan Lake Victoria Basin region. This study carried out in Kibuye market set out to determine tree species preferred for timber and other main wood products, their prices, quantities and sources. Using random sampling a sample of 224 respondents was drawn from a population of about 2,500 wood product dealers in Kibuye market to establish the said objectives through the analysis of data collected by means of interview schedules, questionnaires and observation sheets. Interviews were conducted to gather information from key informants, namely, the Winam divisional forest officer, market superintendent, and leaders of various wood products dealers associations. The study data were analyzed using the statistical package for social sciences (SPSS). Chi-square analysis was used to compare the available tree species for wood products used and species dealers would prefer for various wood products. Results of chi-square ($\chi^2$) indicate that the differences in available tree species for timber product and species dealers would prefer were significant at $p \leq 0.05$ level ($\chi^2 = 1201.651$; df=24; $p < 0.05$). The study found out that trees such as: *Eucalyptus* spp., *Pinus* spp., and *Cupressus* spp. are commonly used species. There was a significant variation in the tree species preferred as well as their geographical location. *Eucalyptus* spp. is widely being adopted as an alternative source of hard wood in the district. The findings also showed that wood quantity demanded has been increasing moderately between the years 1995 to 2002. Results of chi-square ($\chi^2$) indicate that the differences in the quantities of all wood products acquired between 1990-1995 and 1996-2002 were significant at $p \leq 0.05$ level ($\chi^2 = 17.218$; df=9; $p < 0.05$). Prices of wood products have also significantly been increasing over the last ten years. From the study findings, it is evident that *Eucalyptus*, *Cupressus* and *Pinus* spp. tree species are available through out the year; however, some tree species including *Juniperus procera* (Cedar), *Olea africana*, and *Grevillea robusta* among others are generally available in small quantities. *Ocotea usambarensis* (Camphor) and *Olea capensis* spp. *Welwitschii* were hardly available hence the little quantities available in the market were highly priced. The study findings showed sources of tree species for wood products to be: Kisumu, Nakuru, Vihiga, Uasin Gishu, Kericho and Narok. The former East Africa Tanning and Extract Company (Eatec) farm near Eldoret town in Uasin Gishu district is the main source of charcoal made from *Olea mearnsi*. During this study *Eucalyptus* spp., *Pinus* spp. and *Cupressus* spp. used for some wood products including timber, charcoal, posts/poles, and fuelwood among others were found to be more within neighbouring districts especially Nyando, Nandi and Vihiga.

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## Acronyms

| | |
|---|---|
| ASALs | Arid and Semi-Arid Lands. |
| EATEC | East Africa Tanning and Extract Company |
| ELCI | Environment Liason Centre International. |
| ESMAP | Energy Sector Management Assistance Programme. |
| ICRAF | International Centre for Research in Agroforestry |
| FAO | Food Agricultural Organization. |
| GoK | Government of Kenya. |
| IEA | International Energy Agency. |
| KEFRI | Kenya Forestry Research Institute. |
| KIFCON | Kenya Indigenous Forest Conservation Programme. |
| MENR | Ministry of Environment and Natural Resources. |
| NEMA | National Environment Management Authority. |
| NGO | Non-governmental Organisation. |
| SPSS | Statistical Packages for Social Sciences |
| UNEP | United Nations Environment Programme. |
| (*) | Projected figure |

# CHAPTER ONE

# 1.0 INTRODUCTION

## 1.1 Background to the study

Many people who depend on trees for their daily needs are harvesting them faster than they can regenerate, therefore, threatening sustainability. Sustainability of trees determines the longevity of forests because they are a renewable resource and can regenerate when harvested in a sustainable manner (Bussman, 1994). The destruction of woodlands could be the biggest threat to Kenyan's forests already weighed down by excisions. In 2001, the government announced plans to give out 67,000 hectares of gazetted woodlands to individuals (Kenya gazette, 2001), a move that could threaten sustainability of wood resources.

Environmental conservation is greatly threatened by the flourishing charcoal trade that has led to the harvesting of an estimated 2.3 million tons of charcoal per annum (FAO, 1996). According to the Kenya Forest Master plan (2000), the country consumed 2.85 million tonnes of charcoal in 2000, a figure that doubles that of 1982. It takes between 6 and 10 tonnes of wood to manufacture a ton of charcoal (ELCI, 2000), hence putting much pressure on wood resources.

Tree growing needs to be undertaken mainly outside gazetted forest areas. Farm forestry (tree and shrub) planting on farms and other rural lands in order to supply households and markets with wood fuel, poles, timber, fodder, and other direct or indirect tree products (fibre, honey, dyes, and medicines) has been promoted in many districts in Kenya. Wood

resource is perhaps the most economically utilized resource in the 20th and 21st centuries (FAO, 1996). There have been numerous uses of wood resources such as timber sawing, fuel wood (household level and industrial), pulp and charcoal making. This has led to increased pressure on the limited wood resources hence the unsustainable use of wood.

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 shifted the demand for wood from the forests and plantations to the farmers' fields. Utilization of wood resources on energy such as wood fuel has both ecological and socio-economic effects within the Lake Basin region. Wood resources for meeting fuel wood and charcoal demands are derived from the non-sustainable felling of standing timber as well as from the sustainable harvesting of annual yields. Production will not adequately meet growing demands, as the significance depletion of standing stock can be anticipated (the ESMAP phase working paper).

In Kenya, government gazetted natural forest covers 170,000 ha, of which about 6,000ha have been harvested but not yet replaced. This estimate includes only those plantations that are under the management of the Forest Department, and excludes private plantations (which are included in *farmlands*). It is estimated that an average growing stock of the forest plantations is 347 $m^3$/ha of wood biomass. Due to high demand for wood products, shortage will be experienced because the harvesting has been at a rate by area below the average replanting rate (Kenya Forestry Department master plan, 1994).

On-farm production and marketing of tree products has been realised in Kenya. In central Kenya, the farmers tree preferences are for the comparatively slower growing and higher

value indigenous species such as *Cordia africana, Olea usambarensis,* and *Vitex keniensis.* Farmers within the central Kenya highlands have a strong tree growing culture (Castro and Dewees, 1993), but have a limited diversity of trees with marketable products. Although there are several reasons farmers intercrop agricultural crops with trees (Rocheleau et al., 1988; Nair, 1989), one of the reasons in West Usambaras is possibly to diversify the range of products for the households (Moshi, 1997).

While the agricultural crops, which are cultivated during rainy seasons, provide the farmers with staple food and cash from sales of the surplus production, trees usually provide various productive and service functions (Rocheleau et al., 1988; Nair, 1990; Young, 1990; Lulandala, 1994). Inadequate market information to secure favourable markets for timber products may lead to unsustained timber production hence encroachment of neighbouring forests. According to Castro and Dewees (1993), farmers in Murang'a and Nyeri have traditionally used trees in a variety of niches within the farm for example; *Prunus africana* and *Cordia africana* are used for sub-clan boundaries.

**1.2 Statement of the problem**

There is concern over the high demand for wood products that has led to wanton clearance and destruction of trees. This has made the government to put a ban on the use and transportation of wood products from natural forests and government plantations (GoK, 2002). As a result, wood products have increasingly been on demand because of limited sources hence the need to ensure sustained production. It is essential, therefore, that a study is carried out to determine currently demanded tree species and future wood demands to enable farmers achieve a higher awareness of market prices and demand.

This will reduce the pressure on indigenous species, exerted by market actors, through stimulating farmers to produce more from farm forestry.

Most policies for tree product harvesting and sale are framed to control destructive harvesting of trees in natural forests. With less than half a hectare of natural forest remaining per person in the tropics, trees on farms are often more important for tree product supply than trees in forests. The study is aimed at looking for ways in which farmers find access to the commercial timber and other wood product markets in order to provide room for suitable intervention, therefore enhancing environmental conservation through adoption of a wider variety of tree species.

Due to high demand for timber, firewood, and other tree products, it is projected that there will be acute shortage of timber especially from *Cupressus, Pinus*, and *Eucalyptus* spp. (REF). Hence, on-farm timber production cannot be sustained if the farmers are not motivated to plant more trees in their farms due to lack of sufficient market information in order to secure favourable markets for their wood products. Further, the study could provide a basis for future species selection for planting.

### 1.3 Research questions

This study seeks to address the following questions:

(1). What are the quantities and sources of wood products used by the dealers?

(2). What are the tree species preferred for timber and other wood products?

(3). What prices are paid for wood products sold or bought for various tree species?

### 1.4 Objectives of the study

The objectives of the study are:

(1). To determine the quantities and sources of tree species used by the dealers.

(2). To identify trends in species preferred for timber and other wood products.

(3). To determine prices demanded in various wood products.

### 1.5 Hypotheses of the Study

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

1. Quantities of tree species in high demand by customers are not adequately supplied from the farms.
2. Species preferred by users of timber or other wood products do not match species preferred by producer-farmers.
3. There are spatial variations in prices for various tree species in wood products.

### 1.6 Scope of the study

The principal focus of the study was wood products dealers with firms within Kibuye Market. This is because it is within this market that the majority of wood products dealers in Kisumu town have located their businesses.

The variables of the study investigated were limited to determine the quantities and sources of tree species used by dealers, trends in species preferred for timber and other wood products and determining the prices demanded in various wood products.

### 1.7 Justification of the study

Following the recent government ban on the use of forests and government plantations, determination of wood demand and tree species currently preferred by urban wood products dealers will assist in establishing the amount of wood products required hence help in maintaining the desired long-term production by farmers. Adoption of on-farm produced tree species which are preferred by wood products dealers will give an alternative source to indigenous forest hardwood species hence enhance environmental conservation.

The study was conducted in the context of an on-going agroforestry programme carried out by ICRAF/GoK within the lake Victoria basin region of Kenya; hence the findings will be useful in strengthening the ICRAF/GoK's interventions in line with the environmental conservation objective within the study area. The findings will also help in formulating local stakeholders policies that are in line with the desired sustainable

production of timber for furniture making, poles, posts and charcoal from on-farms. Further, planting the right species and at the same time meet the demand for consumers will ensure sustainable production of wood products.

## 1.8 Significance of the study

The study will be significant because by providing information on markets, marketing arrangements, and prices for wood products, it will provide a basis for decision-making by farmers and policy makers. This among other things, information on tree species demanded by the wood dealers will enable farmers to make informed choices on which tree species to plant, possibly in response to market demands hence reduce pressure on scarce indigenous tree species.

## 1.9 The study area

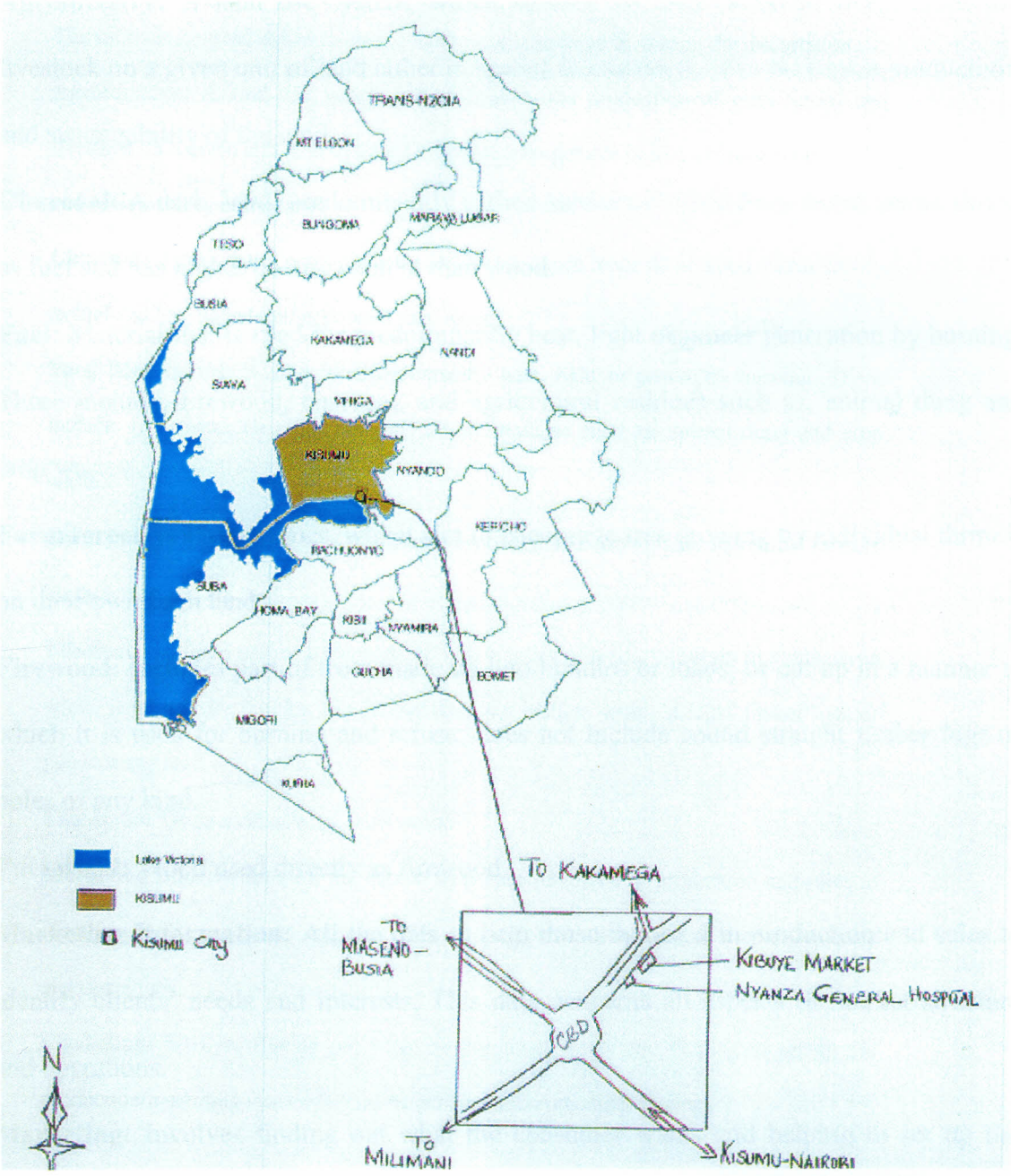
### *1.9.1 Position and size*

The study was conducted in Kibuye market in Kisumu district. Kisumu is the largest of the eleven districts forming Nyanza province. Kisumu town lies within Longitudes $34^{o}$ 46'E and Latitudes $0^{0}$ 5'S. Kisumu district is bordered by Rachuonyo District to the South West, Nyando District to the East, Nandi District to the North East, Vihiga District to the North West and Siaya District to the West [Map 1.1.]

### 1.9.2 Topography and climate

Kisumu district lies in a down warped part of large lowland surrounding the Nyanza Gulf, at the tip of which is Kisumu Town. Rainfall is about 1,500mm per annum. Altitude – 1800 metres at sea level in the south to 4310 metres to the north.

**Map 1.1 Lake Basin map showing the location of Kisumu District**



## 1.10 Definition of terms

The following are the definitions of terms from various sources as used in the dissertation:

**Agroforestry:** A land use system, which enables the production of trees, crops and livestock on a given unit of land either in spatial arrangement or to maximize productivity and sustainability of the land.

**Charcoal:** A dark, hard, predominantly carbon substance made from wood, burns slowly as fuel and has higher energy content than wood.

**Fuel:** Material that is used for predominantly heat, light or power generation by burning. These include, firewood, charcoal, and agricultural residues such as, animal dung and crop wastes.

**Farm forestry:** Programmes, which aim to encourage tree growing by individual farmers on their own farm land.

**Firewood:** Includes part of trees made up into bundles or loads, or cut up in a manner in which it is used for burning and refuse; does not include sound straight timber logs or poles of any kind.

**Fuel wood:** Wood used directly as firewood.

**Marketing Information:** All the data to help those involved in production and sales to identify clients' needs and interests. This data concerns all aspects of market structure and operations.

**Marketing:** Involves finding out what the consumer wants and helping to set up the production/marketing system that meets demand and maximizes income.

**Markets:** Outlet for products and services. The buyers may be either institutional or individuals. Markets may exist for raw materials, semi-processed goods, finished products or services. They can be local, regional, national or international.

**Timber:** Any tree which has been felled or which has fallen, and the part of any tree, which has been cut off or fallen, and all wood whether sawn, split, hewn or otherwise fashioned.

**Trees:** Include not only timber trees, but trees, shrubs, bushes, of all kinds, seedlings, saplings and re-shoots of all ages, palms, bamboos and part of tree. It is a large (usually tall) long-lasting type of plant, having a thick central wooden stem (the truck) from which wooden branches grow, usually bearing leaves.

**Pole:** Long thin rounded piece of wood used as a support or for pushing boats.

**Post:** Piece of wood set upright on the ground to support or mark a position.

# CHAPTER TWO

# 2.0 LITERATURE REVIEW

## 2.1 Introduction

In the middle of 1990-2000 decade, the increases in wood supplies did not keep pace with the increases in wood demand. By the year 2002, wood demand was projected to be about 45 million $m^3$ while the supply was expected to be about 38 million $m^3$ giving a wood deficit of 7.0 million $m^3$. The deficit, which manifested itself mainly in fuel wood, led to further deforestation and environmental degradation (KEFRI, 1999). Further, the current harvesting policies are not geared towards sustainability. Presently, there is over-harvesting of immature crops in more accessible areas. Large cleared areas have also not been replanted; therefore urgent measures ought to be taken to improve plantation management and develop alternative sources such as farmland production.

Farmers in the central highlands of Mount Kenya region have long used integrated farming systems, growing indigenous and exotic trees with crops on farmlands and pasturelands. The tree species produce poles, timber, and fuel wood through the intensive management practices of pollarding and side pruning (Amore, and Kadir, 1988). Several surveys have been carried out on farm and community forestry.

Foley and Bernard (1984) stated that, in Kenya, people plant trees for timber, fruit, shade, ornament, boundaries and windbreaks. Further, few trees are planted purposely for fuel wood; however, farmers expect to obtain fuel from trees, which have been planted for other purposes. Chavangi and Zimmerman (1987), argue that farm forestry is an integral part of subsistence farming but also provides cash income through the sale of poles,

timber, charcoal, fruit, fodder, honey, carving wood, gums and resins. Further, income generation as a main production objective points to the importance of understanding markets for the products of tree cultivation.

The wood resources requirements in Kenya were projected to increase from 20.4 million tons in 1980 to 47.7 million tones by the year 2000 (O'keef et al., 1984). The shortfall was expected to reach about 33 million tones by the year 2000 and it is anticipated that this massive shortfall in wood supplies severely disrupted the economy and lives of many Kenyans, particularly in the rural areas (Tables 2.1 and 2.2) in the next two pages. Projections by O'keef et al. have been discredited, as they did not take into account the stock growing on farms and the increment in the growing stock.

The study on wood market around Mount Kenya carried out in the year 2000/2001 found that wood resource products are consumed on daily basis by the rural people, and poorer communities in urban centres (ICRAF, 2001). The Ministry of Energy undertook households' survey in 25 districts in Kenya with the objective of estimating the current fuel wood demand both in rural and urban households (GoK, 2000). It determined the per capita fuel wood consumption in all districts giving a figure of 98% of the energy for rural Kenya.

Using the 1989 census data, a per capita fuel wood consumption was estimated at an average of 761 kg. Agastiva (1987), points out that the rapidly growing population has increased demand on wood energy. Forests are cut down faster than they can be replaced,

thereby creating shortages in wood supplies. Further, charcoal demand accounts for about 35% of the total fuel wood demand in rural areas, and 23% of urban households (GOK National Land Degradation Assessment and Mapping in Kenya, 1997b). However, little has been done to determine the tree species currently used in the Agastiva's study area.

**Table 2.1: Current trends and projected (*) fuel wood supply-demand balance ('000m$^3$) in Kenya**

| *Year* | *Sustainable fuel wood supply* | *Non-sustainable fuel wood supply from clearings* | *Total Fuel wood supply* | *Fuel wood demand* | *Fuel wood deficit* |
|---|---|---|---|---|---|
| **1992** | 16,923.4 | 254.4 | **17,177.8** | 18,106.5 | **1,238.9** |
| **1995** | 18,250.2 | 261.2 | **18,511.4** | 20,106.7 | **639.9** |
| **2000** | 19,812.4 | 391.7 | **20,204.2** | 23,946.7 | **1,402.8** |
| **2005*** | 21,320.0 | 520.6 | **21,840.6** | 27,693.3 | **4,087.3** |
| **2010*** | 22,890.3 | 647.2 | **23,537.4** | 31,720.0 | **6,634.6** |
| **2015*** | 24,676 | 770.4 | **25,447.2** | 35,880.0 | **9,122.6** |

*** Projections**

**Source: Kenya forestry master plan based on ministry of energy, rural household energy survey 1988.**

At least 80% of urban fuel wood demands by households are met by charcoal. Charcoal use in urban centres amounts to about 1.4 million tones annually. With yields varying from 10% to 14% by weight, this requires 10-14 million tons of wood. Most charcoal used in Kenya is transported by road to the urban areas where it is used. About 90% of Nairobi's charcoal supply comes from Eastern and Rift valley provinces. Kisumu's charcoal comes from Western and Rift Valley provinces, while much of Mombasa's charcoal comes from the North-Eastern and Coast province (Mugo, 1999).

**Table 2.2: Projected (*) fuel wood supply and demand based on current trends ('000m$^3$) in Kenya**

| *Year* | *1995* | *2000* | *2005** | *2010** |
|---|---|---|---|---|
| **Fuel wood demand** | **20,107** | **23,947** | **27,693** | **31,721** |
| Accessible sustainable supply | | | | |
| Indigenous forest | 1,665.5 | 1,143.0 | 1,120.5 | 1,098.0 |
| Woodlands/bush lands | 10,585.4 | 10,507.6 | 10,429.8 | 10,353.0 |
| Farm lands/settlements | 6,145.8 | 7,746.2 | 9,417.7 | 11,079.4 |
| Forests plantations | 353.5 | 415.6 | 351.9 | 360.8 |
| **Total fuel wood supply** | **18,250.2** | **19,812.4** | **20968** | **22891.2** |
| **Deficit**** | **1,856.8** | **4,134.6** | **6,725** | **8,829.8** |

****Majority of these deficits occur in the high potential agricultural areas**

**Source: Kenya forestry master plan based on ministry of energy, rural household energy survey 1988.**

In several cases, farmers have reported on the value of growing trees both for supply of products for their own use and to boost the family's cash income Gustavson and Kimeu (1991). Further, in their study in Vihiga and Kakamega districts in Western Kenya on the socio-economic aspects of eucalyptus spp. growing on small-scale farms through cross-margin calculations, found that it was very profitable, with only tea exceeding it. Income of each farmer increased annually by Ksh. 5000 when he was self reliant from the sale of poles, firewood, fencing posts, and timber. Minae and Akyeampong (1988) state through informal surveys that soil fertility is a major problem in the land use systems and this has led to shortages of trees for livestock feed and fuel wood.

