Factors Affecting the Coconut Industry from Benefitting the Indigenous Communities of Kilifi District, Kenya

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Abstract

This study focuses on the coconut industry and the factors hindering the indigenous communities of Kilifi District from benefiting from the crop. The coconut palm tree cocos nucifera was introduced by the Portuguese in the region in the 7th century. The crop is considered as the tree of life, because of its many uses. The introduction of the plant was expected to benefit the local community. However, this has not been the case and poverty continues to loom despite the many products that accrue from the crop. The purpose of this study was therefore to investigate the factors hindering the local community from benefiting from this cash crop.The study was conducted at three selected sites, namely Mtwapa on the southern border of Kilifi district near Mombasa, Tezo/Roka which is a renowned coconut growing region between Mtwapa and Matsangoni and the third site was Matsangoni on the northern part of the district , bordering Malindi district. The sites were selected so as to completely cover the coconut growing region of the District. Questionnaires were used for collection of data. Simple random sampling methods were used by trained interviewers and the results were analyzed using standard methods of SPSS version 11.0. The results indicated that low prices of the coconut products, unclear legal framework, lack of proper markets, poor farming methods, low productivity and lack of financial support from the government and financial institutions are some of the factors that hinder the indigenous community from benefiting from the coconut products in the region. The de-listing of the coconut tree as a protected crop by the government in 1997, probably as a result of structural adjustments in the Agriculture sector, made the situation worse because the crop became invisible. However, the government created the Kenya Coconut Development Authority (KCDA) in 2007 which along with other agencies and institutions such as, KARI, ABD, KEPHIS and KEBS are making efforts to improve the coconut sub-sector, in the region. The recommendations of this study are that there is urgent need for proper pricing policies, proper markets, proper regulations particularly on the coconut palm wine and that appropriate planting materials be made available to the farmers at affordable prices. Also the farmers should be organized into viable commercial groups with proper collecting centers for their products and financial assistance be provided, so that coconut production can also form part of the Agriculture pillar towards the achievement of the vision 2030 .

Key Words: Coconut palm tree, prices, marketing, legislation, environment, pests and diseases, poverty.

Introduction

The coconut palm *Cocos nucifera* is the primary member of the family Arecaceae (palm family). It is the only species in the genus cocos and is a large palm growing to a height of up to 30m tall with pinnate leaves 4-6m long and pinnate 60-90cm long, the older leaves break away cleanly leaving the trunk smooth. The English name coconut first mentioned in the English print in 1555 (Werth, 1933) comes from the Spanish and Portuguese word 'cocos' meaning monkey face. Spanish and Portuguese explorers found a resemblance to a monkey's face in the three rounded indented markings or 'eyes' found at the base of the coconut. Coconuts received the name from Portuguese explorers, the sailors of Vasco Da Gama in India, who first brought them to Europe.The brown and hairy surface of coconuts reminded them of a ghost or witch called coco. Before it was called nux indica, a name given by Marco Polo in 1280 while in Sumatra, a name taken from the Arabs who called it Jauzi-al-hindi. When coconuts arrived in England, they retained the coco name and nut was added. The origins of this plant are the subject of debate. Most authors claim it is a native to South Asia, particularly the Ganges Delta. Mention is made of coconuts in the 2nd-1st Centuries BC in the Mahawamsa of Sri Lanka.

The later Culawamsa states that King Aggabodhi (575-608 BC) planted a coconut garden of three yojanas length, possibly the earliest recorded coconut plantation. On the Nicobar Islands of the Indian Ocean, whole coconuts were used as currency for the purchase of goods until the early part of the 20th century.Coconuts are the fruits of the Coconut palm, botanically known as *cocos nucifera* . The fruit bearing palms are native to Malaysia, Polynesia and Southern Asia and now also prolific in South America, India, the Pacific Islands Hawaii and Florida. In Sanskrit, the coconut palm is known as 'Kalpa vriksha' meaning 'tree which gives all that is necessary for living' because nearly all parts of the tree can be used in some manner or another. In Kenya, the Coconut palm *cocos nucifera* arrived in East Africa probably before the first century (ASPS, ABD/KCDA 2009). The sailors handbook 'Periplus of the Erythraean sea' records export of the coconut oil from this region in the first century 100AD (Freeman Grenville 1962). The Moroccan explorer Ibin Batuta reports the presence of large Coconut groves along the East African Coast in the 7th century. Similarly, in 1498 when the Portuguese arrived in Malindi, in the East Coast of Africa, most settlements had large Coconut palm groves which were apparently of considerable economic interest. The Coconut palm is often referred to as "the tree of life" in the Kenyan Coast because it is widely used both as a cash crop and food crop by all the communities in the Coast Province (Waijenberg, 1993 and Adkins, 2006). There are hardly any parts of the coconut palm that are left unused.

The Coconut palm produces food and drink, copra for oil, palm wine for ceremonies and refreshment, building materials, fibre for ropes, mats, brushes and brooms, shells for utensils and ornaments and also has medicinal benefits from the coconut oil which is rich in Lauric acid (medium chain fatty acid) best known for being anti-viral, anti-bacterial and anti-fungal (Fife, 2005; Ogbolu *et al* 2007). The Coconut products are many; the raw materials originate from the farmer, who usually handles the raw products like the nuts, the wine, brooms, 'makuti' and coco wood, through the middlemen or Brokers who form the second level of the segmental pattern taking the raw products from the farmer to the processor. Finally the Processor brings about the final products including desiccated coconut, virgin coconut oil, coconut milk or cream and activated carbon.

Methodology

Introduction

The section of the study describes the research design, target population, sample size, sampling method, data collection and data analysis. A simple random design was applied for the study.

Research Design

The research design used in the study was a random survey (Mugenda and Mugenda, 2003), for both qualitative as well as quantitative data using questionnaires. A simple random design was applied to collect data. The design was such that the sample chosen would be able to give a result as when the whole population had been surveyed. Households of farmers were given equal chances of being selected for the survey. Kadere *et al* (2009) used a similar design in an earlier study.

Population

Kilifi Disrict according to the census of 1999 has a total of 28,739 farmers constituting 35.3% of the total number of farmers in the Province. The target population was 150 farmers which was 100% met. Questionnaires were used to collect data, and the data was analyzed using SPSS version 11.0. The Kenya Coconut development Authority (KCDA) estimates the population of the coconut farmers at 15000 in the study population. However not all the farmers are involved in the coconut production. The data was collected from three sites viz: Mtwapa, Tezo/Roka and Matsangoni . The sites were selected so as to completely cover the coastline of the district. The survey targeted 150 households in areas with high concentration of the coconut populations.

Sample and Sampling Method

The study employed a simple random sampling technique to identify 150 farmers (respondents). Simple random sampling technique was preferred because the respondents (coconut farmers) and the subject of the study make the population homogeneous. According to Mugenda and Mugenda (2003), simple random sampling is a probabilistic sampling technique which ensures each subject, object or respondents to have an equal chance of representation. The list which contains the names of all the coconut farmers in the region was obtained from the (KCDA) and this list was used as a sampling frame for the study. Using this technique, 150 respondents were selected; this is equivalent to 10% of the coconut farmers' population. Since this is a descriptive study, according to Mugenda and Mugenda, (2003) and Gay, (1981) 10 percent of the accessible