## 2.1 The world fuel wood situation

The demand for biomass fuels in the world is very high and represents the second largest source of energy use after fossil fuels. According to the International Energy Agency (IEA), global energy use has risen to 70% since 1971 and is poised to continue its steady increase over the next several decades, fuelled by economic expansion and development (World Resource Institute, 1998-1999). Statistics show that in developing nations, about two billion people rely almost entirely on biomass fuels for energy needs, which represents about 1,257 million tones or 35 per cent of the energy used in developing countries (Pasztor and Kristoferson, 1990).

At global level, more people depend on wood than any other single energy source for their daily energy needs (World Resources Institute, 1986). Further, UNEP estimated that at the current rate of deforestation, by the year 2,000, about 2.7 billion people would be short of the fuel they need (Cave, 1993). Going by the above trends, the demand for fuel wood will at least triple by 2020 (World Bank, 1989).

## 2.2 The fuel wood situation in Western Kenya

In Kenya, wood will continue to be the main source of domestic energy. The rural households, comprising 85% of Kenya's population consume up to 72% of Kenya's fuel wood energy. Increasing population pressure on land has contributed to scarcity of woodfuel in most areas hence degradation of little available fuelwood resources (Chavangi, 1992). Further, several studies done point to heavy reliance on wood fuel in the rural areas and the indications of severe deficit due to rapid population increases in

Bungoma District; Sabatia Division in Kakamega District (Mwangi and Alumasa, 1992). The population pressure and the need for fuel wood for domestic use among other needs have created a situation of scarcity in these regions.

### 2.3 Fuel wood supply and consumption

Adequate data in the country, which are detailed to ascertain the balance between supply and consumption of fuel wood are lacking (Karekezi et al., 1991; Mwangi, 1992). Nonetheless, available literature indicates that fuel wood is consumed faster than it is produced (Mugo, 1989). This situation could be attributed to the population increase, which has led to the clearing of natural forestlands for agriculture and settlement.

### 2.4 Charcoal trade in Kenya

Charcoal as a fuel is mostly used in urban households and in small-scale industries. Population growth and rural-urban migration have increased charcoal demand thus putting pressure on wood resources in Kenya's ASALs (Mwangi, 1992). According to the Economic Survey (Republic of Kenya, 2000), at least 80% of the urban household energy demands are met by charcoal, which dominates the use of wood fuel.

According Kenya Forestry Masterplan, see table 2.4 below, it is projected that total fuelwood demand largely be firewood. Twelve million and ninehundred tons will be required in 2005, 14.75 million tons in 2010, 16.67, 18.65 in 2015 and 18.65 million tons 2020. Charcoal will therefore, be the second demanded fuelwood which is projected to be 1.17 million tons by the year 2005, 1.40 million tons in 2010, 1.65 million tons in 2015 and 1.92million tons in 2020.

**Table 2.4: Projected (*) demand for fuel wood (million t) in Kenya**

| *Year* | *Charcoal tons* | *Firewood tons* | *Total fuel wood tons* |
|---|---|---|---|
| **1989** | 0.56 | 7.98 | **12.25** |
| **1995** | 0.75 | 9.64 | **15.08** |
| **2000** | 0.97 | 11.18 | **17.96** |
| **2005*** | 1.17 | 12.90 | **20.77** |
| **2010*** | 1.40 | 14.75 | **23.79** |
| **2015*** | 1.65 | 16.67 | **26.91** |
| **2020*** | 1.92 | 18.65 | **30.10** |

**Source: Forestry Department Master Plan, 1994**

## 2.5 Poles and posts

The annual demand for poles and posts is projected to grow from 1.0 to 2.7 million $m^3$ 1990 and 2020, which is a 3.3% annual growth rate (Table 2.5). The demand for construction poles have been estimated on the basis of an average of 0.0338$m^3$ per capita used in house construction. The per capita wood consumption for house construction is based on a Kenya Indigenous Forests Conservation (KIFCON) study on the use of the country's indigenous forests by local households, which covered four forest types, 530,000 forest-adjacent households, and 5000 forest-dwelling households (KIFCON, 1994).

**Table 2.3: Projected (*) demand for poles and posts ('ooom$^3$) in Kenya**

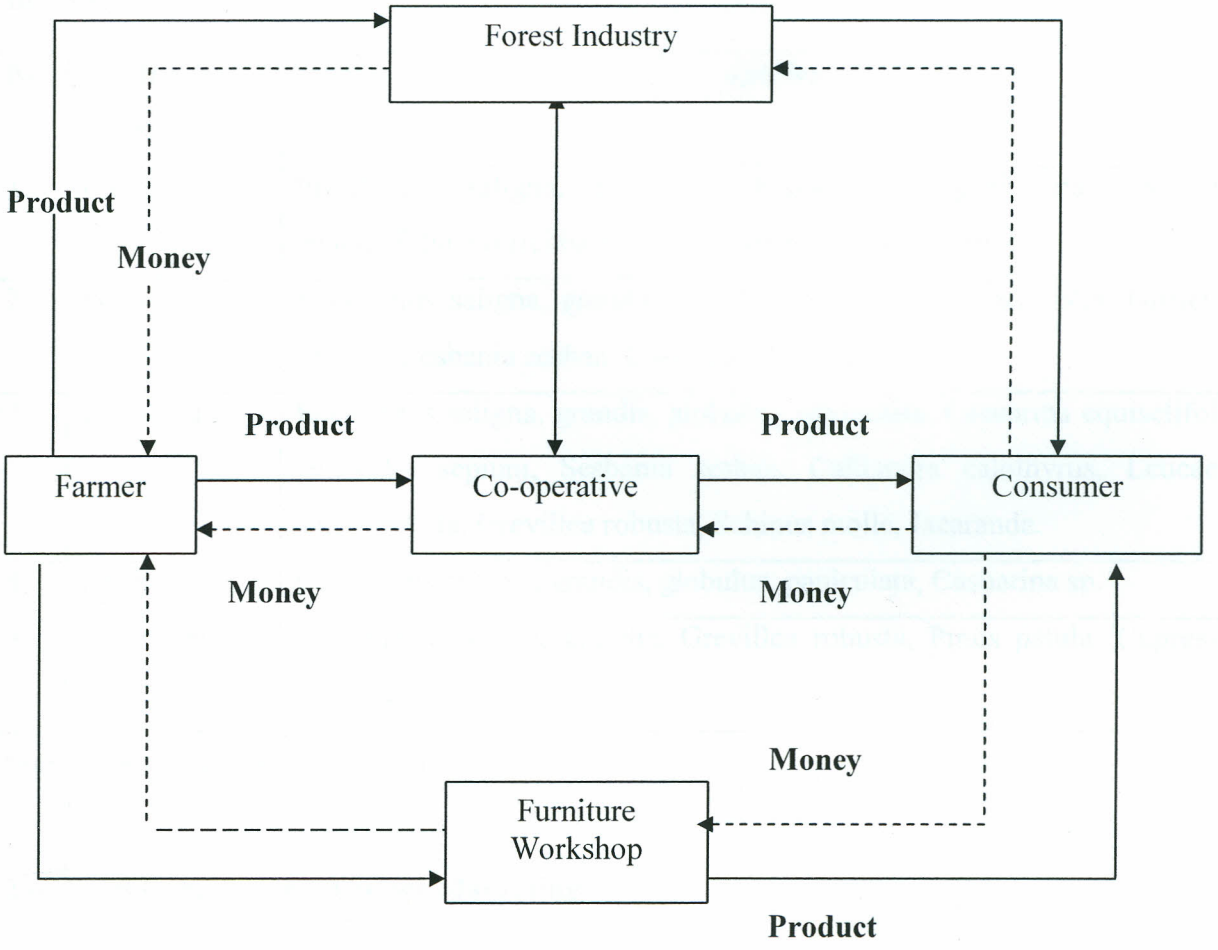
| *Year* | *Construction poles* | *Transmission poles* | *Total* |
|---|---|---|---|
| 1990 | 939.9 | 102.5 | **1042.4** |
| 1995 | 1085.2 | 134.2 | **1219.4** |
| 2000 | 1254.2 | 180.4 | **1434.6** |
| 2005* | 1446.8 | 242.6 | **1689.4** |
| 2010* | 1663.2 | 326.1 | **1989.3** |
| 2015* | 1896.4 | 438.5 | **2334.9** |
| 2020* | 2146.5 | 589.6 | **2736.1** |

**Source: Forestry Department Master Plan, 1994**

Figure 2.1 shows how farmers and consumers of forest resources can market their on-farm and forest wood resource products through a co-operative hence increase their income. This can be done through an organized market system within the community. Farmers get income from the sale of their wood products to furniture workshops, hence are motivated to increase supply from their farms.

The dotted line shows how farmers can get cash income through selling wood products from their farms. The solid line shows how the farm wood produce gets to the end consumers through furniture workshops, co-operatives, or forest industries, for example saw milling companies.

**Fig. 2.1: Organized marketing system for forestry product an organized process**




**Source: Adapted from FAO, 1996.**

The Table 2.4 shows commonly used tree species for various wood products in Western Kenya whereby, *Eucalyptus* tree species are recommended for many uses such as charcoal, fuel wood, poles, posts, and sawn timber. Other tree species recommended for the same are the *Casuarina spp.* for charcoal, poles, fuel wood, and posts. *Calliandra spp.* is also recommended for charcoal, poles, and fuel wood. *Grevillea robusta*, and *Cupressus lusitanica* is recommended for timber.

**Table 2.4 Commonly used tree species for various wood products in Western Kenya in Kenya**

| No. | *Wood Product* | *Species* |
|---|---|---|
| 1. | Charcoal | Eucalyptus saligna, E.grandis, E.globulus, E.paniculata, Casuarina equiselifolia, Gliricidia sepium, Sesbania sesban, Calliandra calothyrus. |
| 2. | Poles | Eucalyptus saligna, grandis, globulus, Casuarina equisetifolia, Gliricidia sepium, Sesbania sesban, Calliandra calothyrus. |
| 3. | Firewood | Eucalyptus saligna, grandis, globulus, paniculata, Casuarina equiselifolia, Gliricidia sepium, Sesbania sesban, Calliandra calothyrus, Leucaena leucocephala, Grevillea robusta, Schinus molle, Jacaranda. |
| 4. | Posts | Eucalyptus saligna, grandis, globulus, paniculata, Casuarina sp. |
| 5. | Saw timber | Eucalyptus saligna, grandis, Grevillea robusta, Pinus patula, Cupressus lusitanica. |

**Source: Gustavson and Kimeu (1991)**

## 2.6 Wood Industry and Timber Marketing

### 2.6.1 Commercial use of timber

Of the variety of industries in Kenya for which timber is an essential resource, construction and furniture making are the largest consumers of timber. Timber is also used for flooring, post-making, carving and for bridge construction, boat building, paper manufacture, and the fuel industry (Forster et al., 1997).

The construction and joinery industries that make various wood products such as blockboard and plywood are often linked in Kenya. The main species used for construction are *Cupressus* and *Pinus* spp., among others. Likewise, the joinery industry uses both softwood and hardwood with preference for *Ocotea usamberensis* and *Khaya*

*spp.* (Forster et al., 1997). Other species, such as *Milicia excelsa*, *Newtonia buchananii* and *Juniperus procera,* are also used. About 60% of hardwoods used in Kenya are for joinery and associated activities.

Parquet flooring is popular in Kenya, although only five companies are said to produce it (Marshall and Jenkins, 1994). In the past mainly *Juniperus procera* was used. As this species is no longer available, manufacturers have turned to other indigenous species, including, *Olea welwitschii, Olea africana,* and *Newtonia buchananii* and to imported *Khaya* spp., and *Milicia excelsa* and the non-native *Acacia melanoxylon, Eucalyptus saligna* and *Cupressus lusitanica.*

In the manufacturing sector, veneers are becoming more widely used, and this is true also for the paneling in the construction industry. In 1994, only one company manufactured veneer in Kenya mainly from *Cupressus* spp., *Acacia melanoxylon, Olea welwitschii, Khaya* spp., and also reportedly from *Ocotea usambarensis* and *Vitex keniensis*. The company uses about 1000m$^3$ of hardwoods a year. Substantial quantities of veneer are imported, chiefly from South East Asia (GoK, 2000).

Posts and poles are used for building, scaffolding, fencing and power line supports. Beside the domestic use there are two large industrial consumers of transmission poles in the country, namely, Kenya Power and Lighting, and Posts and Telecommunications Corporation of Kenya (GoK, 2000). Throughout Kenya *Juniperus procera* has traditionally been the favoured species for fencing. Nowadays, it is more and more being

substituted by *Eucalyptus* spp. which are considered reasonably durable if impregnated with preservatives. At the Coast, posts and poles from Mangroves are widely used (MENR, 1994). This may threaten mangrove diversity in the Coastal region in the near future.

Wood carving is a major artisan industry in Kenya, much dependent on tourism, thus generating considerable foreign exchange. It is essentially confined to the Coast and the semi-arid areas of Ukambani and Kibwezi. Several different tree species are used for carving; the most popular species are, among others, *Dalbergia melanoxylon* and *Brachylaena huillensis.* With diminishing stocks of these species, alternative species are increasingly being utilized, for example, *Olea africana* and *Afzelia guinensis*. Further, Wamboi (2003) reported that *Grevillea robusta* is used in the wood carving industry in Embu. Estimates of volumes are difficult to make, but clearly, they reach thousands of cubic metres annually. Among the hardwood species *Ocotea usambararensis* is the most commonly used one (about 70%), followed by *Khaya Spp.* (18%), *Olea welwitschii* (4%) and others (4%) (MENR, 1994).

**2.7 Tree species used for charcoal making**

Charcoal can be made from all woody species. However, factors such as tree species, moisture content, heat value, specific gravity, durability, and ease of harvest influence the selection of the species for use as wood fuel (O'keef, 1979). Both consumers and producers prefer dense hardwood because it makes charcoal of a higher energy value.

Mugo (1997) reported that wood from indigenous tree species is preferred for wood fuel because it has high heat intensity. From her study, indigenous tree species have relatively less competing uses than exotic tree species because of their generally twisted nature. For this reason they are mostly used for wood-fuel. However, once preferred species are depleted in an area there is indiscriminate use of any available biomass thus accelerating the negative impact. Further, Mugo (1999) in a report on charcoal trade in Kenya, identified *Acacia tortilis, Terminalia brownii* and *B. aegyptiaca* as the tree species used for making charcoal between Kibwezi and Mtito Adei. In a report by Emerton (1999) *A. tortilis, Acacia senegal, Acacia seyal, Baranites aegyptiaca* and *Combretum spp.* were the major tree species used for charcoal making in Kibwezi Division.

Imbalances between supply and demand as a result of poor market information could have negative impacts on farmers who fail to get good prices for their products hence selling at low prices (Falconer and Arnold, 1991). In addition poor access to markets and weakness in marketing can have negative effects. For example, prices of the poles and wood for industry seem not to have stimulated investment by farmers in producing wood as a cash crop.

Foley and Bernard (1984) argued that trees on private land may be sold to address the external commercial demands for the wood product both in markets and households. The amount of sales will depend on the prices being offered and the financial needs of the farmers who process them. ICRAF (2002) points out that market information system must, therefore, be built piece by piece, in relation to needs. It is important to put in place

proper strategies to utilize non-timber forest products through collaborative exercise that makes full use of local people's knowledge as well as expertise of outside professionals with relevant experience (Koppell, 1995).

**2.8 Source of timber for commercial use**

Most of the soft wood used in construction and joinery comes from timber plantations. Since the ban on felling of indigenous trees by a presidential decree in 1986, most of the indigenous timber legally extracted comes from plantations; only a small portion comes from indigenous forests such as Mt. Elgon or from exploitation based on old, but still valid, licenses (MENR, 1994). Further, the total amount of indigenous timber produced legally in 1991/92 was about 34,000$m^3$.

Notwithstanding, the demand for indigenous timber is still very high, especially for construction. Since the felling of indigenous trees is mostly illegal, the overall volume of indigenous hardwoods harvested from the natural forests of Kenya is difficult to estimate. The figure of 50,000$m^3$ estimated by Marshall and Jenkins (1994), may well be considered less than the actual amount coming out of the indigenous forests.

Kenya also imports timber from Australia, Tanzania, Zaire, Uganda, and some other countries. In 1992, altogether about 2,300$m^3$ of hardwood and about 3,400$m^3$ of other wood were imported. Exports of unworked indigenous hardwoods have been banned since 1983, and exports of charcoal and mangrove products since 1982. Licensed exports

are therefore almost entirely of *Pinus* and *Cupressus* spp., but there are no figures available (Forster et al., 1997).

### 2.9 Timber prices

Virtually all hardwood is bought by users "at the door," from middlemen for cash. Prices are therefore negotiated on a case-by-case basis and may vary considerably, depending on the quality of timber, the amount bought, and the relationship between the seller and the buyer, among other things (Forster et al., 1997).

### 2.10 Structure of the timber trade

The trade network for timber and wood products within Kenya is a complex one. There are significant differences between the hardwood and softwood trades, owing in large measure to the illegal, or at least irregular, nature of much of the former (Forster, et al., 1997). The major extractors of timber in the country are pit-sawyers and saw millers. There were over 350 licensed saw millers who bought logs directly from the Forest Department and also processing logs purchased from private land owners, unlicensed mills licensed operators, or obtained illegally.

In 1994, most mills are small, semi-portable and operated on one-year licenses. Around 60 operate on five-year licenses and have an average log intake of about 4,000$m^3$ per annum (Marshall et al., 1994). The larger sawmills deal almost entirely with plantation timbers (largely *Cupressus* and *Pinus* spp.). They either used the sawn wood for their own further processing or sold it to other wood processing companies or wholesalers and retailers.

Hardwood timber, by contrast, is almost invariably bought at "the door" from a timber trader and paid almost in cash, and only after inspection. Such are generally beams sawn usually in irregular sizes and sold unseasoned. This makes it necessary for the companies to season their own timber, which is the reason why they stockpile, as much as possible. Because of the uneven geographical distribution of timber resources in the country, much timber, both hardwood and soft wood, is transported a long distance before being used, which increases the cost of timber considerably (Forster et al., 1997).

**Table 2.5 Projected wood supply and demand ('000m$^3$) in Kenya**

| | **1995** | **2000** | **2005*** | **2010*** | **2015*** | **2020*** |
|---|---|---|---|---|---|---|
| Wood demand | | | | | | |
| • Industrial wood | 1058 | 1209 | 1378 | 1543 | 1709 | 1961 |
| • Poles and posts | 1219 | 1435 | 1689 | 1989 | 2335 | 2736 |
| • Fuel wood | 20107 | 23947 | 27693 | 31720 | 35880 | 40133 |
| **Total wood demand** | **22384** | **26591** | **30760** | **35251** | **39924** | **44830** |
| Accessible sustainable supply | | | | | | |
| • 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 | 2121 | 2494 | 2112 | 2165 | 2281 | 2657 |
| **Total sustainable wood supply** | **22740** | **24929** | **26450** | **28393** | **30649** | **33064** |
| Non-sustainable wood supply | 283 | 414 | 544 | 671 | 794 | 912 |
| Fuel wood substitutes | 2011 | 2395 | 2769 | 3172 | 3588 | 4013 |
| **Total wood supply** | **25034** | **27738** | **29763** | **32236** | **35031** | **37989** |
| **Surplus/deficit** | **2650** | **1147** | **-997** | **-3015** | **-4893** | **-6841** |

**Source: Forestry Department Master Plan, 1994.**

At present, the demand for forest products is so high that the existing supply cannot match it. For example, in 1995, the demand for fuel wood was 0.49 million tons, while the supply stood at 0.17 million tons. The Kenya Forestry Master Plan (1994) projected demand for the year 2000 was 0.57 million tones. However, there is little that has been done to give quantities of the required wood products especially in Kibuye market in Kisumu town.

Sustained production of wood products provides economic benefits through sale of tree products and other environmental benefits such as replenishment, erosion control, and provision for households (ICRAF, 2002). Information on demand for agroforestry products, the quantity, particular seasons, timing of demand, and market links and location often assist the farmers promote the production of certain trees or tree products. In addition, improvement of timber quality through encouraging farmers to manage their trees for timber sale purposes, in terms of proper spacing, thinning and harvesting them at mature age (Holding, *et. al.* 2001) is recommended by wood products market actors

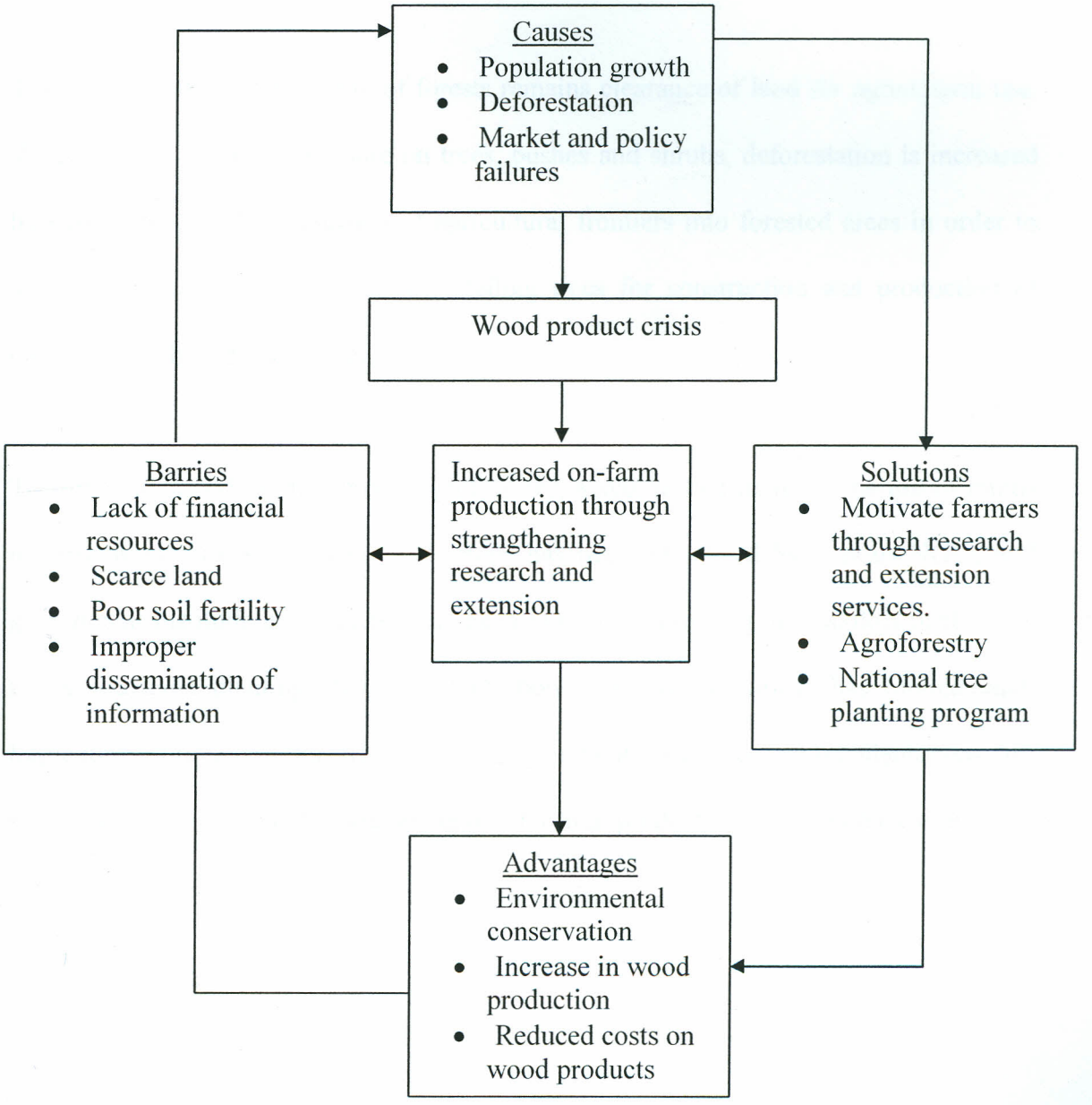
There is very little recent research work that has been carried out in the study area on wood consumption. Few studies on species used for various wood products (International Union for conservation of Nature, ICUN 1998), have been done. There is, therefore, need to carry out a study aimed at getting information on marketing of specific products or line of products such as timber and other tree products from the wood products dealers. This is expected to improve on the existing knowledge concerning wood product consumption, to enable farmers make informed decisions when practising farm forestry, therefore,

accelerate the current pace of tree planting, improve the management of trees on-farm and stimulate income generation from tree products to alleviate poverty and attain environmental sustainability.

## 2.10 Conceptual Model

The conceptual framework of this study is based on the premise that wood products are important for construction purposes, fuel wood, and fencing land purposes. Figure 2.2 shows causes, barriers, solutions, and advantages within the scenario which includes population growth, deforestation, market and policy failures.

**Figure 2.2: Wood product crisis, causes, and recommended solutions**




**Source: Author**

The rising cost of woodfuel substitutes such as paraffin and gas for cooking has left a majority of the rural population with little choice other than to use cheaper sources of woodfuel therefore, depleting much of the existing wood resources (Karekezi and Ranja, 1997). The rapid increase in human population has also contributed to the wood products scarcity. Land for settlement and cultivation has also been practised on high agricultural potential areas.

The main means of destruction of forests remains clearance of land for agricultural use. Where there is growing pressure on trees, bushes and shrubs, deforestation is increased by several forces: the expansion of agricultural frontiers into forested areas in order to supply food as populations increase; felling trees for construction and production of charcoal and the supply of firewood.

To solve the 'wood product crisis' agroforestry, a system that involves the use of multi-purpose woody trees or shrubs with crops has been advocated by various NGOs and government institutions. Emphasis has been put on the growing of woodlots next to the farms and even planting along the farm boundaries if the farmer has limited land. Replanting portions of forests with existing natural forests or exotic plantations, or, species whose characteristics are favourable for high productivity fuelwood base supply.

# CHAPTER THREE
# 3.0 METHODOLOGY

## 3.1 Materials

The research methodology employed in this study covered the following: research design, the source of data, research instruments, modes of administering the research instruments, the sampling design used and methods of data analysis. The survey was carried out between January and April 2002.

## 3.2 The Research Design

This study was based on a survey design employing formal methods of data collection. Formal methods involved use of questionnaires, interview schedules, and direct observation.

## 3.3 Nature and Sources of Data

Data were collected from primary and secondary sources. The primary data were generated from interview schedules, and a focus group interview that was conducted on a 72-member group of an association of furniture dealers, all targeting to answer the research questions that guided the study.

The secondary sources, on the other hand, entailed an explorative review of relevant literature on wood products market and consumption. Secondary data collected involved reviewing literature from various libraries such as World Agroforestry Centre, UNEP,

Forest department, and public universities libraries. Both published and unpublished reports were reviewed. This helped to unveil previous research efforts that are pertinent to this study.

### 3.4 Methods of Data Collection

Several methods were used in collecting data from both primary and secondary sources. This process entailed conducting interview schedules; recording observation made, and review of documented information as below:

#### Interview schedule

An open approach was employed in interviews with wood products dealers in the informal sector. Information was requested on the species and volumes used or sold, prices, and origins of timber or any other wood product involved in the study. Opinions were sought on the characteristics and uses of different types of wood species as well as on future prospects for the industry sectors relevant to the interviewee.

At respondent level (carpenter, posts/poles, charcoal, fuel wood, and timber yard dealer), the following data were collected: Data on the characteristics of the firm, and data on the acquired product, main wood species acquired, availability, sources, cost of product and degree of demand. Structured questionnaires (Appendix I) were used to ensure uniformity and objectivity in the kind of data collected from the respondents.

**Questionnaire administration**

This was administered to the wood products dealers who formed the respondents. Open-ended and closed questions were asked. The questionnaires were given to 35 respondents to fill in themselves because the firm owners were willing to do so during their own free time. However, the remaining 189 respondents had their answers recorded by the researcher/interviewer.

**The observation sheet**

A checklist of tree species was used for various wood products. The interviewer made observation to verify the information provided by the respondents on tree species dealt with.

**Photograph taking**

Photographs (plates 1-6) were taken to capture salient information about the study. These were later used in the text to support the discussion and to explain some facts about the study.

**3.5 Pilot Survey or Pre-testing of the instruments**

An important vehicle in questionnaire construction is a pretest where a questionnaire is used on some individuals who are typical (but not a part) of the sample respondents

(Freund and Wilson, 1997). The data collection instruments were pre-tested to ensure their validity and reliability for the actual survey. This enabled the researcher to identify vague questions, and ensure that the instrument measures the concepts intended, as well checking for flows and bias. It also enabled the researcher to familiarize with interview items.

Pre-testing was done on five respondents in each category of dealers with similar characteristics as those to be included in the sample study. These ten respondents were not part of the sample in the main study. Further, the pilot survey enabled the researcher to make acquaintance with relevant authorities including the local forest officers, extension officers of various organizations among others, as well as to general reconnaissance of the study area.

### 3.6 Sampling Design

#### Target population

The target population of interest was the timber and other wood product dealers within Kibuye market, Kisumu town, Kisumu district.

#### Systematic Random Sampling

Respondents within an estimated population of 2,500 wood product dealers were chosen using stratified random sampling. This was considered appropriate because there were different wood products dealers including timber, charcoal, posts/poles, fuel wood, and

furniture among others. A systematic samples consisting of 143 timber respondents, 72 charcoal, 33 posts/poles, 42 fuelwood, 77 blockboard, 72 plywood among others were selected from each $n^{th}$ term from a list of each wood product dealers. This was done by randomly sampling the first respondent from the first 10 firms along the strata then kept on with the tenth respondent. It was done randomly to ensure that each firm had a chance of being selected.

### 3.7 Data Analysis

At the end of data collection in the field, data were collated and analysed. This process involved coding of all responses, which then were fed into a computer and analysed using the standard statistical package for social sciences (SPSS) 10.0 version. Coding of data led to new ideas, which were put into a matrix.

Descriptive statistical techniques were important because they provided crucial summaries related to the data (Mugenda and Mugenda, 1999). Descriptive measures such as means, percentages, frequencies and cross tabulation were used to describe, organize and summarize the data. The results are presented in form of tables, graphs and charts in the next two chapters.

Inferential statistics, on the other hand, entailed the use of chi-square. Responses on various variables were further treated to Pearson chi-square ($\chi^2$) test (Siegel and Castellar, 1988) to find out the statistical significance of the relationships and

associations between variables (Gupta, 1992). The chosen level of significance to reject or accept a $H_0$ hypothesis was 0.05 alpha level, which is, the recommended level for social sciences (Coolican, 1994). The smaller the P (a), the greater the confidence in the observed results. An alpha level a $\leq$ 0.05 allows for 95% confidence in the results with a possibility of a % error or less (Muller, 1977).

### 3.8 Research Constraints

The following constraints were encountered in the course of the research:

1) Organizing interviews with the respondents (wood products dealers), in some cases, was not easy. This was attributed to owners leaving their workers in the firms thus making it difficult to get all the questions answered hence forcing the interviewer to schedule for another visit. This made the interviewer to call-back on 26 respondents to get all the data required.

2) Non-cooperation on the part of respondents who perhaps thought that their responses would be used against them. This was addressed by showing evidence the information sought was meant for academic purposes. This was by showing letter from World Agroforestry Centre (ICRAF) and Kenyatta University student identification card.

3) Language barrier, whereby some respondents were only very conversant with dholuo (Luo community language). This was addressed by involving an interpreter.

4) Interruptions by customers who visited the respondents during the interviews. This was addressed by interviewer visiting another respondent and make callback.

# CHAPTER FOUR
# 4.0 RESULTS AND DISCUSSION

## 4.0 Introduction

This chapter presents the results from the survey data analyses and discussion of the findings of the study that examined wood products consumption in an urban area. The discussions are presented in the sections addressing specific research questions and study objectives.

The bulk of the information originated from responses given by wood products dealers during the survey and in personal observations made during field visits. It also includes secondary information gathered from literature. The chapter starts by describing the general characteristics of the target firms within the study area; followed by information on the year the firm was established and the wood products dealt with.

## 4.1 Firm Characteristics

This section describes the general characteristics of the target firm in the study area.

**Location of other branches of the firm aside from Kisumu town.**

During the study 29 (12.8%) of respondents said that they had invested in other towns, however 195 (86.3%) have not established business branches outside Kisumu town. Many respondents did not invest in other branches. Respondents who indicated that they have business branches outside Kisumu town mentioned surrounding towns including Ahero, Awasi and Koru all in Nyando district.

**Year respondents established their firms**

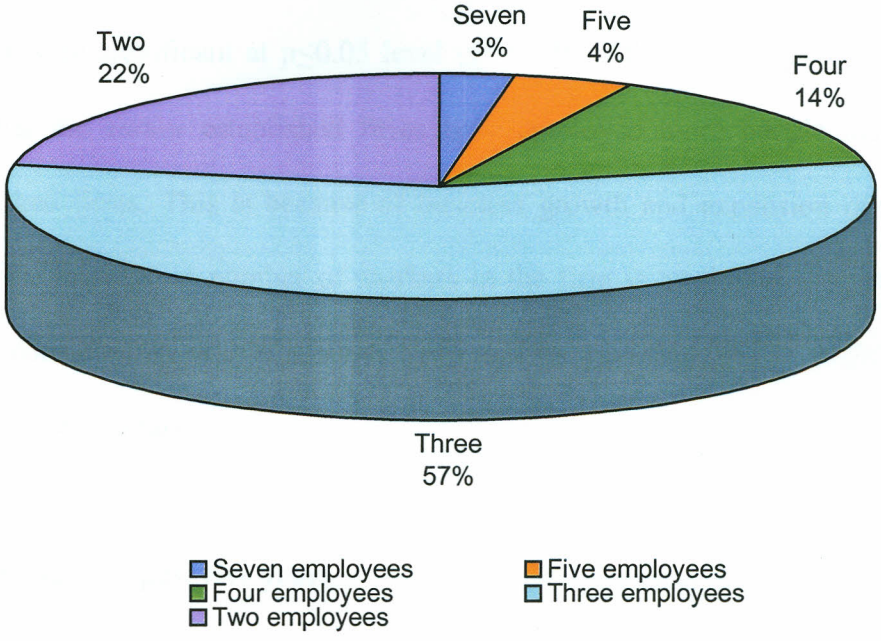
Out of the total sample of the respondents interviewed, 6 (3%) indicated that their firms were established before the year 1972, 10 (4%) between 1972 and 1980, 32 (14%) between 1981-1989, 127 (57%) between 1990 and 1995, while 49 (22%) of the respondents said they established their firms between 1996 and 2002 (Table 4.1).

**Table 4.1: Year respondents established firm**

| Year firm established | Number of responses | Percentage (%) |
|---|---|---|
| Before 1972 | 6 | 3 |
| 1972-1980 | 10 | 4 |
| 1981-1989 | 32 | 14 |
| 1990-1995 | 127 | 57 |
| 1996-2002 | 49 | 22 |

**Number of employees in the firm**

From the data results out of 224 respondents interviewed, 6 (3%) indicated that they have an average number of seven employees in their firms, 10 (4%) said they have five workers, while 32 (14%), 127 (57%) and 49 (22%) respondents said they had employed four, three and two workers respectively (Figure 4.1).




**Key:**

% = Percent

**Figure 4.1: Average number of employees in the firm as indicated above**

**NB: Different colours present percentage of various number of employees in the firm**

From the above Figure 4.1, more than one half of the firms have managed to create employment for an average of three people.

## 4.2: Relationship between the year firm established and average number of employees

The results show the relationship between the year firms were established and the average number of employees. Firms established before 1972 have an average work force

of seven, those established between 1972-1989, 1981-1989, 1990-1995, and 1996-2002 have an average of five, four, three and two employees respectively.

Results of chi-square ($\chi^2$) indicate that the differences in number of employees and year firm established were significant at $p \leq 0.05$ level ($\chi^2 = 890.000$; df = 16; $p < 0.05$). The results show that the earlier established firms have employed more people than the recently established firms. This is because of business growth and expansion over the years. Further, the increase in number of workers in the firm is attributed to increased wood products consumption within Kisumu town and its environs, due to population increase over the last 10 years.

### 4.3 Investments over the past five years

The results indicate that, 126 (56%) of the firms have invested in transport capacity, machinery/equipment, or buildings, however, 98 (44%) of the respondents said that they had not invested in any of the mentioned investments. Out of the 126 firms with investment, 67 (53%) have invested in transport capacity, 33 (26%) building, while 114 (90%) out of 126 invested in machinery/equipment (Table 4.2).

**Table 4.2: Investment in firm over the past five years**

| Investment | Responses | Percentage (%) |
|---|---|---|
| Transport | 67 | 53 |
| Building | 33 | 26 |
| Machinery | 114 | 90 |

From table 4.2 above, shows the level of investment in the firms with 114 (90%) of the 126 firms that have investments, investing in Machinery or equipment, 67 (53%) and 33 (26%) investing in transport and building respectively.

### 4.4 Wood products bought by the respondents

The products that respondents deal in are shown in Table 4.3 below.

**Table 4.3: Number of respondents dealing in various wood products**

| *Wood product* | *Responses* | **% of dealers* |
|---|---|---|
| Timber | 144 | 64.3 |
| Charcoal | 72 | 32.1 |
| Poles/Posts | 38 | 17.0 |
| Fuel wood | 43 | 19.2 |
| Block board | 69 | 30.8 |
| Plywood | 77 | 34.4 |
| Other | 22 | 9.8 |

**Key:**

% = Percent

* = Percentages do not sum up to 100% because some firms deal in more than one wood product

Many respondents who dealt in charcoal also had fuel wood, and a number of those that had timber sold blockboard and plywood.

### 4.5 Monthly quantities of wood product acquired between 1990-1995 and 1996-2002 as perceived by the respondents

Quantities of wood products acquired were bought in the units as follows: Timber, poles and Posts (Seven ton lorry loads); charcoal in 35kgs bags; fuelwood in cubic meters blockboard, plywood and chipboard were acquired in pieces (120cm x 240cm). Between the years 1990-1995, significant increase in timber product acquired applied to those respondents who recorded an increase of three seven-ton lorry loads per month, two similar lorry loads indicated increasing moderately, while one or less a lorry load was more or less the same quantities.

Between 1996-2002 period, significant increase in the timber product bought by the respondents recorded an increase of four seven-ton lorry loads per month, those who bought three lorry loads said it was moderate increase, while those who acquired one and half felt that no change in price quantities (Table 4.4 below).

**Table 4.4: Quantity of wood product acquired between 1990-1995 and 1996-2002**

| | | *Average monthly wood product acquired as indicated by respondents* | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1990-1995 | | | 1996-2002 | | |
| ***Product*** | ***Unit*** | *Increasing significantly* | *Increasing moderately* | *About the same* | *Increasing significantly* | *Increasing moderately* | *About the same* |
| Timber | Lorry load (7-ton) | 3 | 2 | 1 | 4 | 3 | 1½ |
| Charcoal | Bag | 550 | 350 | 120 | 700 | 480 | 150 |
| Posts/poles | Lorry load (7-ton) | 2 | 1½ | 1 | 3 | 2 | 1½ |
| Fuelwood | Ton | 120 | 80 | 30 | 150 | 110 | 40 |
| Blockboard | Piece | 40 | 25 | 16 | 72 | 52 | 30 |
| Plywood | Piece | 64 | 35 | 22 | 76 | 42 | 24 |
| Chipboard | Piece | 45 | 30 | 24 | 65 | 44 | 32 |

**NB:** Piece (Blockboard, plywood, chipboard) = 120cm x 240 cm.

**Quantity of wood product acquired between 1990-1995**

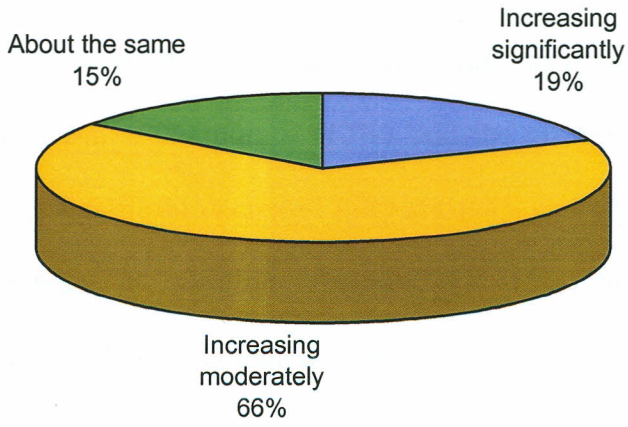
Five percent of the respondents indicated that there has been significant increase in timber quantities acquired, 76% of the respondents said the increase was moderate, while 19% of respondents indicated that there was no change in quantities acquired. Generally, there is high demand for timber within the study area. The study noted that most respondents acquired their products in lorries. On average, each respondent acquired two seven-ton lorries of timber per month. The figure includes all tree species acquired.

Twenty three percent of the respondents indicated significant increase in quantities of charcoal acquired, 66% reported a moderate increase, while 11% said that the quantities acquired were the same. Nineteen percent of the respondents indicated that there was significant increase in quantities of poles/posts acquired, 67% reported a moderate increase while 14% said the monthly quantities of wood acquired between 1990-1995 remained constant. Twenty six percent of fuelwood respondents said there was significant increase in quantities bought, 60% of the respondents reported moderate increase, while 14% said that quantities of fuelwood acquired were the same.

Twenty three percent of blockboard respondents indicated significant increase in the product acquired, 59% reported a moderate increase, while 18% said the quantities acquired were about the same. Twenty per cent of plywood respondents indicated significant increase in quantities acquired, 64% of the respondents said there was moderate increase, while 16% of the respondents in the same product indicated that quantities acquired recorded no increase in the quantities acquired. Twenty one percent of

chipboard respondents indicated that there was significant increase, 66% of the respondents said there was moderate increase, while 13% of the respondents in the same product said that the quantities of chipboard acquired remained the same.

In summary, 19% of respondents in all the above wood products that are bought by the respondents indicated significant increase, 66% of respondents reported moderate increase, while 15% of respondents in all wood products said quantities bought were about the same (Figure 4.2).




**Key:**

% = Percent

**Figure 4.2: Quantity of wood products acquired between 1990-1995 as perceived by the respondents**
NB: Each colour presents various responses

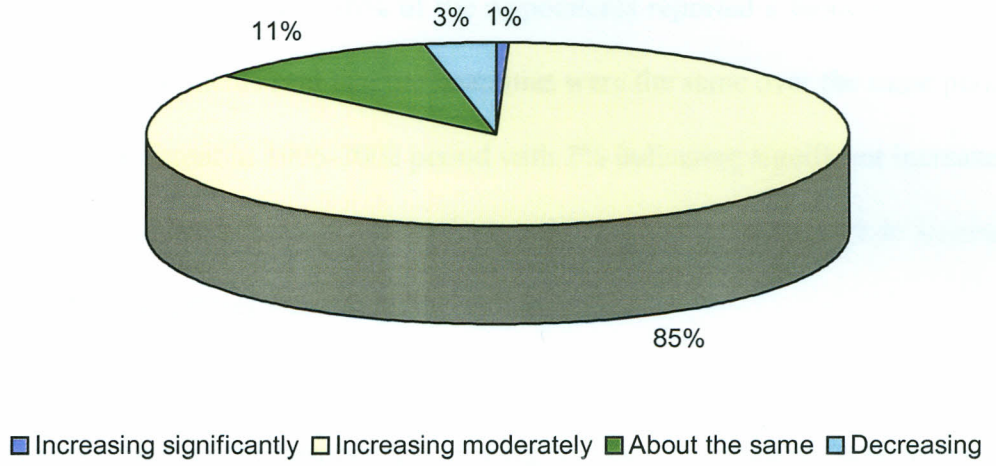
**Quantities of wood product bought by respondents between 1996-2002**

Four percent of the respondents indicated that there was significant increase in quantities of timber acquired, 109 (87%) reported moderate increase, while 15 (12%) said monthly quantities of timber acquired between 1996-2002 remained constant. Generally, there is high demand for timber within the study area. The study noted that most respondents acquire their timber product in lorries. On average, each respondent acquired two seven-ton lorries of different timber species per month.

About 69 (96%) of the charcoal respondents indicated quantities they buy increased moderately, while 3 (4%) of the respondents said the quantities were the same. Fifteen (46%) of the respondents said that there was moderate increase in quantities of posts/poles acquired, while 6 (18%) indicated moderate decrease in posts/poles quantities bought. Sixty (78%) of respondents indicated moderate increase in quantities of blockboard acquired between 1996-2002, 9 (12%) said the quantities were the same, while 8 (10%) indicated significant decrease. Fifty six (77%) of plywood respondents indicated moderate increase in quantities acquired, 11 (15%) of respondents said quantities were the same, while 6 (8%) indicated moderate decrease. Fifty four (81%) of chipboard respondents indicated moderate increase, while 13 (19%) of respondents in the same product said that quantities acquired were the same.

In summary, 4 (1%) of respondents in all the wood products they acquired indicated that there was significant increase in quantities acquired between 1996-2002, 591 (84%) of the respondents indicated moderate increase, 75 (11%) of the respondents said that the

quantities were the same, while 24 (4%) of the respondents said quantities on all wood products acquired decreased moderately (Figure 4.3).




**Key:**

% = Percent

**Figure 4.3: Quantities of wood products acquired by the firms between 1996-2002 as perceived by the respondents**
NB: Each colour presents various responses

Increase in quantities of wood product acquired as perceived by the respondents is because of population increase in the town and its neighbouring district. Population of Kisumu has increased for the last ten years hence attracting demand for wood products.

### 4.6 Monthly quantities of all wood products bought by the respondents between 1990-1995 and 1996-2002

Quantities of wood product acquired on monthly basis between 1990-1995 and 1996-2002 had been generally increasing moderately (Table 4.5 and 4.6). The standardized unit of acquired wood products was seven-ton lorry loads for timber and posts/poles, 35kgs

bags of charcoal, cubic metre or one ton on fuel wood, pieces (120cmx240cm) on blockboard, plywood and chipboard.

Between 1990-1995 period, 5% of the respondents indicated that timber quantities bought had been increasing significantly, 76% of the respondents reported a moderate increase, while 19% of the respondents said that the quantities were the same over the same period. The scenario was different in 1996-2002 period with 3% indicating significant increase in timber quantities acquired, 85% of respondents said that there was moderate increase, while 12% said the quantities were about the same.

Twenty three per cent of the respondents dealing in charcoal products between 1990-1995 period, indicated that the quantities bought were increasing significantly, 66% of the respondents reported moderate increase, while 11% indicated that the quantities acquired were about the same within the same period.

Ninety six per cent of respondents indicated that charcoal quantities acquired between 1996-2002 period were increasing moderately, while 4% of respondents said the quantities did not increase or reduce. Responses on quantities of posts/poles, fuelwood, blockboard, plywood and chipboard products acquired are indicated in Table 4.5 below. Increase in wood quantities consumed is attributed mainly by the population increase and wood sourced from government plantation.

**Table 4.5: Monthly quantities of wood product acquired between 1990-1995 and 1996-2002**

| *Product* | *Unit* | *Average wood product quantity acquired as indicated by respondents* | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 1990-1995 quantity trends (% frequency) | | | 1996-2002 quantity trends (% frequency) | | | |
| | | Increasing significantly | Increasing moderately | About the same | Increasing significantly | Increasing moderately | About the same | Decreasing moderately |
| Timber | Lorry load (7-ton) | 5 | 76 | 19 | 3 | 85 | 12 | - |
| Charcoal | 30kgs bag | 23 | 66 | 11 | - | 96 | 4 | - |
| Posts/poles | Lorry load (7-ton) | 19 | 67 | 14 | 18 | 46 | 36 | 18 |
| Fuelwood | Cubic meter | 26 | 60 | 14 | 21 | 69 | 10 | 10 |
| Blockboard | Piece (120cm x 240cm) | 23 | 59 | 18 | 10 | 78 | 12 | 10 |
| Plywood | Piece (120cm x 240cm) | 20 | 64 | 16 | 8 | 77 | 15 | 10 |
| Chipboard | Piece (120mx 240cm) | 21 | 66 | 13 | 10 | 81 | 19 | - |

**Table 4.6: Frequency distribution of responses on quantities of all wood product acquired between 1990-1995 and 1996-2002 as indicated by respondents**

| **Period** | Number of respondents in each category as perceived by the respondents in percentage (%) | | | |
|---|---|---|---|---|
| | ***Increasing significantly*** | ***Increasing moderately*** | ***About the same*** | ***Decreasing moderately*** |
| 1990-1995 | 19 | 66 | 15 | - |
| 1996-2002 | 1 | 84 | 11 | 4 |

The above data was analysed using chi-square test to give the degree of significance as indicated below.

Results of chi-square ($\chi^2$) indicate that the differences in quantities of all wood products acquired between 1990-1995 and 1996-2002 were significant at $p \leq 0.05$ level ($\chi^2 = 17.218$; df = 9; $p<0.05$).

### 4.7 Wood products processed or used up in the firm

Eighty two (37%) of the total respondents dealing with refining or processing of the acquired wood products into new products consume timber, 69 (31%) blockboard, 75 (33%) plywood, while 27 (12%) other wood products (Table 4.7).

**Table 4.7: Respondents using different wood products to make furniture**

| *Wood product* | *Responses* | *Percentage (%)* |
|---|---|---|
| Timber | 82 | 37 |
| Block board | 69 | 31 |
| Plywood | 75 | 33 |
| Other | 27 | 12 |

### 4.8 Perceptions of respondents on timber prices trend between 1990-1995

Five (5%) of the timber respondents indicated significant increase in timber price in 1995, 87 (82%) of the respondents said that there was moderate increase, while 14 (13%) of the respondents said the price of timber remained the same (Table 4.8).

**Table 4.8 Trend of timber prices between 1990-1995 as perceived by the respondents**

| *Price* | *Responses* | *Percentage (%)* |
|---|---|---|
| Increasing significantly | 5 | 5 |
| Increasing moderately | 87 | 82 |
| About the same | 14 | 13 |
| **Total** | **106** | **100** |

The study findings showed that timber prices have been increasing since 1990. Between 1990-1995 period, for example, a piece of timber measuring 18cmx3cmx30cm was sold as follows: *Eucalyptus* spp., *Grevillea robusta* and *Pinus* spp. was sold at an average price of Ksh. 7., while *Cupressus* spp. was sold at Ksh. 8., whereas the prices of the same species increased between 1996-2002 period with the former selling at an average price of Ksh. 12. while the latter sold at an average price of Ksh. 14 per ft.

### 4.9 Timber prices between 1996-2002

Nine percent of the timber respondents indicated significant increase in timber price between 1996-2002 period, 88 (62%) of respondents in the same product reported moderate increase, while 43 (30%) reported that that the prices were the same and 3 (2%) said the prices were decreasing moderately (Table 4.9).

**Table 4.9: Prices of timber in 1996-2002**

| *Price* | *Responses* | *Percentage (%)* |
|---|---|---|
| Increasing Significantly | 9 | 6 |
| Increasing moderately | 88 | 62 |
| About the same | 43 | 30 |
| Decreasing moderately | 3 | 2 |
| **Total** | **143** | **100** |

### 4.10 Quantity of wood demanded in 1996-2002

Over 101 (90%) of the respondents reported moderate increase in the quantities of timber demanded by customers while 12 (10%) said the quantities were the same. The trend is almost similar in the quantities of charcoal product demanded with 125 (90%) of the

respondents indicating that it was increasing moderately, while 14 (10%) said that quantities demanded remained the same. Twenty eight (72%) of posts/poles respondents indicated moderate increase in quantities demanded by their customers, while 11 (28%) of the respondents said the quantities demanded were the same.

The scenario was slightly different in fuelwood product with 39 (97%) of the respondents indicating moderate increase in the quantities demanded by their customers, while 1 (3%) said that amount of fuelwood demanded remained the same. Sixty three (89%) of beds respondents indicated that there was moderate increase in quantity demanded by their customers, while 8 (11%) of the respondents said the quantities acquired were same. Sixty six (89%) of table respondents said quantities demanded by their customers increased moderately, while 8 (11%) of the respondents said the quantities were the same.

Sixty one (88%) of respondents dealing in chairs said quantities demanded by their customers were increasing moderately, while 8 (12%) said that quantities demanded were the same. This is similar to wall units with 61 (88%) of the respondents indicating that there was moderate increase, while 8 (12%) said the quantities of wall units demanded was the same. About 21 (78%) of respondents dealing in stools indicated that the quantities demanded increased moderately, while 6 (22%) of the respondents indicated that the quantities demanded were the same. Demand for more wood quantities is attributed to population growth within and around Kisumu town over the last 10 years.

### 4.11 Changes in timber prices between 1990-1995 and 1996-2002 period

Timber prices have been increasing moderately between 1990-1995 and 1996-2002 period. Between 1990-1995, 5% of the timber dealers indicated significant increase in timber prices at an average increase of Ksh. 3 on piece of timber (18cmx3cmx30cm), on the other hand, 82% indicated moderate price increase at Ksh. 2, while 13% of the respondents reported that the price remained the same.

The scenario is slightly different in 1996-2002 period, 6% of the respondents reported significant price increase at an average of Ksh. 5 on 18cmx3cmx30cm piece of timber, 64% of respondents reported moderate increase at an average of Ksh. 4, while 30% said there was no price increase (Table 4.10 and Figure 4.4). The figure below indicate that there has been increase in prices between 1990-1995 and 1996-2002 period.

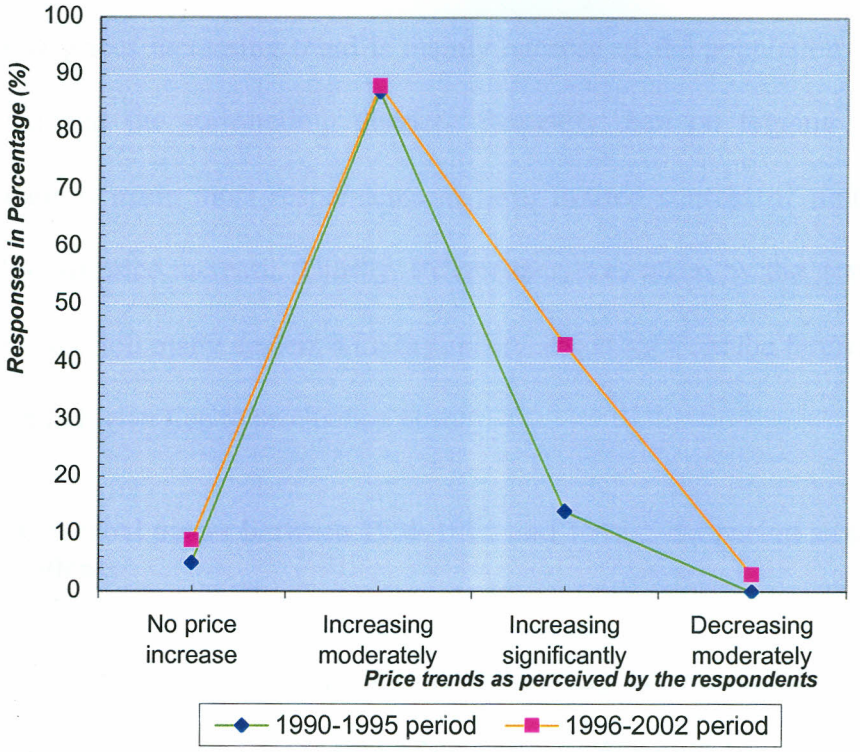



**Figure 4.4: Timber price change curve between 1990-1995 period and 1996-2002 period as perceived by the respondents**

NB: Each colour of the line presents various responses for each period

**Table 4.10: Frequency distribution of responses on timber prices between 1990-1995 and 1996-2002 as perceived by the respondents**

| **Period** | Number of respondents in each category as perceived by the respondents in percentage (%) | | |
|---|---|---|---|
| | ***Increasing significantly*** | ***Increasing moderately*** | ***About the same*** |
| 1990-1995 | 5 | 82 | 13 |
| 1996-2002 | 6 | 66 | 30 |

The above data was analysed using chi-square test to give the degree of significance as indicated below.

Results of chi-square ($\chi^2$) indicate that the differences in timber prices between 1990-1995 and 1996-2002 were significant at $p \leq 0.05$ level ($\chi^2 = 221.805$; df = 9; $p < 0.05$). Timber prices increasing trend is mainly because of the population increase in Kisumu district and the surrounding districts. Secondly, ban on logging in the government plantations made most respondents to have limited sources of timber hence shortage leading to price increase. Thirdly, stricter measures taken by the government to protect forests has left many dealers with the option of getting from the farmers whose prices are normally higher due to production costs.

### 4.12 Charcoal prices between 1990-1995 and 1996-2002 period as perceived by the respondents

Charcoal prices have been increasing moderately between 1990-1995 and 1996-2002 period. In 1990-1995 period, 18% of the charcoal dealers indicated significant increase in charcoal prices at an average increase of Ksh. 50 per 35kg. bag, on the other hand, 66% indicated moderate price increase at an average of Ksh. 30 per 35 kg. bag, while 16% of the respondents reported no increase in price of charcoal acquired over the period. The scenario is slightly different in 1996-2002 period, with 25% of the respondents reporting price increase at an average of Ksh. 110 per 35kg. bag, 47% of respondents reported moderate increase in price by an average of Ksh. 50 per 35kg, while 16% of the respondents in the same product reported slight increase in prices by an average Ksh. 20 per 35kg bag (Table 11).

**Table 4.11: Frequency distribution of responses on charcoal prices between 1990-1995 and 1996-2002 as perceived by the respondents**

| Period | Number of respondents in each category as perceived by the respondents in percentage (%) | | |
|---|---|---|---|
| | ***Increasing significantly*** | ***Increasing moderately*** | ***About the same*** |
| 1990-1995 | 18 | 66 | 16 |
| 1996-2002 | 37 | 47 | 16 |

The above data was analysed using chi-square test to give the degree of significance as indicated below:

Results of chi-square ($\chi^2$) indicate that the differences in charcoal prices between 1990-1995 and 1996-2002 were significant at $p \leq 0.05$ level ($\chi^2 = 93.420$; df=4; $p<0.05$). Charcoal prices increasing trend over the last 10 years is mainly due to population increase within Kisumu district and the surrounding districts.

### 4.13 Prices of posts/poles between 1990-1995 and 1996-2002 as perceived by the respondents

Prices of poles have been increasing moderately between 1990-1995 and 1996-2002 period. Between 1990-1995, 14% of respondents in poles/posts indicated significant increase in prices at an average increase of Ksh. 20 per post/pole, on the other hand, 72% indicated moderate price increase of Ksh. 15, while 14% of the respondents said the prices remained the same.

The scenario was slightly different in 1996-2002 period, with 15% of the respondents reporting significant price increase by an average Ksh. 30 per post/pole, 60% of the

respondents reported moderate increase by an average Ksh. 20 per post/pole, while 25% of the respondents reported that the prices remained the same.

**Table 4.12: Frequency distribution of responses on changes in price of posts/poles between 1990-1995 and 1996-2002 as perceived by the respondents**

| Period | Number of respondents in each category as perceived by the respondents in percentage (%) | | |
|---|---|---|---|
| | ***Increasing significantly*** | ***Increasing moderately*** | ***About the same*** |
| 1990-1995 | 14 | 72 | 14 |
| 1996-2002 | 15 | 60 | 25 |

The above data was analysed using chi-square test to give the degree of significance as indicated below:

Results of chi-square ($\chi^2$) indicate that the differences in the prices of posts/poles acquired between 1990-1995 and 1996-2002 were significant at $p \leq 0.05$ level ($\chi^2 = 122.857$; $df = 9$; $p < 0.05$). Therefore, it is necessary to enhance ways of increasing production of tree species to meet the demands. Posts and poles prices increasing trend over the last 10 years is mainly due to population increase within Kisumu district and the surrounding districts.

### 4.14 Firewood prices between 1990-1995 and 1996-2002 period

Firewood prices have been generally increasing moderately between 1990-1995 and 1996-2002 period. In 1990-1995 period, 26% of firewood dealers indicated significant increase in timber prices at an average increase of Ksh. 120 per cubic metre, on the other

hand, 54% indicated moderate price increase of Ksh. 80, while 20% of the respondents indicated that prices remained the same.

The scenario is slightly different in 1996-2002 period, with 38% of the respondents reporting significant price increase by an average Ksh. 150 per cubic metres, 50% of the respondents reported moderate increase by an average Ksh. 110, while 12% of the respondents said the prices were the same. The significant increase in firewood prices by 150 shillings could be due to government stricter measures undertaken to check encroachment of government forestland. This has made most dealers to acquire the product from the farmers at a higher cost hence increase in selling prices.

**Table 4.13: Frequency distribution of responses on firewood price changes between 1990-1995 and 1996-2002 as perceived by the respondents**

| **Period** | Number of respondents in each category as perceived by the respondents in percentage (%) | | |
|---|---|---|---|
| | ***Increasing significantly*** | ***Increasing moderately*** | ***About the same*** |
| 1990-1995 | 26 | 54 | 20 |
| 1996-2002 | 38 | 50 | 12 |

The above data was analysed using chi-square test to give the degree of significance as indicated below:

Results of chi-square ($\chi^2$) indicate that the differences in firewood acquired prices between 1990-1995 and 1996-2002 were significant at $p \leq 0.05$ level ($\chi^2 = 48.695$; df =6; $p<0.05$). Firewood prices increasing trend over the last 10 years is mainly due to population increase within Kisumu district and the surrounding districts.

### 4.15 Blockboard prices between 1990-1995 and 1996-2002 period

Blockboard prices generally increased moderately between 1990-1995 and 1996-2002 period. In 1990-1995 period, 29% of blockboard respondents indicated significant increase in timber prices at an average increase of Ksh.150 per piece (120cmx240cm), on the other hand, 53% indicated moderate price increase of Ksh. 120, while 18% of the respondents reported that prices remained the same.

The scenario was slightly different in 1996-2002 period, with 20% of the respondents reporting significant price increase by an average Ksh. 180 per piece (120cmx240cm), 54% increasing moderately by an average Ksh. 130, while 26% of the respondents indicated that prices remained the same. This could be attributed possibly to the government restrictions in getting forest wood product in the government land hence reducing local supply of wood especially *Cupressus* spp.

**Table 4.14: Frequency distribution of responses on blockboard prices between 1990-1995 and 1996-2002 as perceived by the respondents**

| **Period** | Number of respondents in each category as perceived by the respondents in percentage (%) | | |
|---|---|---|---|
| | ***Increasing significantly*** | ***Increasing moderately*** | ***About the same*** |
| 1990-1995 | 29 | 53 | 18 |
| 1996-2002 | 20 | 54 | 26 |

The above data was analysed using chi-square test to give the degree of significance as indicated below: Results of chi-square ($\chi^2$) indicate that the differences in prices on blockboard bought between 1990-1995 and 1996-2002 were significant at $p \leq 0.05$ level

($\chi^2 = 138.492$; df =6; $p < 0.05$). Blockboard prices increasing trend over the last 10 years is mainly due to population increase within Kisumu district and the surrounding districts.

**4.16 Plywood prices between 1990-1995 and 1996-2002 period**

Plywood prices have been generally increasing moderately between 1990-1995 and 1996-2002 period. In 1990-1995 period, 29% of the plywood respondents indicated significant increase in plywood prices at an average increase of Ksh. 150 per piece (120cmx240cm), on the other hand, 53% indicated moderate price increase of Ksh. 120, while 18% of respondents said the price was the same.

The scenario was slightly different in 1996-2002 period, with 20% of the respondents reporting significant price increase by an average Ksh. 180 per piece (120cmx240cm), 54% increasing moderately by an average Ksh. 130, while 26% of the respondents indicated slight increase of an average Ksh. 110. This could be attributed possibly by the government restrictions in acquisition of wood products from the government plantations hence reducing local supply of wood especially *Cupressus* spp. and *Pinus* spp.

**Table 4.15: Frequency distribution of responses on plywood prices between 1990-1995 and 1996-2002 as perceived by the respondents**

| Period | Number of respondents in each category as perceived by the respondents in percentage (%) | | |
|---|---|---|---|
| | ***Increasing significantly*** | ***Increasing moderately*** | ***About the same*** |
| 1990-1995 | 29 | 53 | 18 |
| 1996-2002 | 20 | 54 | 26 |

The above data was analysed using chi-square test to give the degree of significance as indicated below:

Results of chi-square ($\chi^2$) indicate that the differences in plywood acquired prices between 1990-1995 and 1996-2002 were significant at $p \leq 0.05$ level ($\chi^2 = 138.492$; df =6; $p<0.05$). Plywood prices increasing trend over the last 10 years is mainly due to population increase within Kisumu district and the surrounding districts.

### 4.17 Chipboard prices between 1990-1995 and 1996-2002 period

Chipboard prices have been generally increasing moderately between 1990-1995 and 1996-2002 period. Twenty three per cent of the respondents dealing in chipboard product said the prices have been increasing significantly between 1990-1995 at an average increase of Ksh. 40 per piece (120cmx240cm). Sixty four percent of the respondents indicated moderate price increase by Ksh. 30, while 13% of the respondents said there was an increase of Ksh. 20 per piece.

The scenario was slightly different in 1996-2002 period, with 28% of the respondents in the same product reporting significant price increase by an average Ksh. 60 per piece, 51% increasing moderately by an average Ksh. 45, while 21% of the respondents indicated that prices were the same. This could be possibly attributed to the government restrictions on acquisition of wood products from the government plantations hence reducing local supply of wood especially *Cupressus* spp.

**Table 4.16: Frequency distribution of responses on chipboard prices between 1990-1995 and 1996-2002 as perceived by the respondents**

| **Period** | Number of respondents in each category as perceived by the respondents in percentage (%) | | |
|---|---|---|---|
| | ***Increasing significantly*** | ***Increasing moderately*** | ***About the same*** |
| 1990-1995 | 23 | 64 | 13 |
| 1996-2002 | 28 | 51 | 21 |

The above data was analysed using chi-square test to give the degree of significance as indicated below:

Results of chi-square ($\chi^2$) indicate that the differences in prices of chipboard bought between 1990-1995 and 1996-2002 were significant at $p \leq 0.05$ level ($\chi^2 \leq 97.123$; df=6; $p<0.05$). Chipboard prices increasing trend over the last 10 years is mainly due to population increase within Kisumu district and the surrounding districts.

**Table 4.17: Frequency distribution of responses on prices of all wood products acquired apart from timber between 1990-1995 and 1996-2002 as perceived by the respondents**

| Period | Number of respondents in each category as perceived by the respondents in percentage (%) | | | |
|---|---|---|---|---|
| | ***Increasing significantly*** | ***Increasing moderately*** | ***About the same*** | ***Decreasing moderately*** |
| 1990-1995 | 25 | 51 | 22 | 2 |
| 1996-2002 | 31 | 53 | 13 | 3 |

The above data was analysed using chi-square test to give the degree of significance as indicated below:

Results of chi-square ($\chi^2$) indicate that the differences in wood products acquired prices between 1990-1995 and 1996-2002 were significant at $p \leq 0.05$ level ($\chi^2 = 321.235$; df = 9; $p < 0.05$). All wood products prices increasing trend over the last 10 years is mainly due to population increase within Kisumu district and the surrounding districts.

**Wood quantity demanded by customers of the respondents**

Furniture products such as beds, tables, and wall units have been demanded by many customers. The respondents indicated moderate increase of 89%, 89%, and 88% in beds, tables and wall units respectively. However, stool product had fewer respondents who indicated that its demand increased moderately. This is perhaps because of the substitute from the sofa sets such as plastic chairs (Table 4.18).

**Table 4.18: Wood quantity demanded by customers of the respondents**

| Product | Wood product quantity demanded | | Total Percentage (%) |
|---|---|---|---|
| | *Increasing moderately (%)* | *About the same (%)* | |
| *Timber* | 90 | 10 | **100** |
| *Charcoal* | 90 | 10 | **100** |
| *Poles/posts* | 72 | 28 | **100** |
| *Fuel wood* | 97 | 3 | **100** |
| **Furniture** | | | |
| *Beds* | 89 | 11 | **100** |
| *Tables* | 89 | 11 | **100** |
| *Wall units* | 88 | 12 | **100** |
| *Stools* | 78 | 22 | **100** |

**Key:**

% = Percent

### 4.19 Wood products sold

Eighty two (13%) of the total products sold is timber, 73 (12%) charcoal, 37 (6%) poles/posts, 37 (6%) fuel wood, 73 (12%) beds, 76 (13%) tables, 69 (12%) chairs, 71 (12%) wall units, while 74 (13%) stools (Table 4.19 and Figure 4.6).

In this case, many respondents who acquired timber product use it for furniture making. For instance, out of the total 143 timber respondents mentioned earlier, only 82 (57%) sold timber product, though they could also be selling other wood products such as posts/poles, blockboard, plywood and furniture (Table 4.19).

**Table 4.19: Wood products sold by all the respondents (N = 224)**

| Wood Product | Percentage of respondents in wood products sold | |
|---|---|---|
| | *Responses* | **% of Total Respondents* |
| *Timber* | 82 | 36.4 |
| *Charcoal* | 73 | 32.6 |
| *Posts/poles* | 37 | 16.5 |
| *Fuel wood* | 37 | 16.5 |
| *Beds* | 73 | 32.6 |
| *Tables* | 76 | 33.9 |
| *Chairs* | 69 | 30.8 |
| *Wall units* | 71 | 31.7 |
| *Stools* | 74 | 33.0 |

**Key:**

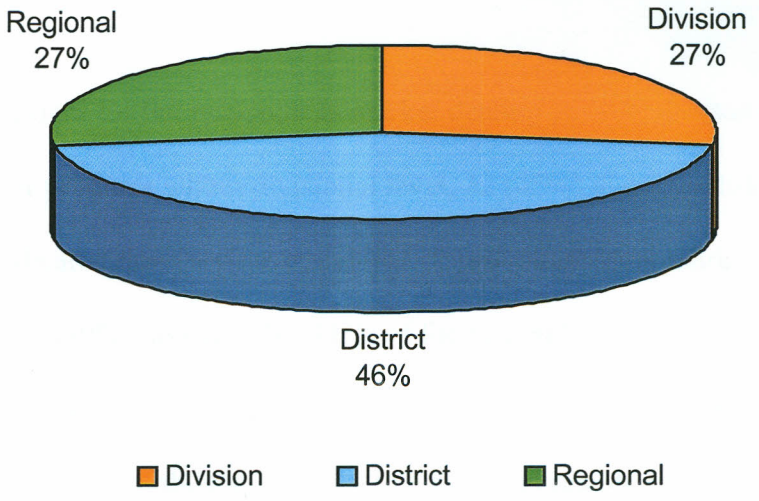
% = Per cent

N = Number of respondents

* = Percentages do not sum up to 100% because some respondents dealt in more than one product

### 4.20 Geographical location of timber market

Major markets for timber acquired are: 31 (27%) of respondents said they sold their timber product within the division, 51 (46%) of the respondents reported district level, while 31 (27%) of timber respondents indicated that they sold their timber product within region or province (Figure 4.5).




**Key:**

% = Percent

**Figure 4.5: Geographical location of timber market**
NB: Each colour presents various responses

#### 4.20.1 Geographical market of other wood products

Six (8%) of the charcoal respondents sell their product within the location, 26 (37%) of the respondents said they sell within the division, 29 (41%) in the district, while 10 (14%)

of the respondents reported that they sold within the region or nationally. The case is similar to poles/posts products whereby 8 (21%) of the total respondents have their market within the division, 21 (53%) of the respondents said they have their market at the district level, while 10 (26%) of the respondents said they have their market within the region or province.

Two (5%) of fuelwood respondents sell their product within location level, 3 (8%) within division, 30 (74%) within district, while 5 (3%) of the respondents sell their products within the province. Twenty eight (39%) of the respondents dealing with bed products said they had their market within the division, 30 (43%) within the district, while 13 (18%) regional or provincial level (Table 4.20).

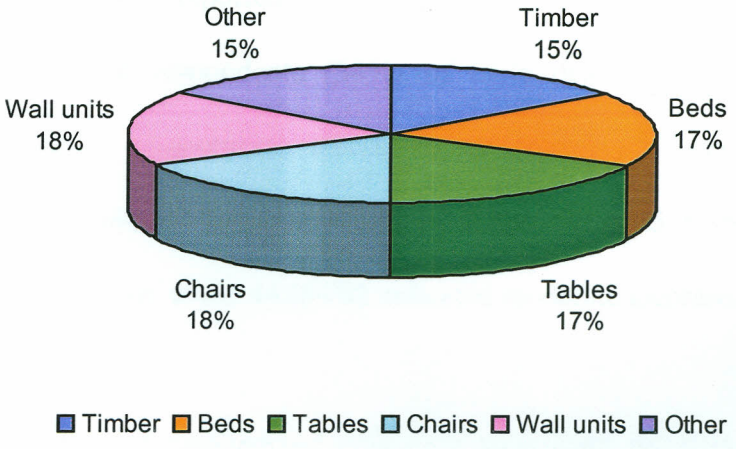
Geographical extent for the respondents market dealing in table product indicated that 29 (39%) sold their products within divisional level, 32 (43%) district, while 13 (18%) of the respondents indicated that they have regional or provincial level market. Market for wall units sold had 27 (39%) division, 30 (44%) of the respondents report district level market, while 12 (17%) of the respondents reported regional or provincial market. Stools sold had geographical market as follows: 10 (37%) of the respondents indicated divisional level market, 12 (44%) of the respondents reported they had district level market, while 5 (19%) of the respondents said they had regional or provincial level (Table 4.20).

**Table 4.20: Geographical market extent in other wood products sold by the respondents**

| *Market Location* | Percentage of market geographical location Percentage | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Charcoal* | *Poles/ posts* | *Fuel wood* | *Beds* | *Tables* | *Wall units* | *Stools* | *Block board/plywood* |
| **Village/ Location** | 8 | - | 5 | - | - | - | - | - |
| **Division** | 37 | 21 | 8 | 39 | 39 | 39 | 37 | 6 |
| **District** | 41 | 53 | 74 | 43 | 43 | 44 | 44 | 15 |
| **Regional** | 14 | 26 | 13 | 18 | 18 | 17 | 19 | 67 |
| **National** | - | - | - | - | - | - | - | 12 |
| **Total Percentage** | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **100** |

### 4. 21 Wood Products Exported to Uganda

Eleven (15%) of the total exported wood products comprised timber, 13 (17%) beds, 13 (17%) tables, 13 (18%) chairs, 13 (18%) wall units, while 11 (15%) other wood products (Figure 4.6). The respondents said travelers ending to Uganda by products and transport by bus.




**Key:**

% = Percent

**Figure 4.6: Wood products exported by the respondents**
NB: Each colour presents various responses

From the above results, many wood products dealers do not export their wood products hence depend on locally available market.

### 4.22 Number of competitors as perceived by respondents

Twenty four (21%) of timber respondents experienced significant increase in number of competitors, 78 (69%) increasing moderately, while 11 (10%) of the respondents recorded no significant change in the number of competitors. Sixteen percent said the number competitors in charcoal product increased significantly, while 46 (74%) indicated moderate increase. Seven (18%) of respondents dealing in poles/posts indicated significant increase in number of competitors, 29 (77%) indicated moderate increase, while 2 (5%) of the respondents reported no significant change in number of competitors respectively.

All 40 (100%) fuel wood respondents indicated moderate increase in number of competitors, unlike beds dealers who had 25 (35%) indicating significant increase, while 46 (65%) of the respondents reported moderate increase in the number of competitors respectively. Twenty five respondents (34%) of table dealers indicated significant increase in number of competitors, where as 49 (66%) had moderate increase respectively. This was similar to competitors in chairs, with 25 respondents (36%) reporting significant increase, while 44 (64%) indicated moderate increase.

Wall units had 24(35%) of respondents indicating significant increase in number of competitors, while 45 (65%) said there was moderate increase in the number of competitors. This applied to respondents dealing in stools, 14 (52%) indicated significant increase, while 13 (48%) said the number of competitors increased moderately. Twenty three (68%) of respondents dealing with other wood products said the number of competitors increased significantly, while 11 respondents (32%) indicated moderate increase significantly (Table 4.21).

**Table 4.21: Number of competitors in wood product as indicated by the respondents**

| Product | Number of competitors Percentage | | | Total Percentage (%) |
|---|---|---|---|---|
| | *Increasing significantly* | *Increasing moderately* | *About the same* | |
| *Timber* | 21 | 69 | 10 | **100** |
| *Charcoal* | 26 | 74 | - | **100** |
| *Poles/posts* | 18 | 77 | 5 | **100** |
| *Fuel wood* | - | 100 | - | **100** |
| *Beds* | 35 | 46 | - | **100** |
| *Tables* | 34 | 66 | - | **100** |
| *Wall units* | 36 | 64 | - | **100** |
| *Stools* | 35 | 65 | - | **100** |
| *Other products: block board, and ply wood.* | 52 | 48 | - | **100** |

**4.23 Available tree species preferred for timber sold as indicated by the respondents**

From field survey, 82 respondents singled out three tree species that are mainly used for timber. In order of preference, the three most preferred tree species for various wood products in the study area are as follows: 79% of the respondents mentioned *Eucalyptus* spp., 60% *Cupressus* spp., while 52% reported P*inus* spp. Other tree species sold are *Olea capensis* spp. *Welwitschii*, *Chlorophora excelsa*, *Ocotea usambararensis*, *Trichilia emetica* and *Grevillea robusta*. (Table 4.24). The increasing demand for *Grevillea robusta* agrees with the findings of Opanga, (2000), which indicated 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 factors influencing choice of tree species for timber sold were: availability for example in the case of *Eucalyptus* spp., which is considered an alternative to *Olea capensis* spp. *Welwitschii* (Elgon teak), *Ocotea usambarensis*, and *Chlorophora excelsa*. The scarcity of *Cupressus lusitanica* in the market has greatly enhanced the use of *Eucalyptus* spp. by the carpenters in furniture making.

In the study area, the carpenters mainly obtain their timber from farmers. Source of wood greatly influence the tree species whereby *Eucalyptus* spp. is locally available hence preferred by many dealers. On the other hand, the scarcity of most preferred species including *Olea capensis* spp. *Welwitschii*, *Chlorophora excelsa*, *Trichilia emetica*, *Ocotea usambarensis* and *Juniperus procera* among others has left many respondents with an option of *Eucalyptus* spp. as their main wood for furniture making in Kisumu town.

**Table 4.22: Available tree species preferred for various uses as indicated by the respondents**

| *Wood product* | *Eucalyptus* | | *Cupressus* | | *Pinus species* | | *Other spp.* | |
|---|---|---|---|---|---|---|---|---|
| | Responses | % | Responses | % | Responses | % | Responses | % |
| Timber | 65 | 79 | 49 | 60 | 43 | 52 | 21 | 26 |
| Charcoal | - | - | - | - | 17 | 21 | 63 | 77 |
| Posts/poles | 21 | 57 | 13 | 35 | 15 | 41 | 27 | 73 |
| Fuelwood | 27 | 72 | 11 | 30 | 17 | 46 | 11 | 30 |
| **Furniture** | | | | | | | | |
| Beds | 51 | 70 | 30 | 41 | 27 | 40 | 12 | 16 |
| Tables | 47 | 62 | 43 | 57 | 38 | 50 | 19 | 25 |
| Chairs | 43 | 62 | 31 | 45 | 28 | 41 | 21 | 30 |
| Wall units | 44 | 62 | 27 | 38 | 23 | 32 | 33 | 75 |
| Stools | 46 | 62 | 37 | 50 | 27 | 36 | 22 | 30 |

From the results presented in table 4.22 above, many wood product dealers have ended up adopting *Eucalyptus* tree species mostly *Eucalyptus globulus* (*Tasmanian blue gum*) as an alternative source of timber for making hardwood furniture items. Following strict measures taken to protect government forests, there has been scarcity of hardwood tree species and the little that is locally available is extremely expensive to many potential buyers. Furniture made from *Eucalyptus* spp. is considered to be relatively cheap, durable, and attractive if properly vanished compared to species such as *Ocotea usambarensis*, *Olea capensis* spp. *Welwitschii* (Elgon teak), and *Trichilia emetica* among others, hence increased demand by most customers of the respondents. *Eucalyptus* spp.

are among the most successful exotic hardwood species in Kenya and they account for 9.5% of the total established plantations (Gor, 1990).

Seventy seven percent of charcoal dealers prefer *Acacia mearnsi* tree species, while 41% prefer *Pinus* spp. Among respondents dealing in poles/posts, 73% preferred *Juniperus procera*, 57% preferred *Eucalyptus* spp., 14% *Pinus* spp. while 35% preferred *Cupressus* spp. Seventy two percent of the respondents dealing in fuel wood preferred *Eucalyptus* spp., 46% *Pinus* spp., while 30% preferred *Cupressus* spp. About 70% of the respondents dealing with beds indicated they preferred *Eucalyptus* spp., 41% *Cupressus* spp. 40% *Pinus* spp. while 16% of the respondents reported they preferred other tree species such as *Grevillea robusta*, *Chlorophora excelsa* and *Ocotea usambarensis*.

The scenario is slightly different on table sold with 62% of the respondents preferring *Eucalyptus* spp., 57% cypress, 50% *Pinus* spp., while 25% of respondents preferred other tree species. Sixty two percent of the respondents selling chairs reported that they prefer *Eucalyptus* spp., 45% *Cupressus* spp., 41% *Pinus* spp., while 30% of respondents said they prefer other tree species including *Gravillea robusta*, *Ocotea usambarensis*., and *Trichilia emetica*. About 62% of the respondents prefer *Eucalyptus* spp. for wall units, 38% *Cupressus* spp., 32% *Pinus* spp. while 75% of respondents preferred other tree species such as: *Olea capensis* spp. *Welwitschii*, mahogany and *Ocotea usambarensis*.

Sixty two per cent of the respondents in stools sold said they preferred *Eucalyptus* spp., 50% *Cupressus* spp., 36% *Pinus* spp. while 30% of the respondents said they preferred

other species including *Olea capensis* spp. *Welwitschii*, *Grevillea robusta*, *Ocotea usambarensis* and *Trichilia emetica*. Six percent of the respondents of other wood products sold by respondents said they prefer *Eucalyptus* spp., 11 (50%) of the respondents indicated that they would prefer *Cupressus* spp., while 5 (23%) of the respondents said that they would prefer other tree species (Table 4.22).

In the above scenario, preferred tree species of higher quality are scarce hence respondents end up adopting *Eucalyptus* spp. as an alternative source of fuel wood. According to Mugo (1997), *Syzgium cumini*, a less preferred species for fuel wood has been in the use in Naitiri sub-location in Bungoma District since other species had been depleted.

According to the results presented above, *Acacia mearnsi* has been preferred by most charcoal product dealers, this is because of its high quality charcoal, and constant supply within the lake Victoria region from former Eatec firm (plantation) that has so far been subdivided to farmers, near Eldoret town. The land has since the year 2000 been subdivided to local people who are aggressively cutting down *Acacia mearnsi* mainly for charcoal, poles, posts and firewood production, poles, posts and firewood.

However, some dealers prefer charcoal product from tree species such as *Pinus* spp., *Cupressus* spp. and *Eucalyptus* spp. though in small quantities. Charcoal from *Pinus* spp. tree species recorded lowest prices, that is Ksh. 200 per 35kg bag at the time of survey. Dealers could tell the tree species used to make charcoal by breaking it, weight or source

of the product. For example charcoal from former EATEC is mainly made from *Acacia mearnsi* while that from Narok is mainly made from *Olea africana* (Mtamaiyu). Further, charcoal made from Acacia sp. is heavier has compared to the one made from softwood such as *Pinus* sp.

*Eucalyptus* spp. is highly preferred for construction poles and posts. This is because they are long enough and durable and prices are relatively low compared to *Juniperus procera* (cedar) posts. In addition, *Eucalyptus* spp. suitable for poles and posts are locally available.

Further, furniture products made from *Eucalyptus* spp., such as beds, tables, wall units, and stools are on high demand because they are relatively cheap, attractive, and durable. Other wood products such as blockboard and plywood are made of *Cupressus* spp. tree species. *Cupressus* spp. is also preferred by some wood product dealers for making tops of tables, stools, beds, and wall units among other furniture items among other furniture items (plates 1-6).

Plate 1: Knock down seat made of *Eucalyptus* spp.

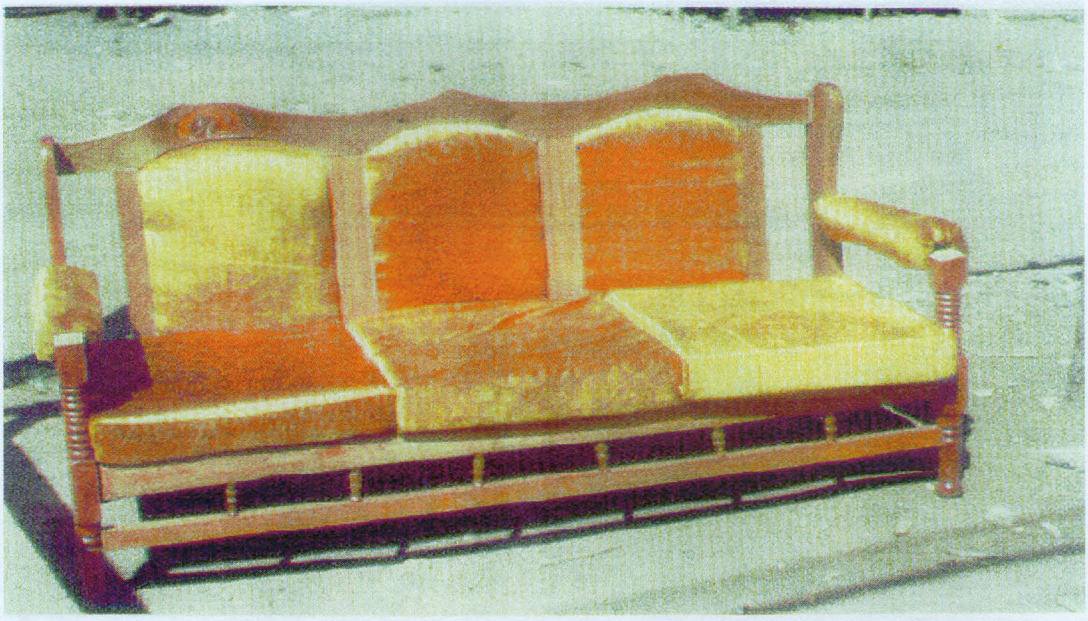


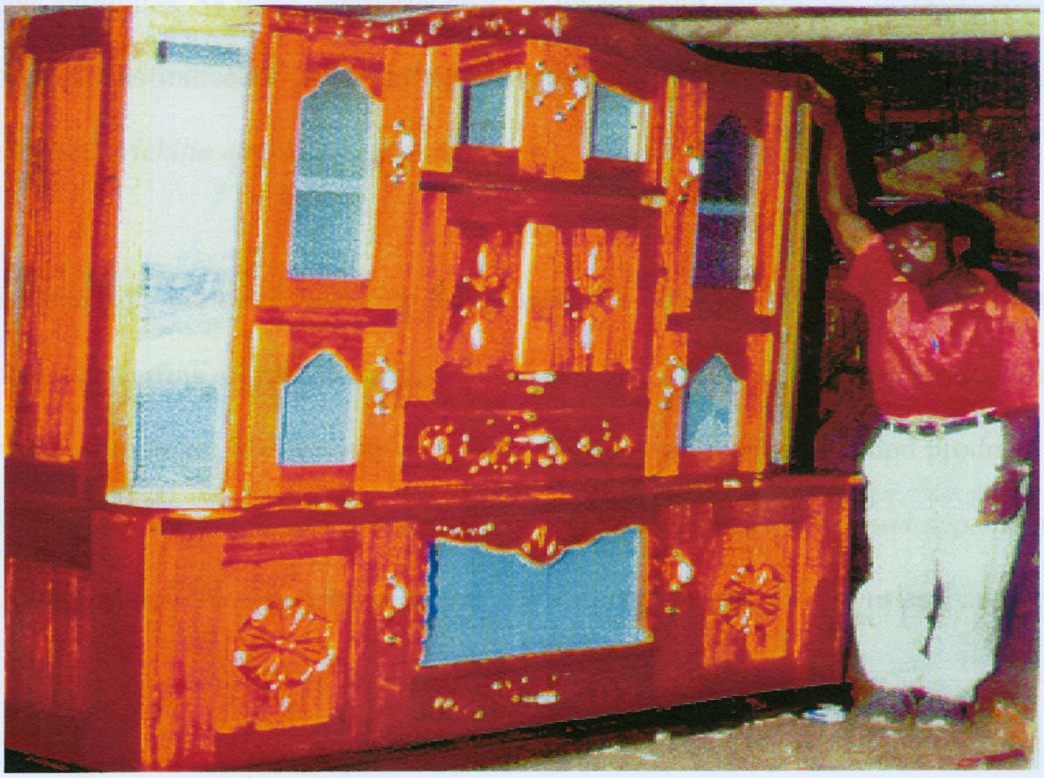
Plate 2: Wall unit made of *Cupressus* spp.

Plate 3: Coffee set made of *Cupressus* spp.

Plate 4: A bed made of *Eucalyptus* spp.

Plate 5: Sideboard made of *Ocotea usambarensis* tree species.

Plate 6: Wall unit made of *Ocotea usambarensis* tree species.



**4.24 Tree species respondents would prefer for various wood products**

This section discusses the responses on tree species that would be preferred by the respondents assuming all species are easily available. The data shows that 180 (30%) of the respondents indicated that they would prefer *Eucalyptus* spp. that is relatively affordable to many respondents, durable, attractive if well vanished, and locally available in large quantities.

Similarly, 130 (21%) of the respondents indicated they would prefer *Olea capensis* spp. *Welwitschii* (Elgon teak) for making durable and attractive furniture, 78 (13%) would prefer *Cupressus* spp. which has long timber that is highly recommended mainly for roofing, furniture making and other construction purposes, *Acacia mearnsi* mostly preferred for charcoal recorded 65 (11%) of the responses, 35 (6%) *Grevillea robusta* for making coffins, 32 (5%) indicated *Pinus* spp. for providing construction timber and low cost furnitures, 38 (6%) *Juniperus procera* for fetching posts/poles, while 48 (8%) of the respondents indicated other tree species including *Ocotea usambarensis*, *Chlorophora excelsa*, *Trichilia emetica* among others.

Respondents indicated that they would consider what is affordable to their customers, hence preferring *Cupressus* spp., *Pinus* spp., and other tree species for various wood products to target low income customers. Considering individual wood product, 41% of timber respondents would prefer *Eucalyptus* spp., 21% *Olea capensis* spp. *Welwitschii* (Elgon teak), 15% *Grevillea robusta*, 12% *Cupressus* spp., 8% *Pinus* spp., while 3% of

the respondents said that they would prefer other tree species such as *Ocotea usambarensis*, *Chlorophora excelsa* and *Trichilia emetica*.

Ninety percent of charcoal dealers would prefer *Acacia mearnsi* tree species, while 10% would prefer other tree species such as *Pinus* spp. and *Olea africana*. Sixty six percent of posts/poles respondents interviewed said they would prefer *Juniperus procera*, 18% *Eucalyptus* spp., while 16% of the respondents indicated that they would prefer other tree species including *Acacia mearnsi*, *Cupressus* spp. and *Grevillea robusta* among others.

The data in table 4.23 indicates that 48% of the respondents would prefer *Eucalyptus* spp. in fuel wood product sold, 41% *Pinus* spp., while 11% of the respondents indicated they would prefer *Cupressus* spp. Further, 54% of the respondents selling beds indicated that they would prefer *Eucalyptus* spp., while 19% of the respondents said they would prefer *Cupressus* spp. 15 % *Olea capensis* spp. *Welwitschii* (Elgon teak), 6% *Grevillea robusta,* while 6% of the respondents said they would prefer other tree species including *Chlorophora excelsa*, *Trichilia emetica*, *Ocotea usambarensis* among others.

The responses in table product sold indicated that 36% of the respondents would prefer *Eucalyptus* spp., 28% *Cupressus* spp., 20% would prefer *Olea capensis* spp. *Welwitschii* (Elgon teak), 9% *Gravillea robusta*, and 7% other tree species including *Chlorophora excelsa*, *Pinus* spp., *Ocotea usambarensis*, and *Trichilia emetica* among others. The data results indicates that 45% of the respondents would prefer *Olea capensis* spp. *Welwitschii* (Elgon teak), for wall unit product, 30% *Eucalyptus* spp., while 15% of the respondents

said they would prefer other tree species such as *Ocotea usambarensis*, *Trichilia emetica*, and *Chlorophora excelsa*. Fifty seven percent of the respondents indicated they would prefer *Olea capensis* spp. *Welwitschii* (Elgon teak) in stools sold, 22% *Eucalyptus* spp., 12% *Cupressus* spp., while 9% of respondents indicated that they would prefer other tree species including *Chlorophora excelsa*, *Ocotea usambarensis* and *Tricilia emetica* among others.

Finally, 23% of respondents dealing in other wood products sold for example radio speakers said they would prefer *Eucalyptus* spp., 20% *Cupressus* spp., 20% *Olea capensis* spp. *Welwitschii* (Elgon teak), 16% of the respondents would prefer *Grevillea robusta*, while 11% of respondents said they would prefer other tree species including *Ocotea usambarensis*, *Chlorophora excelsa* and *Trichilia emetica* among others. (Table 4.23).

**Table 4.23: Tree species the respondents would prefer for various wood products**

| Product | Percentage of tree species that would preferred for use | | | | | | | | Total Percentag (%) of tre species preferred |
|---|---|---|---|---|---|---|---|---|---|
| | *Eucalyptus* spp. | *Elgon teak* | *Cupressus* spp. | *Grevillea robusta* | *Pinus* spp. | *Acacia mearnsi* | *Junip-erus proc-era* | *Other* | |
| *Timber* | 41 | 21 | 12 | 15 | 8 | - | - | 3 | 100 |
| *Charcoal* | - | - | - | - | - | 90 | - | 10 | 100 |
| *Poles/posts* | 18 | - | - | - | - | - | 66 | 16 | 100 |
| *Fuel wood* | 48 | - | 11 | - | 41 | - | - | - | 100 |
| *Beds* | 54 | 15 | 19 | 9 | - | - | - | 7 | 100 |
| *Tables* | 36 | 20 | 28 | 10 | - | - | - | 7 | 100 |
| *Wall units* | 30 | 46 | 10 | - | - | - | - | 14 | 100 |
| *Stools* | 22 | 57 | 12 | - | - | - | - | 9 | 100 |
| *Other products* | 22 | 20 | 20 | 16 | 11 | - | - | 11 | 100 |

NB: Elgon teak - *Olea capensis* spp. *Welwitschii*

**4.25: Available tree species for wood products used and species dealers would prefer for various wood products**

Table 4.24 below shows the chi-square results on the available tree species for wood products used and species dealers would prefer for various wood products. The results indicate that there is significant difference on the tree species available and the ones dealers would prefer for various uses. For example, *Olea capensis* spp. *Welwitschii* would be preferred by 130 respondents as compared to 78 (*Cupressus* spp.), 32 (*Pinus* spp.), and 65 (*Acacia mearnsi*) among others.

**Table 4.24: Chi-square results indicating comparison of responses on available tree species used and species dealers would prefer for timber**

| | *Tree species responses in percentage (%)* | | | | | |
|---|---|---|---|---|---|---|
| | *Eucalyptus* spp. | *Elgon teak* | *Grevillea robusta* | *Cupressus* spp. | *Pinus* spp. | *Other spp.* |
| ***Available species*** | 41 | 21 | 15 | 12 | 8 | 3 |
| ***Species preferred*** | 31 | 15 | 21 | 22 | 10 | 1 |

NB: Elgon teak - *Olea capensis* spp. *Welwitschii*

The above data was analysed using chi-square test to give the degree of significance as indicated below:

Results of chi-square ($\chi^2$) indicate that the differences in available tree species for timber product and species dealers would prefer were significant at $p \leq 0.05$ level ($\chi^2 = 1201.651$; df=24; $p<0.05$).

**4.26 Tree species acquired from suppliers by the respondent**

Sixty (53%) respondents in timber bought from the suppliers comprise 30 (27%) *Eucalyptus* spp., *Cupressus* spp., 10 (9%) *Pinus* spp., while 12 (11%) other tree species. *Acacia mearnsi* comprise 50 (69%) of charcoal product acquired, 12 (16%) *Pinus* spp., while 11 (15%) of the respondents said they buy other tree species mainly *Olea africana*. Twenty of respondents (51%) in the poles/posts said they buy *Eucalyptus* spp., while 19 (49%) indicated that they buy poles/posts from other tree species respectively.

The results further indicate that 25 (62%) of the respondents in fuel wood product buy *Eucalyptus* spp., 10 (25%) of the respondents buy *Pinus* spp., while 5 (13%) other tree species. Fifty (69%) of respondent dealing in block board get *Cupressus* spp. from suppliers, while 22 (31%) *Pinus* spp.. Further, 10 (25%) *Eucalyptus* spp., 15 (37%) *Cupressus* spp., 10 (25%), and 5 (13%) other tree species are acquired for other wood products from suppliers (Table 4.25).

**Table 4.25: Tree species acquired from suppliers**

| | *Tree species percentage* | | | | | |
|---|---|---|---|---|---|---|
| ***Product*** | ***Eucalyptus* spp.** | ***Cupressus* spp.** | ***Pinus* spp.** | ***Acacia mearnsi (wattle)*** | ***Other spp. Acacia* spp., *gravillea, camphor, mvule, olea africana elgon teak and mahogany.*** | ***Total Percentage (%)*** |
| *Timber* | 53 | 27 | 9 | - | 11 | 100 |
| *Charcoal* | - | - | 16 | 69 | 15 | 100 |
| *Poles/ posts* | 51 | - | - | - | 49 | 100 |
| *Fuel wood* | 62 | - | 25 | - | 13 | 100 |
| *Block board* | - | 69 | 31 | - | - | 100 |
| *Other products* | 25 | 37 | 25 | - | 13 | 100 |

NB: Camphor: *Ocotea usambarensis*
Elgon teak: *Olea wilwitchii*
Mahogany: *Trichilia emetica*

During this study *Eucalyptus* spp., *Pinus* spp. and *Cupressus* spp. used for some wood products including timber, charcoal, posts/poles, and fuel wood among others were found

to be more dominant within Kisumu and surrounding districts especially Nyando, Nandi and Vihiga.

### 4.27 Tree species bought from farmers by the respondents

Sixty five per cent of the timber product acquired from the suppliers comprise *Eucalyptus* spp., 10% *Cupressus* spp., 12% *Pinus* spp. and 13% other tree species. Seventy four per cent of charcoal product respondents said they bought *Acacia mearnsi*, 15% *Pinus* spp. while 11% of charcoal respondents said they buy other tree species. Seventy seven per cent, 5% and 18% comprise *Eucalyptus* spp., *Cupressus* spp. and other tree species respectively in the poles/posts acquired. The results further indicate that 27% of fuel wood respondents said they acquire *Eucalyptus* spp. from farmers, 63% *Cupressus* spp., while 10% of fuel wood respondents said they acquire other tree species. Fourty per cent of respondents in other wood products acquired said they buy *Eucalyptus* spp. from suppliers, while 25%, 15%, and 20% of the respondents indicated *Cupressus* spp., *Pinus* spp., and other tree species respectively (Table 4.26).

**Table 4.26: Tree species of various wood products acquired from farmers**

| *Product* | *Tree species percentage (%)* | | | | | *Total Percentage (%)* |
|---|---|---|---|---|---|---|
| | ***Eucalyptus* spp.** | ***Cupressus* spp.** | ***Pinus* spp.** | ***Acacia mearnsi*** | ***Other spp. wattle, grevillea, camphor, mvule, olea africana, elgon teak and mahogany.*** | |
| *Timber* | 65 | 10 | 12 | - | 13 | 100 |
| *Charcoal* | - | - | 15 | 74 | 11 | 100 |
| *Poles/posts* | 77 | 5 | - | - | 18 | 100 |
| *Fuel wood* | 27 | - | 63 | - | 10 | 100 |
| *Other products* | 40 | 25 | 15 | - | 20 | 100 |

NB: Camphor: *Ocotea usambarensis*
Elgon teak: *Olea wilwitchii*
Mahogany: *Trichilia emetica*
Wattle: *Acacia mearnsi*

During this study the respondents indicated that *Eucalyptus* spp., *Pinus* spp. and *Cupressus* spp. used for some wood products including timber, charcoal, posts/poles, and fuelwood among others were mainly supplied from surrounding districts especially Nyando, Nandi and Vihiga.

**4.28 Reasons why available tree species are preferred for wood products sold**

Table 4.27 below shows reasons why some available tree species are preferred for various wood products sold. Sixty two per cent of the respondents preferred *Eucalyptus* spp. because it is moderately durable. Other reasons why respondents preferred *Eucalyptus* spp. are as follows: Fifty three per cent said it is relatively attractive, 58% reported that its prices are relatively low, 55% indicated that it is easily worked on, 15% said it has high calorific value hence preferred for firewood, 10% said it is less smoky, 68% said the species is available in long sizes, while 33% of the respondents indicated that *Eucalyptus* spp. dries fast.

Twenty per cent of the respondents who prefer *Cupressus* spp. indicated that it is durable, 33% said it is attractive, 18% reported low prices, 73% said it is easily worked on, 10% indicated that it has high calorific value, 8% less smoky, 10% does not crack easily, 79% said it is available in long sizes, while 47% of *Cupressus* spp. respondents said they prefer it because it dries fast.

Seventeen per cent of the respondents preferring *Pinus* spp. said it is durable, 21% indicated that it is attractive, 42% reported that it has relatively low prices, 64% of the respondents said it is easily worked on. Further, 73% of the respondents said *Pinus* spp. has high calorific value (in fuel wood), 79% said it is less smoky, 38% reported that it does not crack easily, 79 said it is available in long sizes, while 61% of respondents indicated that *Pinus* spp. dries fast.

Sixty one per cent of respondents of respondents preferring *Grevillea robusta* indicated that it is durable, 58% said it is attractive, 41% said prices are relatively low, 47% said that it is easily worked on, 29% said it does not crack easily, 38% of the respondents reported that it is available in long sizes, while 44% of the respondents preferring *Grevillea robusta* indicated that it dries fast. In addition, Opanga (2000) reports that all furniture makers interviewed indicated that mature *Grevillea robusta* of over 20 years is quite good. Further, *Grevillea robusta* timber is ranked as moderately durable and moderately resistant. His results confirm that *Grevillea robusta* timber is easily sawn and nailable.

Eighty one per cent of respondents who preferred *Acacia mearnsi* indicated durability being the main reason for preferring the species especially for charcoal product, 93% of the respondents said charcoal from the species has high calorific value, while 91% of the respondents said charcoal from *Acacia mearnsi* species is less smoky.

Eighty three respondents preferring other tree species gave the following reasons: 83% indicated durability as the reason for preferring other species, 71% attractiveness, 31% relatively low prices, 21% easily worked on, 15% high calorific value, 17% less smoky, 39% indicated that they do not crack easily, 41% said they are available in long sizes, while 27% of the respondents said they prefer other tree species because they dry fast.

**Table 4.27: Reasons why available tree species are preferred for wood products sold as indicate by the respondents**

| Reason | Responses in percentage (%) | | | | | |
|---|---|---|---|---|---|---|
| | *Eucalyptus* spp. | *Cupressus* Spp. | *Pinus* Spp. | ***Grevillea robusta*** | ***Acacia mearnsi*** | ***Other* spp. *e.g. Olea capensis, Chlorophora excelsa, Trichilia emetica*** |
| *Durable* | 62 | 20 | 17 | 61 | 81 | 83 |
| *Attractive* | 53 | 33 | 21 | 58 | - | 71 |
| *Low prices* | 58 | 18 | 42 | 41 | - | 31 |
| *Easily worked on* | 55 | 73 | 64 | 47 | - | 21 |
| *High calorific value* | 15 | 10 | 73 | - | 93 | 15 |
| *Less smoky* | 8 | - | 79 | - | 91 | 17 |
| *Does not crack easily* | 10 | 66 | 38 | 29 | - | 39 |
| *Available in long sizes* | 68 | 79 | 77 | 38 | - | 41 |
| *Dries fast* | 33 | 47 | 61 | 44 | - | 27 |

### 4.29 Tree species availability for wood products acquired

About 112 (79%) of the respondents indicated that timber species acquired are available through out the year, while 29 (21%) are available but with some problems. Ninety seven (76%) of respondents said that the species in charcoal product acquired are generally

available through out the year, while 30 (24%) of the respondents said the species are generally available with some problems.

Seventy seven (77%) of the respondents selling poles/posts indicated that they are generally available, while 23 (23%) of the respondents said the species are available with some problems. Fifty two (71%) of respondents said species acquired for fuel wood are available through out the year, while 21 (29%) of the respondents indicated that species are generally available with some problems. In other wood products acquired, 37 (77%) of respondents indicated that species are available through out the year, while 11 (23%) of the respondents said species are generally acquired with some problems (Table 4.28).

**Table 4.28: Availability of tree species for different wood products as indicated by the respondents**

| Product | Availability of wood products as indicated by the respondents | | | |
|---|---|---|---|---|
| | *Available through out the year* | | *Generally available, some problems* | |
| | **Frequency** | **Percentage (%)** | **Frequency** | **Percentage (%)** |
| *Timber* | 112 | 79 | 29 | 21 |
| *Charcoal* | 97 | 76 | 30 | 24 |
| *Poles/posts* | 77 | 77 | 23 | 23 |
| *Fuel wood* | 52 | 71 | 21 | 29 |
| *Other products* | 37 | 77 | 11 | 23 |

### 4.30 Unit of acquiring various wood products

Seventy one (57%) of timber respondents said they buy it in pieces, 3 (3%) in tons, while 52 (41%) of the respondents said they bought in lorry loads. Eleven (15%) of the charcoal respondents indicated they buy the product in lorry loads, while 62 (85%) of the respondents said they buy it in bags (35kgs). Twenty eight (71%) of poles/posts

respondents indicated they acquire their product in pieces, while 12 (30%) of respondents said they acquire the product in lorry loads. Twenty seven (71%) of the fuel wood respondents acquire their product in tons, while 11 (29%) acquire their product in lorry loads. All the 62 responses in other wood products including plywood, blockboard, chipboard among others are acquired in pieces (Table 4.29).

**Table 4.29: Unit acquired in wood products**

| *Product* | *Responses percentage (%)* | | | | *Total Percentage (%)* |
|---|---|---|---|---|---|
| | *Pieces (120cmx240cm)* | *Cubic metre* | *Lorry loads* | *Bags (35kgs)* | |
| *Timber* | 57 | 2 | 41 | - | 100 |
| *Charcoal* | - | - | 11 | 62 | 100 |
| *Poles/posts* | 71 | - | 12 | - | 100 |
| *Fuel wood* | - | 71 | 29 | - | 100 |
| *Other wood products* | 100 | - | - | - | 100 |

### 4.31 Degree of price fluctuation in wood products

Fifteen (10%) of timber respondents indicated that there was a high degree of price fluctuation, 126 (87%) of the respondents said there was moderate price fluctuation, while 5 (3%) of the respondents indicated low price fluctuation. Two (3%) of charcoal product respondents indicated high degree of price fluctuation, 68 (94%) moderate, while 2 (3%) of the respondents reported low price fluctuation. The scenario was similar in posts/ poles products acquired with 2 (6%) of the respondents reporting high price fluctuation, 32 (88%) of the respondents reporting moderate price fluctuation, while 2 (6%) low.

Ten (25%) of respondents in fuel wood acquired reported high prices fluctuation, 25 (62%) of the respondents reported moderate price fluctuation, while 5 (3%) of the fuel wood respondents reported low price fluctuation. Eight of the respondents indicated high price fluctuation for blockboard, 63 (86%) of the respondents reported moderate price fluctuation, while 2 (3%) of block board respondents reported low price fluctuation. Eight (23%) of plywood respondents indicated high degree of price fluctuation, while 27 (77%) of the respondents reported moderate fluctuation in the same product. The scenario was slightly different in other wood products acquired with 11 (23%) indicating high degree of price fluctuation, 22 (47%) of the respondents reporting moderate price fluctuation, while 14 (30%) of the respondents reported low price fluctuation in the same product (Table 4.30).

**Table 4.30: Degree of price fluctuation in wood products as indicated by respondents**

| *Product* | *Degree of price fluctuation* | | | *Total Percentage %)* |
|---|---|---|---|---|
| | *High (%)* | *Moderate (%)* | *Low (%)* | |
| *Timber* | 10 | 87 | 3 | 100 |
| *Charcoal* | 3 | 94 | 3 | 100 |
| *Poles/posts* | 6 | 88 | 6 | 100 |
| *Fuel wood* | 25 | 62 | 3 | 100 |
| *Block board* | 11 | 86 | 3 | 100 |
| *Plywood* | 23 | 77 | - | 100 |
| *Other products* | 23 | 47 | 30 | 100 |

### 4.32 Transportation arrangement of wood products acquired

Five (3%) of the respondents dealing in timber product use their own means, while 141 (97%) of the respondents said suppliers meet their transportation costs. Twenty (28%) of

charcoal respondents use their own transportation means to acquire the product, while 52 (72%) of the respondents said they receive the same product from the suppliers. Two (8%) of poles/posts respondents use their own transportation means, while 23 (92%) of the respondents said they are supplied the product in their firm. Nineteen (44%) of fuel wood respondents use their own means, while 24 (56%) of respondents receive their product from suppliers.

All the 73 block board respondents, and 65 plywood respondents receive their products from suppliers located in Kisumu town. However, 30 (48%) of the respondents said they use their own transport means while 33 (52%) of the respondent receive from suppliers means on the other wood product bought (Table 4.31).

**Table 4.31: Transportation arrangement of wood products bought by the respondents**

| *Product* | Responses percentage (%) | | *Total Percentage %)* |
|---|---|---|---|
| | *Own means (%)* | *Suppliers means (%)* | |
| *Timber* | 3 | 97 | 100 |
| *Charcoal* | 28 | 72 | 100 |
| *Poles/posts* | 8 | 92 | 100 |
| *Fuel wood* | 44 | 56 | 100 |
| *Block board* | - | 100 | 100 |
| *Plywood* | - | 100 | 100 |
| *Other products* | 48 | 52 | 100 |

**4.33 Source (geographical location) of wood products acquired by the respondents**

Fourty five (33%) of timber respondents said they acquire the product from within the district 30 (22%) of the respondents said they acquire timber from Nakuru district, 27

(20%) of the respondents indicated they acquire timber from Nandi district, 27 (20%) of the respondents reported they acquire timber from Vihiga district, while 7 (5%) of the respondents said they acquire timber from other districts.

Twenty (28%) of charcoal product respondents said they buy it within the district, 24 (33%) of the respondents said they buy from Nandi district, while 28 (39%) of the charcoal respondents said they buy from Uasin Gishu among other districts. Fifteen (40%) of poles/posts respondents reported that they buy within the district, 15 (39%) of the respondents said they buy from Vihiga district, while 8 (21%) of poles/posts respondents said they buy from other districts.

Twenty six (59%) of the fuel wood respondents reported that they buy within district, 14 (32%) of the respondents said they buy from Vihiga district, while 10 (9%) of the respondents said they buy from other sources. Fifty three (69%) of respondents in other wood products said they buy from within the district, 14 (18%) of the respondents said they buy from Nakuru district, while 10 (13%) of the respondents said they buy other wood products from Vihiga district (Table 4.32).

**Table 4.32 Source (geographical location) of wood products bought as indicated by the respondents**

| | *Geographical location percentage (%)* | | | | | |
|---|---|---|---|---|---|---|
| *Product* | *Kisumu* | *Nakuru* | *Nandi* | *Vihiga* | *Other: Uasin Gishu, Narok, Kericho.* | *Total Percentage %)* |
| *Timber* | 33 | 22 | 20 | 20 | 5 | 100 |
| *Charcoal* | 28 | - | 33 | - | 39 | 100 |
| *Poles/posts* | 40 | - | - | 39 | 10 | 100 |
| *Fuel wood* | 59 | - | - | 32 | 9 | 100 |
| *Other* | 69 | 18 | - | 10 | - | 100 |

**4.34 Advantages of geographical location of the acquired wood products as indicated by the respondents**

One hundred and twenty five (88%) of the timber respondents said low prices is the main advantage for preferring the source of their product, while 17 (12%) of the respondents indicated availability of large quantities being the main advantage of the source. Thirty four (47%) of charcoal respondents indicated low prices as the main reason for preferring the source they buy it, while 38 (53%) of the respondent reported that availability of large quantities is the main advantage of charcoal source.

Twenty nine (74%) and 10 (26%) of posts/poles respondents said advantages for the source of their product were: low prices and availability of large quantities respectively. Thirty five (95%) of fuel wood respondents indicated that prices are low in their preferred buying source while 2 (5%) said they get their product in large quantities. Sixty eight

(93%) of blockboard respondents indicated low prices as the main advantage for preferring the buying source, while 5 (7%) of the respondents indicated availability of product in large quantities as the main advantage for their source of block board product.

Thirty three (94%) and 2 (6%) of plywood respondents indicated main advantages for preferring buying source as low prices and availability in large quantities respectively. The scenario was different in the other wood products acquired whereby all the 29 respondents singled out low prices as the main advantage for preferring source of buying their other wood products (Table 4.33).

**Table 4.33: Advantages of geographical location of the acquired wood products**

| | **Responses on the advantages** | | | | |
|---|---|---|---|---|---|
| | ***Low prices*** | | ***Large quantities*** | | |
| ***Wood product*** | ***Frequency*** | ***Percentage*** | ***Frequency*** | ***Percentage*** | ***Total percentages*** |
| *Timber* | 125 | 88 | 17 | 12 | 100 |
| *Charcoal* | 34 | 47 | 38 | 53 | 100 |
| *Poles/posts* | 29 | 74 | 10 | 26 | 100 |
| *Fuel wood* | 35 | 95 | 2 | 5 | 100 |
| *Block board* | 68 | 93 | 5 | 7 | 100 |
| *Plywood* | 33 | 94 | 2 | 6 | 100 |
| *Other* | 29 | 100 | - | - | 100 |

**4.35 Market demand on wood products sold**

Data results show that 19 (19%) of the respondents dealing in timber, reported good market through out the year, 67 (72%) of the respondents said the market was generally good, while 6 (7%) said the market was often unfavourable. Twenty one (29%) of the charcoal product dealers indicated good market through out the year, while 51 (71%) of the respondents said the market was generally good.

Fourteen (25%) of the poles/posts respondents reported that they had good market through out the year, 39 (71%) of the respondents in the same product said the market was generally good, while 2 (4%) of the respondents indicated that the market was often unfavourable. Nine (23%) of the fuel wood dealers indicated good market through out the year, while 31 (77%) of the respondents said the market was generally good.

Eleven (19%) of the respondents selling beds said the market was not good through out the year, 35 (60%) of the respondents in the same product indicated that the market was generally good, while 12 (21%) of the respondents said the market was often unfavourable. Thirteen (21%) of table product respondents had good market through out the year, 34 (56%) of the respondents said the market was generally good, while 14 (23%) of the respondents in the same product said the market was often unfavourable.

Ten (20%) of wall unit product respondents indicated that they had good market through out the year, 30 (62%) of the respondents said the market was generally good, while 9 (18%) of the respondents said the market was often unfavourable. Thirteen (18%) of stool

product respondents indicated they had good market through out the year, 43 (60%) of the respondents said the market was generally good, while 8 (22%) of the respondents said the market was often unfavourable. The scenario was slightly different in other wood products acquired whereby 33 (75%) of the respondents indicated that the market was good through out the year, while 11 (25%) said the market was often unfavourable (Table 4.34 and Figure 4.7).

**Table 4.34: Market demand for the wood products sold as perceived by the respondents**

| *Wood product* | **Percentage of market demand** | | | *Total percentages* |
|---|---|---|---|---|
| | *Good through out the year* | *Generally good* | *Often unfavourable* | |
| Timber | 21 | 72 | 7 | 100 |
| Charcoal | 29 | 71 | - | 100 |
| Poles/posts | 25 | 71 | 4 | 100 |
| Fuel wood | 23 | 77 | - | 100 |
| Beds | 19 | 60 | 21 | 100 |
| Table | 21 | 56 | 23 | 100 |
| Wall unit | 20 | 62 | 18 | 100 |
| Stools | 18 | 60 | 22 | 100 |
| Other | - | 75 | 25 | 100 |

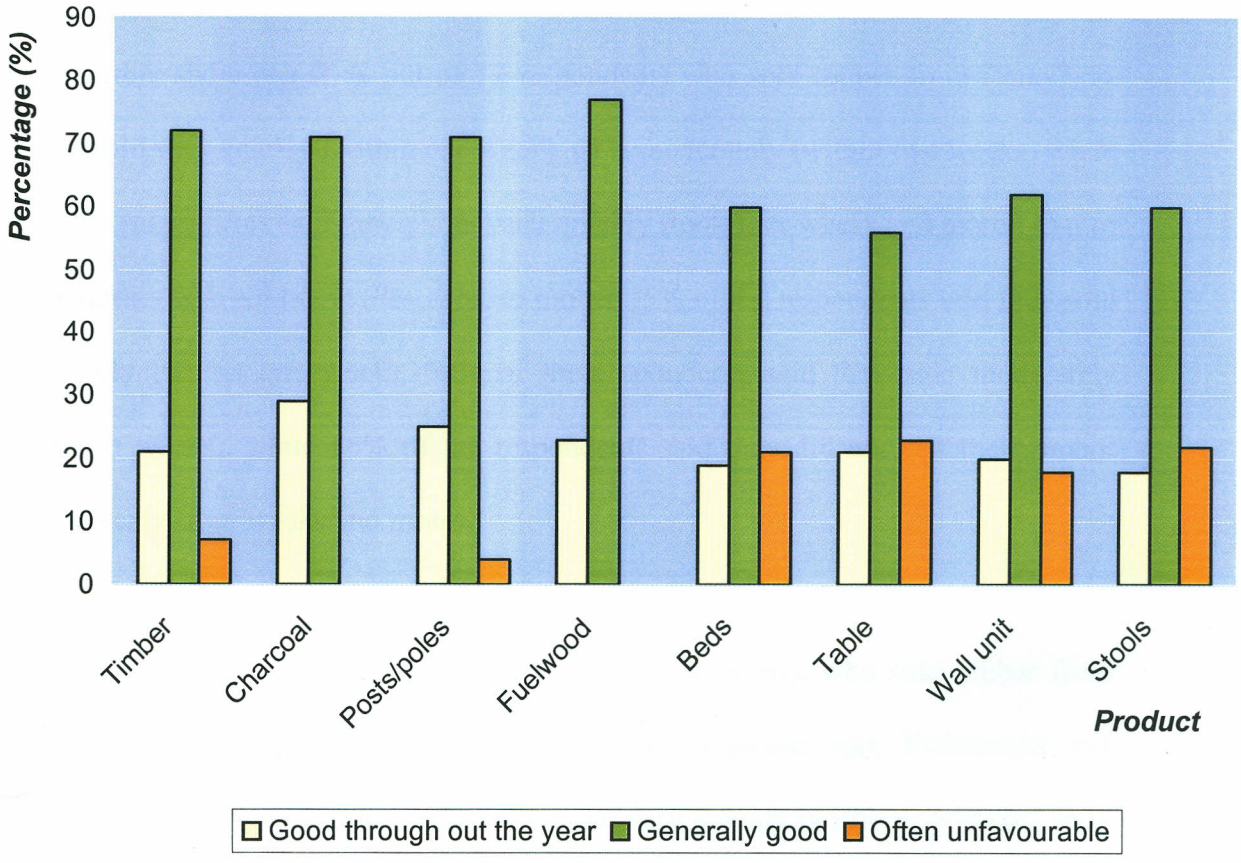



**Figure 4.7: Market demand for the wood products sold as perceived by the respondents**
NB: Each colour presents various responses

**4.36 Duration taken to sell one seven-ton lorry of timber as indicated by the respondents**

Data results (Table 4.35) show that out of the 82 respondents who sold timber from *Eucalyptus* spp. were as follows: Twenty one per cent of the respondents said they sold very quickly (within one week), 52% of the respondents said they sold moderately (within two weeks), while 27% of the respondents said they do not sell quickly (four weeks and more). Results further show that 19% out of 72 respondents who sold timber from *Cupressus* spp. said they sold very quickly (within one week), 60% of the

respondents said they sold moderately (within two weeks), while 21% of the respondents reported that they did not sell quickly (took four weeks and more).

Results further show that 21% out of 77 respondents who sold timber from *Pinus* spp. said they sold very quickly (within one week), 61% moderately (within two weeks) while 18% of the respondents said they did not sell quickly (took four weeks and more). Out of 67 respondents who sold *Grevillea robusta* timber 25% of the respondents said they sold very quickly (within one week), 59% of the respondents said they sold moderately (within two weeks), while 16% of the respondents said they did not sell their timber product quickly (four weeks and more).

Results on other tree species show that 17% of 63 respondents who sold timber from other tree species including mvule, mahogany, *Olea capensis* spp. *Welwitschii* and *Ocotea usambarensis* among others said they sold very quickly (within one week), 66% of the respondents said the time taken to sell their product was moderate (within two weeks), while 17% of the respondents said they did not sell quickly (took four weeks and more).

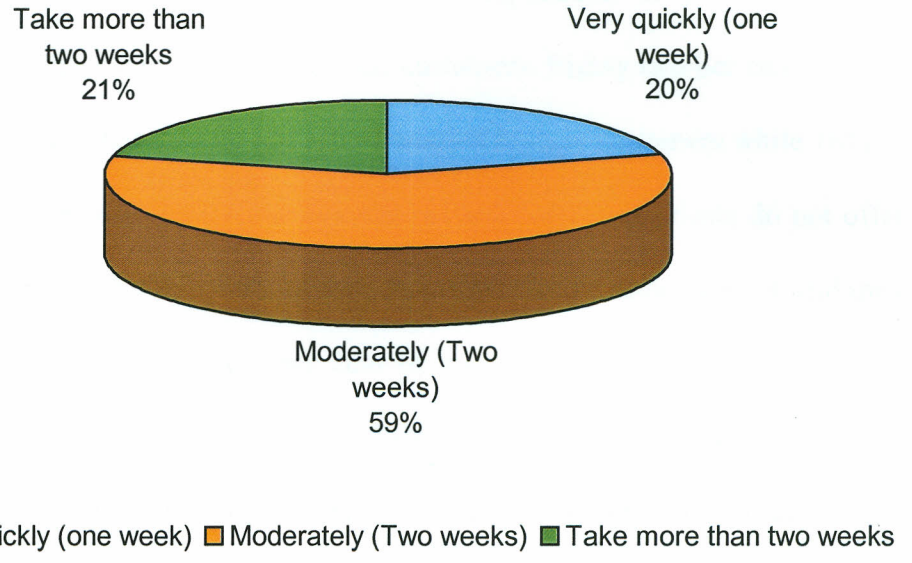
**Table 4.35: Duration taken to sell one seven-ton lorry of timber product acquired as indicated by the respondents**

| *Tree species* | *Very quickly* | | *Moderately* | | *Not quickly* | |
|---|---|---|---|---|---|---|
| | *Sold within one week* | | *Sold within two weeks* | | *Four weeks and more* | |
| | *Responses* | *%* | *Responses* | *%* | *Responses* | *%* |
| ***Eucalyptus*** | 17 | 21 | 43 | 52 | 22 | 27 |
| ***Cupressus*** | 13 | 19 | 41 | 60 | 18 | 21 |
| ***Pinus*** | 16 | 21 | 47 | 61 | 14 | 18 |
| ***Grevillea*** | 17 | 25 | 39 | 59 | 11 | 16 |
| ***Other*** | 11 | 17 | 41 | 66 | 11 | 17 |

**Key:**

% = Percent

In summary, Figure 4.8 below shows out of all the 361 responses on the duration taken to sell various timber species, 74 (20%) of the respondents said they sold very quickly (within one week), 211 (59%) of the respondents said they took moderate duration (two weeks) while 76 (21%) of the respondents did not report selling quickly (took more than two weeks).




**Key:**

% = Percent

**Figure 4.8: Duration taken to sell one seven-ton lorry of timber as indicated by the respondents**

### 4.37 Transportation means to the buyers on wood products sold

Eighty five per cent of timber product respondents do not offer transportation to their customers, however, 15% of the respondents said they deliver the product to their customers. Charcoal respondents comprise 85% of respondents who do not offer transport services to their customers unlike 15% of respondents who reported they deliver the product to their customers. Sixty one percent of poles/posts respondents said they do not offer transportation means to their customers, while 38% do. Seventy four per cent of fuel wood respondents indicated that they do not offer transport to their customers, while 26% of the respondents said they do offer. Ninety two per cent of respondents in beds

product sold indicated that their customers make their own transportation arrangement, while 8% of the respondents said they deliver product to their customers (Table 4.36). Eighty five per cent of respondents said their customers who bought table product made their own transportation arrangement, while 15% of respondents in the same product indicated that they do offer transportation to their customers. Eighty two per cent of chair product respondents indicated they do not offer transport to their customers while 18% of the respondents said they do. Eighty four per cent of wall unit respondents do not offer transportation of the product, while 16% of the respondents in the same product said they deliver to their customers. Eighty five per cent of respondents selling stools indicated they do not offer transport to their customers, while 15% of the respondents said they do deliver product to their customers. The scenario is similar to other wood products sold with 65% of the respondents indicating that they do not offer transportation means to their customers, while 35% of the respondents said they deliver product to their customers (Table 4.36).

**Table 4.36: Means of transportation to the buyers on wood products sold**

| *Wood product* | *Transportation means* | | | | *Total percentages* |
|---|---|---|---|---|---|
| | *Buyers own means* | | *Firm takes to the buyer* | | |
| | *Responses* | *%* | *Responses* | *%* | |
| Timber | 71 | 85 | 13 | 15 | 100 |
| Charcoal | 60 | 85 | 11 | 15 | 100 |
| Poles/posts | 23 | 61 | 15 | 39 | 100 |
| Fuel wood | 29 | 74 | 10 | 26 | 100 |
| Beds | 68 | 92 | 6 | 8 | 100 |
| Table | 61 | 85 | 11 | 15 | 100 |
| Chairs | 59 | 82 | 13 | 18 | 100 |
| Wall unit | 61 | 84 | 12 | 16 | 100 |
| Stools | 63 | 85 | 11 | 15 | 100 |
| Other | 24 | 65 | 13 | 35 | 100 |

**4.38 Seasonal price changes on wood products acquired within the calendar year**

Table 4.37 below shows that the prices of timber tend to go up during the months of October with 83%, November 82%, and December 85% indicating high prices, for example, the price of *Cupressus* spp. and *Eucalyptus* spp. would go up to as much as Ksh.16 up from an average of Ksh. 13.50 per 30cmx12cmx3cm during the other period of the year. This is because many people tend to buy furniture items during the Christmas holidays. Further, during this period, transportation problem is experience due to heavy rains.

Prices for charcoal are normally high during the periods of short and long rains; for example, during the month of April, 89% of the respondent indicated high prices prices of high quality tree species such as *Olea africana* and *Acacia mearnsi* sell at Ksh. 350 up

from an average of Ksh. 300 per 35 kilogrammes bag. The scenario is similar in the months of November and December with 86% and 81% recording high prices respectively.

Fuel wood respondents have recorded high prices during the rainy seasons with the month of April recording 70%, May 70%, while in months of November and December 83% and 79% respectively see Table 4.37. Fuel wood is sold at an average price of Ksh.900 per cubic metre up from an average of Ksh. 600. The increase in charcoal and fuel wood products prices may be as a result of high demand for the products by the customers who require it for cooking, and warming their rooms during months of rainy season including March, April, November and December.

Transportation network also plays a vital role in determining wood product prices; for example, most sources of the products are inaccessible during rainy seasons including Uasin Gishu, Narok and Nandi districts which are the main source of *Olea africana* spp.

**Table 4.37: Seasonal price changes on wood products acquired within the calendar year**

| Month | Percentage (%) of seasonal price variation in various wood products | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Timber* | | *Charcoal* | | *Poles/post* | | *Fuel wood* | | *Block board* | | *Plywood* | | *Other* | |
| | **H** | **L** | **H** | **L** | **H** | **L** | **H** | **L** | **H** | **L** | **H** | **L** | **H** | **L** |
| January | 17 | 83 | 12 | 88 | 25 | 75 | 19 | 81 | 20 | 80 | 21 | 79 | 46 | 54 |
| February | 18 | 82 | 10 | 90 | 25 | 75 | 14 | 86 | 12 | 88 | 13 | 87 | 43 | 57 |
| March | 23 | 77 | 38 | 62 | 47 | 53 | 37 | 63 | 17 | 83 | 18 | 82 | 41 | 59 |
| April | 42 | 58 | 89 | 11 | 50 | 50 | 70 | 30 | 47 | 53 | 50 | 50 | 56 | 52 |
| May | 69 | 21 | 75 | 25 | 44 | 56 | 70 | 30 | 57 | 49 | 54 | 46 | 48 | 52 |
| June | 57 | 43 | 75 | 25 | 50 | 50 | 40 | 60 | 68 | 32 | 67 | 33 | 35 | 65 |
| July | 60 | 40 | 40 | 60 | 44 | 56 | 23 | 77 | 69 | 31 | 68 | 32 | 42 | 58 |
| August | 68 | 32 | 29 | 71 | 69 | 31 | 40 | 60 | 64 | 36 | 62 | 38 | 41 | 59 |
| September | 72 | 28 | 30 | 70 | 67 | 33 | 44 | 56 | 68 | 32 | 65 | 35 | 39 | 61 |
| October | 83 | 17 | 42 | 58 | 93 | 7 | 65 | 35 | 81 | 19 | 72 | 28 | 50 | 50 |
| November | 82 | 18 | 86 | 14 | 83 | 17 | 83 | 17 | 91 | 9 | 79 | 21 | 30 | 70 |
| December | 85 | 15 | 81 | 19 | 81 | 19 | 79 | 21 | 82 | 18 | 74 | 26 | 72 | 28 |

KEY:
**H**- High prices
**L**- Low prices

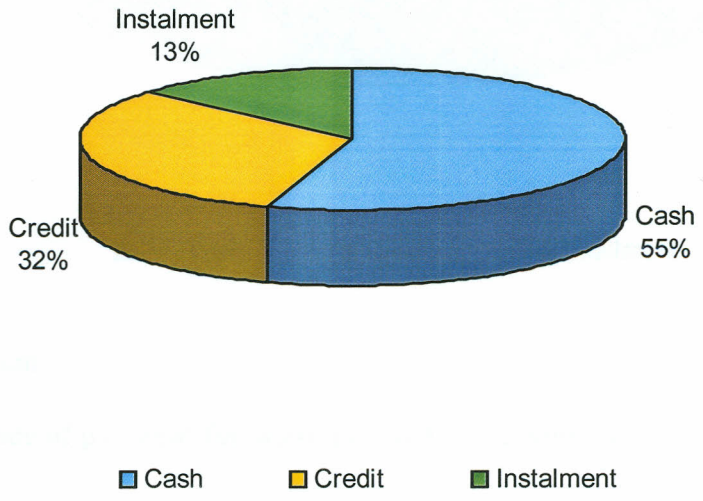
From table 4.37 above respondents indicated that the prices of wood products sold within the calendar year period varied during rainy and dry seasons in all wood products. During the dry season when roads leading to the source of wood products are okay, prices are lowered and subsequently go up during rainy seasons.

The reasons given for this variation are as follows: transportation problems from the source, preoccupation of casual labourers in the farmlands during wet season and less charcoal production once the food is available on the firms. According to Mugo (1999), the charcoal prices are high in urban centres a major external market for charcoal.

Similarly, Makuyu charcoal traders who sell at Ksh. 80 per bag during dry season and Ksh.110 on average during rainy season due to increased demand in the market for heating in urban areas (Ndung'u, 1995).

### 4.39 Mode of payment on wood products bought by dealers

One hundred and twenty three (55%) of all the respondents indicated that their customers pay in cash, however, 71 (32%) and 30 (13%) of the respondents indicated that they buy their products on credit and installment respectively (Figure 4.9).



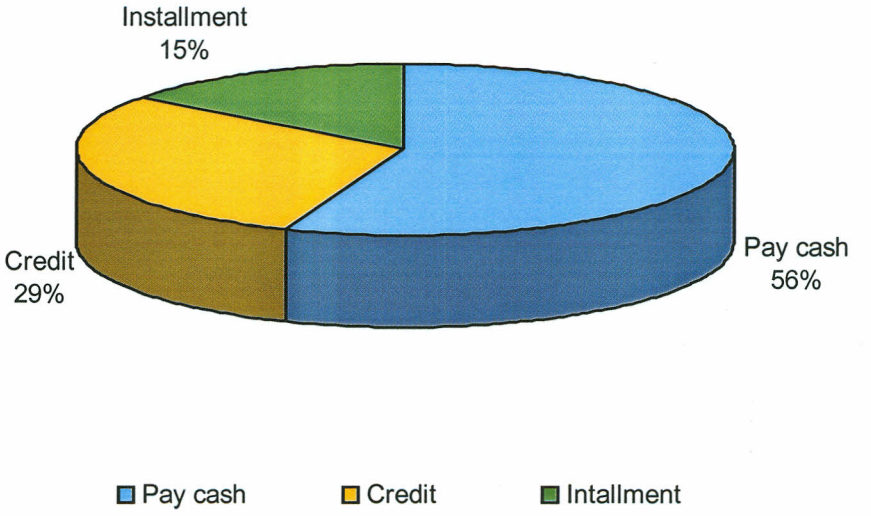

**Key:**

*% = Percent*

**Figure 4.9: Mode of payment for wood products bought by dealers**
NB: Each colour presents various responses

### 4.40 Mode of payment for wood products by customers

One hundred and twenty five (56%) of all the respondents indicated that their customers pay in cash, while 66 (29%) of the respondents indicated that their customers buy on credit and 33 (15%) on installment respectively (Figure 4.10).




**Key:**

% = Percent

**Figure 4.10: Mode of payment for wood products by customers**

### 4.41 Causes of variation in buying prices

Out of 224 respondents, 189 (84%) indicated that the season of the year determines the degree of price variation. A product such as charcoal has higher prices during rainy season, whereby most preferred species such as *Olea africana* and *Acacia mearnsi* prices go up to Ksh. 400 per 30kgs bag while during dry season, price of such a bag reduces to Ksh. 350. Further, 143 (64%) of the respondents indicated number of suppliers

determines the price variation. Seventy nine (35%) of the respondents indicated that price variation is caused by the government restrictions (Table 4.38).

**Table 4.38: Causes of variation in buying prices as indicated by the respondents**

| *Cause* | *Reasons* | *Percentage (%)* | *Rank* |
|---|---|---|---|
| Season of the year | 189 | 84 | 1 |
| Number of suppliers | 143 | 64 | 2 |
| Government restrictions | 79 | 35 | 3 |

# CHAPTER FIVE
# CONCLUSION AND RECOMMENDATIONS

## 5.1 Introduction

In an attempt to study wood products consumption in Kisumu town, 224 wood products dealers were interviewed, two group discussions were held, a number of photographs taken and direct observations made. Data gathered was analyzed. Based on the findings, conclusions were drawn and recommendations made on sustainable management strategies. Areas for further research were also suggested which could complement the study.

## 5.2 The study findings were as follows:

The first objective of the study was to determine quantities and sources of tree species used by the dealers. Based on the study findings, the respondents indicated that the quantities of wood products acquired since 1990 have been increasing moderately, hence need for enhancing production of more wood products. The results further showed that the quantities of wood products demanded have generally recorded moderate increase since 1990.

The study findings indicated that Vihiga, Nandi, Kericho, Nakuru and Kisumu district are the main sources of wood products in Kisumu town (Table 4: 34). The results of the survey showed that the sources of the wood products dealt with were: Kisumu (mainly fuel wood, poles, timber), Nakuru timber, Nandi (timber and charcoal), Vihiga (*Eucalyptus* spp. for timber, poles/posts and fuel wood), Uasin Gishu (charcoal), and

Kericho *Juniperus procera* (Cedar) for posts. The market demand for all the wood products dealt with has been generally moderate. The duration taken to sell wood products is generally good according to the respondents. The market of wood products dealt with by the respondents is largely at regional, district, divisional, and location levels (Table 4.23). However, a few respondents indicated that there is national and export market whereby some customer traveling to Uganda bought furniture product.

The second objective of the study was to identify tree species preferred for timber and other wood products. The study noted that *Eucalyptus* spp. is the most used for timber, furniture products, and poles/posts, this is because it is generally durable, attractive, and relatively cheap for making furniture products. *Cupressus* spp. and *Pinus* spp. are the most preferred tree species for those customers who required it for construction purposes for example roofing their houses since they are available in long sizes. In addition, *Cupressus* spp. is also used to make tops of tables and other furniture products.

Many respondents mentioned that *Cupressus* spp. timber is easily worked on and does not crack easily when making furniture. *Pinus* spp. is also highly preferred for fuelwood because it is considered to produce less smoke, burns easily, easily worked on and relatively cheap. There are also other tree species used in small quantities such as *Juniperus procera* (Cedar) for posts, *Grevillea robusta*, *Chlorophora excelsa, Trichilia emetica*, *Ocotea usambarensis*, *Olea capensis* spp. *Welwitschii* are also used for making high quality furniture products. A few respondents indicated that though it is possible to get high quality timber from tree species such as: *Chlorophora excelsa*, *Trichilia emetica*,

*Ocotea usambarensis* and *Olea capensis* spp. *Welwitschii* among others, most customers could hardly afford to meet the costs. Therefore, furniture products from tree species such as *Ocotea usambarensis*, *Olea capensis* spp. *Welwitschii*, *Chlorophora excelsa* and *Trichilia emetica* have very few dealers.

The third objective was to determine prices demanded for various wood products. The study noted that prices of all wood products have been generally increasing moderately within 1990-2002 period. The results showed further that buying price of wood products by the respondents has been increasing moderately from 1990 to 2002. Respondents indicated that the prices of wood products sold within the calendar year period varied from one month to another in all wood products. Transportation problems had led to increase in prices in all products dealt with, for example, charcoal prices are high during rainy months of April and May, October and November. The scenario was similar in fuel wood, poles/posts products, timber, and furniture (Table 4.37).

### 5.3 Recommendations as suggested by the respondents

Based on the respondent's experience, the following recommendations were suggested, in order to improve production and marketing of wood products (Table 5.1).

**Table 5.1: Recommendations for improving wood products market as suggested by the respondents**

| *Suggested action* | *% Distribution of respondents* | | *Rank* |
|---|---|---|---|
| | *Respondents* | *%* | |
| Planting trees | 195 | 87 | 1 |
| Establishing community tree nurseries | 172 | 76 | 2 |
| Checking logging | 163 | 73 | 3 |
| Giving dealers soft loans | 146 | 65 | 4 |
| Reduction of taxes | 135 | 60 | 5 |
| Promoting importation of timber | 122 | 54 | 6 |
| Allocating farmers government plantations | 115 | 51 | 7 |

From the results (Table 5.1), the following specific strategies were suggested to improve wood products market within Kisumu district: Planting of more trees-starting community work programmes such as planting indigenous tree species in return for wood products as suggested by 87% (Table 5.1). Establishment of community tree nurseries as suggested by 76% of the respondents is needed to guarantee future supply of wood product. This is especially so for tree species in high demand locally including *Eucalyptus* spp., *Cupressus lusitanica, Olea capensis spp.weltschii,* and *Pinus* spp.. In Kenya, therefore, agroforestry faces the challenge of promoting agricultural intensification in the high potential areas to prevent population overspills to ASALS.

There is need to establish community-based tree nurseries in order to strengthen and promote the crucial practice of tree planting especially the fast growing tree species at individual and/or community levels, hence increase the supply of wood in the future. Activities such as agro forestry and tree-planting should be encouraged. They will not

only provide wood products such as timber, charcoal, poles/posts and fuel wood but also reduce deforestation, soil erosion, air and water pollution. Suitable sites and tree species should be identified to enhance planting of trees particularly in the communal centers, government plantations, and on-farms.

Creating awareness that is conducive to action to improve natural resource management and facilitate change through extension services (Barrow, 1996). Enhancement of local decision making capabilities and an effective means of harnessing indigenous knowledge that is useful in agroforestry practices will strengthen local programmes in wood products production.

**Tree management**

The public requires advice on different aspects of tree management. This will ensure the production of quality tree products for the market. Information on the proper tree management should be passed on the farmers so that they meet the requirement of the market. The number of trees for example *Eucalyptus* spp., *Cupressus* spp., *Pinus* spp., *Grevillea robusta* among others per hectare could be 1,000-1,600, an indication that production of wood product can be undertaken as an enterprise by farmers. However, this will depend on the product being produced.

Stoppage of issuance of exploitation licenses by the Department of forest as indicated by 73% of the respondents would remarkably check illegal logging of trees in government forests within the neighbouring districts. Respondents indicated that many dealers exploit

product from the government plantations hence affecting the prices of those who buy from the farmers. The study also noted that there is need to give dealers soft loans to enable them improve the quality of their products. Imposition of immediate ban to control the harvesting of particular indigenous species such as *Chlorophora excelsa*, *Juniperus procera*, *Olea capensis spp.weltschii*, *Olea africana* spp. and *Ocotea usambarensis* is highly recommended.

Reduction of taxes levied on the products was also suggested to increase the profit margin of the respondents. Taxes are paid for the products acquired within the firm. About 54% of respondents also suggested that importation of timber should be encouraged through imposing tax waver on imported timber. Further, 51% of the respondents were of the view that local farmers around government plantations should be considered and given some portion of land to take care of trees as they get food. This can be used to reduce squatter problem hence reduce pressure on the encroachment of the neighbouring government forests.

## 5.4 Recommendations as suggested by the author

### 5.4.1 Marketing arrangements

To ensure a fair distribution of revenue along the production-marketing chain, organized marketing of wood products is necessary.

At the small scale-farm level, wood products producers should form producers associations in order to coordinate production and increase their bargaining power. The

producer associations should then open collection centers at the sub-locational level. All farmers producing wood products have to sell their products at these centers. For government plantations, each plantation should have several wood product collection points located as near the main road as possible. Selling through any other location including roadside selling should not be allowed. This will help in monitoring illegal harvesting and provide the highly needed information on supply.

Standards on wood product especially charcoal and timber should be developed in consultation with all the stakeholders and enforced. Charcoal could be sold by weight in order to protect the consumers. In such a case, high quality denser charcoal will be a smaller volume than the light charcoal from the less dense species like the *Commiphora* spp. and *Pinus* spp. This will motivate farmers to grow indigenous species in their farms.

Wood products transporters should be required to buy products only from the designated buying centers. A one-stop fees/levy/cess charged on each bag of charcoal or a ton/lorry of timber/posts/poles, should be paid by transporters to the District Environmental Committee at the time of obtaining a movement permit. No illegal levies should be demanded anywhere else. Spot-checks should be conducted by NEMA inspectors along the transportation routes, to monitor illegal transportation.

The urban wood products traders should also have an association to coordinate activities in the towns. The association could mainly coordinate acquisition of information on demand of wood product, the delivery system of products by transporters and harmonize

the prices. The association in collaboration with NEMA should also be able to monitor illegal wood products on the market.

The wood products producer and marketing associations should have a savings and credit programme to encourage savings and also provision of development loans for investing in tree growing for wood products such as: timber, poles/posts, fuelwood, charcoal or in charcoal trade.

### 5.4.2 Marketing arrangements

Contracting farmers by major wood product consumers should be encouraged to enable them get involved in tree growing programmes. For example, large fuelwood consumers such as tea factories and manufacturing industries should give support to farmers hence enable them meet their woodfuel needs hence improving their livelihoods.

## 5.5 Areas for further research

In view of the findings and in order to provide a broader insight into wood products consumption issues, and tree planting motivation, this study recommends the following areas for further research:

1. More studies need to be carried out to establish the wood products supply and consumption patterns after implementation of government strict measures on the protection of government plantations and revocation of forestland excision.
2. Feasibility studies should be carried out to introduce alternative sources of energy, to conserve the fuel wood resources in the study area.

3. Similar studies should be carried out in different geographical settings to give more insight on wood product consumption.
4. The annual consumption rates for the different wood products should urgently be determined. The findings would be useful in quantifying the supply of wood resources available in the area.
5. There is need to carry out a study on the implications of contracting farmers to grow tree for wood products.

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# APPENDIX I

# INTERVIEWING SCHEDULE

Respondent number _____

Interviewers name _____

Date _____

**Firm/organization Characteristics**

1. Name of firm/organization: _____

2. Locations of other branches of the firm aside from this town: _____

3. Year firm began or established: _____

4. How many employees are in the firm now: _____

5. Have you invested in any of these items over the past five years?

01 = Yes [ ] 02 = No [ ]

a) Transport capacity _____

b) Machinery or equipment _____

c) Buildings _____

d) Number of employees _____

6. What are the wood products that the firm:

a) Acquires: 0=none [ ], 1=timber [ ], 2=charcoal [ ], 3=poles [ ], 4=posts [ ]
5=firewood [ ], 6=block board [ ], 7=plywood [ ]
8=other [ ]

b) Uses up on premises (consumes):
0=none [ ], 1=timber [ ], 2=charcoal [ ], 3=poles [ ], 4=posts [ ]
5=firewood [ ], 6=block board [ ], 7=plywood [ ]
8=other [ ]

c) Sells to others:
0=none [ ], 1=timber [ ], 2=charcoal [ ], 3=poles [ ], 4=posts [ ]
5=firewood [ ], 6=block board [ ], 7=plywood [ ]
8=other [ ], 9=chipboard [ ], 10=beds [ ], 11=tables [ ]
12=chairs, 13=sideboard, 14=wall unit,
15=cupboard [ ], 16=stools [ ], 17=doors [ ]

7. Are there other non-wood products that the firm sells to others? Please list them in order of importance.

0=None [ ], 1=Nails [ ], 2=Paints [ ], 3=Glue [ ], 4=Wire mesh [ ], 5=Barbed wire [ ], 6=Sand paper [ ], 7=Iron sheet [ ], 8=wood preservative [ ], 9=Other

8. For the major wood products that you acquire or sell, what are the general trends over the past 5-10 years as per the table below?

Table 1A Products Acquired

| Major Product | Quantities supplied to you | Average purchasing price in 1995 (per unit specified) in Ksh | Average purchasing price in 2002 in Ksh. |
|---|---|---|---|
| 1. Timber | | | |
| 2. Charcoal | | | |
| 3. Poles | | | |
| 4. Posts | | | |
| 5. Fuelwood | | | |
| 6. Other | | | |

Codes: 01-- Increasing significantly 02 – Increasing moderately 03 – About the same 04 – Decreasing moderately 05 – Decreasing significantly

9.Table 1B Products Sold

| Major Product | Quantities demanded by your buyers | Average purchasing price in 1995 (per unit specified) in Ksh | Average purchasing price in 2002 in Ksh. | Geographic extent of your market for this product | Are any of these products exported by you or your buyers | # of firms/ traders you compete with in the same business |
|---|---|---|---|---|---|---|
| 1. Timber | | | | | | |
| 2. Charcoal | | | | | | |
| 3. Poles | | | | | | |
| 4. Posts | | | | | | |
| 5. Fuelwood | | | | | | |

0=none, 1=timber, 2=charcoal, 3=poles, 4=posts 5=firewood, 6=block board, 7=plywood 8=other, 9=chipboard, 10=beds, 11=tables 12=chairs, 13=sideboard, 14=wall unit, 15=cupboard, 16=stools, 17=doors

Codes (quantities & # of competing firms): 01-- Increasing significantly 02 – Increasing moderately 03 – About the same 04 – Decreasing moderately 05 – Decreasing significantly

Codes (geographical location): 01) Village/sublocation 02) division 03) district 04) region/province 05) national/international

Codes (export): 01) yes 02) no

10. Which species of trees do your customers prefer? And why? (Give a reason for each tree species as indicated in the table below)

**Table 2**: Wood species preferred by customers and reasons

| ***S/No*** | ***Product sold to buyers*** | ***Tree Species*** | ***Reasons why preferred*** |
|---|---|---|---|
| 1. | | | |
| 2. | | | |

| | | | |
|---|---|---|---|
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| 9. | | | |
| 10. | | | |

0=none, 1=timber, 2=charcoal, 3=poles, 4=posts 5=firewood, 6=block board, 7=plywood 8=other, 9=chipboard, 10=beds, 11=tables 12=chairs, 13=sideboard, 14=wall unit, 15=cupboard, 16=stools, 17=doors

1=Blue gum/Eucalyptus, 2=cypress, 3=Pine, 4=Gravillea, 5=Simberly, 6=Sogo, 7= Other, 8=Elgon teak, 9=Cedar, 10=Mvule, 11=Rosewood, 12=Mahogany, 13=Wattle, 14=Olea spp

1=Durable, 2=Attractive, 3=easily worked on, 4=Cheap, 5= hardwood, 6=for prestige/status, 7=Available, 8=Available in long size, 9=Does not easily bend, 10=Other,

11. Which species do you prefer for the type of products that you acquire and why?

**Table 3**: Wood species that would be preferred by processor/dealer

| ***S/No*** | ***Product acquired form supplier*** | ***Wood Species*** | ***Reasons why preferred*** |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |

0=none, 1=timber, 2=charcoal, 3=poles, 4=posts 5=firewood, 6=block board, 7=plywood 8=other, 9=chipboard, 10=beds, 11=tables 12=chairs, 13=sideboard, 14=wall unit, 15=cupboard, 16=stools, 17=doors

1=Blue gum/Eucalyptus, 2=cypress, 3=Pine, 4=Grevillea, 5= Other, 6=Elgon teak, 7=Cedar, 8=Mvule, 9=Mahogany, 10=Wattle, 11=Olea spp

1=Durable, 2=Attractive, 3=easily worked on, 4=Cheap, 5= hardwood, 6=for prestige/status, 7=Available, 8=Available in long size, 9=Does not easily bend, 10=other,

12. Wood Product Acquired: _____ (0=none, 1=timber, 2=charcoal, 3=poles, 4=posts, 5= firewood, 6=block board, 7=plywood, 8=other,)

***Table 4***

| A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| Main Species | % from natural forest | % bought from plantation | % bought from farmers | % bought from suppliers | % from own sources | Availability of species | Quantity acquired in 2001 | Typical unit acquired | Typical amount paid per unit | Degree of price fluctuation during the year |
| 1. | | | | | | | | | | |
| 2. | | | | | | | | | | |
| 3. | | | | | | | | | | |
| 4. | | | | | | | | | | |
| 5. | | | | | | | | | | |
| How is wood transported from source to the firm? | | | | | | | | | | |
| Geographical location of dominant source | | | | | | | | | | |
| Main advantages of this source | | | | | | | | | | |
| Main disadvantages of this source | | | | | | | | | | |

**Column A: Main Species**
1=Blue gum/Eucalyptus, 2=cypress, 3=Pine, 4=Grevillea, 5= Other, 6=Elgon teak, 7=Cedar, 8=Mvule, 9=Wattle, 14=Olea spp, 15=Mahogany, 99=N/A

Column B-F: Percentage from indicated sources
1=over 90%, 2=80-89%, 3=70-79%, 4=60-69%, 5=50-59%, 6=40-49%, 7=30-39%, 8=20-29%, 9=10-19%, 10=below 10%, 0=none

| Codes-Column K: | Codes-Column G | Codes-Column I | | Codes-Column K |
|---|---|---|---|---|
| 01= High | 01= Available through out the year | 01= Square metres | 04= Lorry loads | 01=High |
| 02= Moderate | 02= Generally available, some problems | 02= Tons | 05= Bags | 02=Moderate |
| 03= Low | 03= Frequently unavailable | 03= Headloads | 06= Piece | 03=Low |
| | 04=Other | | | |

Transportation arrangement:
1=Own means, 2=Suppliers means, 3=Other,
12=Both suppliers and own means
District source:
1=Within the district, 2=Nandi, 3=Vihiga, 4=Kericho, 5=Nakuru, 6=Kisii, 7=Kakamega, 8=Uasin Gishu, 10=Mt. Elgon, 0=None
Advantages of the source:
1=Low prices, 2=Available in large quantities, 3=Easy to negotiate prices, 4=Easy credit negotiations
5=Near the firm, 6=Constant supply 7=Other, 8=Well season

Disadvantages of the source:
1=High prices, 2=Available in small quantities, 3=Not easy to bargain 4=Credit is not easily given
5=Far from the firm 6=Inconsistent supply 7=Not well seasoned, 8=Time used looking for the product, 10=Own transportation means, 9=Other

13. Transformation/value added for wood products

***Table 5***

| Product acquired | Species | What service/process do you supply | How long this take? | What is the end product, if different than the Original product acquired? |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Product acquired:
1=timber, 2=charcoal, 3=poles, 4=posts, 5= firewood, 6=block board, 7=plywood, 8=Other, 9=chipboard, 10= beds, 11=tables, 12=chairs, 13=sideboard, 14=wall units, 15=cupboards, 16=stools, 17=doors, N/A=99

Services supplied:
01= Transport/delivery
02= Packaging
03=Cutting/shaping/smoothing
04= Treatment
05= Assembly
06= Processing

Time taken:
1=10 minutes, 2=15 minutes, 3=20 minutes, 4=30 minutes, 5=Above 30 minutes

End product:
1= Furniture, 2= Timber, 3= Other, N/A=99

14. Wood Product Sold: _____ (01=Timber, 02=Charcoal, 03=Poles, 04=Posts, 10=beds, 11=tables, 12=chairs, 13=wall unit, 14=cupboard, 15=stools, 16=doors)

***Table 6***

| A | B | C | D | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|
| Species | % sold to transporters | % sold to firms/ traders who will resell | % sold to large end users | % sold to small end users | Market demand for species | Quantity sold for 2001 | Typical unit sold | Typical amount charged per unit | Degree of price fluctuation during the year | How quickly are these sold |
| 1. | | | | | | | | | | |
| 2. | | | | | | | | | | |
| 3. | | | | | | | | | | |
| 4. | | | | | | | | | | |
| 5. | | | | | | | | | | |
| | | | | | | | | | | |
| How is wood transported from firm to the buyer? | | | | | | | | | | |
| Main advantages of this buyer | | | | | | | | | | |
| Main disadvantages of this buyer | | | | | | | | | | |

Column A-Tree species:
1=Blue gum/Eucalyptus, 2=cypress, 3=Pine, 4=Grevillea, 5=Elgon teak, 6=Mahogany, 7=cedar, 8=Mvule, 9=Wattle, 10=Olea spp. 99=N/A

Codes for Column B-F:

| Codes-Column G: | I: | | K: | L: |
|---|---|---|---|---|
| 01= Good throughout the year | 01= square metres | 04=lorry | 01= High | 01= Very quickly |
| 02= Generally good | 02=tons | 05=bags | 02= Moderate | 02= Moderately |
| 03= Often unfavourable | 03=Headloads | 06=Piece | 03= Low | 03= Not quickly |

Advantage(s) of the buyer:
1= Buy in Large quantities, 2= Regular buyer, 3= Pay in cash, 4=Other, 99=N/A

Disadvantage(s) of the buyer:
1=Buy in small quantities, 2=Not regular buyers, 3=Other, 99=N/A

Codes for transportation to the buyer:
1= Buyer's own means, 2= Firm takes to the customer

15. Are you able to buy wood products on credit or installment? _____ (00 = Cash, 01=credit, 02=installment)

16. Do you allow some clients to buy from you on credit or installment? _____ (00 = Cash, 01=credit, 02=installment)

17. (a). Are the buying prices constant or they vary? _____ (1=vary, 2=do not vary)

(b). If they vary what causes the variation?

1= Period of the year [ ], 2= Number of Suppliers [ ], 3= Government restrictions [ ], 4=Other [ ]

**Table 7:** A calendar indicating the months of low and high prices (Tick in the appropriate column)

| Wood product | | Jan. | | Feb. | | Mar. | | April | | May | | June | | July | | Aug. | | Sept. | | Oct. | | Nov. | | Dec. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | | H | L | H | L | H | L | H | L | H | L | H | L | H | L | H | L | H | L | H | L | H | L | H | L |
| 2. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6. | | | | | | | | | | | | | | | | | | | | | | | | | |

NB

Wood product acquired:

0=none [ ], 1=timber [ ], 2=charcoal [ ], 3=poles [ ], 4=posts [ ], 5=firewood [ ], 6=block board [ ], 7=plywood [ ]
8=other [ ]

Months of January to December:

H-High Prices

L-Low prices

18. Are some products more difficult to deal in because of government wood resources policies? Yes [ ] No [ ]

If Yes, which ones? 0=None [ ], 1= Forest ban [ ], 2= Licenses/trade permits [ ]
3= Other [ ], N/A=99 [ ]

19. What do you think should be done to sustainable consumption of wood products?

1=Planting of more trees
2=Revoke allocation of forested land, 3=other

# APPENDIX II

## RESEARCH SCHEDULE

| *Period: month, year* | *Activity* |
|---|---|
| Feb, 2002<br>to<br>May, 2002 | ▪ Preparation of the research proposal<br>▪ Identification of the supervisor. |
| June, 2002<br>to<br>Aug., 2002 | ▪ Submitting the proposal to the university and Icraf supervisors.<br>▪ Defense of the proposal at the departmental level |
| Aug., 2002 | ▪ Making corrections.<br>▪ Submission |
| Sept., 2002 | ▪ Developing instruments on the study area. |
| Sept., 2002<br>to<br>Nov., 2002 | ▪ Data collection from the sampled respondents.<br>▪ Starting with sampling of subjects/ respondents and then pilot study to Pre-test research instruments in a different location. |
| Dec, 2002 | ▪ Data analysis. |
| Jan, 2003 | ▪ Thesis draft and submission to the supervisors. |
| March-December, 2003 | ▪ Thesis submission to the supervisors and giving a departmental seminar. |
| January, 2005 | ▪ Making corrections from examiners and final BPS thesis defense. |

## APPENDIX III

## OBSERVATION SHEET

**Respondent No. _____**

**Table I: Wood products unit sold (Tick [√] in the appropriate box)**

| Product | Unit sold Percentage | | | | Total Percentage (%) |
|---|---|---|---|---|---|
| | *Pieces* | *Tons* | *Lorry loads* | *Bags* | |
| *Timber* | | | | | |
| *Charcoal* | | | | | |
| *Poles/posts* | | | | | |
| *Fuel wood* | | | | | |
| *Block board* | | | | | |
| *Ply wood* | | | | | |
| *Other* | | | | | |

**Table II: Tree species preferred by dealers for various wood products (Tick [√] in the appropriate box)**

| Product | Tree species preferred Percentage | | | | | | | | Total Percentag (%) |
|---|---|---|---|---|---|---|---|---|---|
| | *Eucalyptus* | *Elgon teak* | *Cypress* | *Grevillea* | *pine* | *Wattle* | *Cedar* | *Other* | |
| *Timber* | | | | | | | | | |
| *Charcoal* | | | | | | | | | |
| *Poles/posts* | | | | | | | | | |
| *Fuel wood* | | | | | | | | | |
| *Beds* | | | | | | | | | |
| *Tables* | | | | | | | | | |
| *Wall units* | | | | | | | | | |
| *Stools* | | | | | | | | | |
| *Other products* | | | | | | | | | |

Cedar: *Junipera procera,* Elgon teak: *Olea* spp., Wattle: *Acacia mearnsi,* Pine: *Pinus* spp.

## APPENDIX IV

## BUDGET DURING DATA COLLECTION AND ANALYSIS

| | |
|---|---|
| Accommodation | 450 |
| Food | 200 |
| Personal expenses | 250 |
| **Sub-Total** | **US$ 900** |
| | |
| **Travel** | |
| Local travel | 400 |
| Subsistence allowance | 200 |
| **Sub-Total** | **US$ 600** |
| | |
| **Cost of research reports** | |
| Stationery | 150 |
| Software | 50 |
| Maps | 10 |
| Photographs | 40 |
| **Sub-Total** | **US$ 250** |
| **GRAND TOTAL** | **US$ 1,750** |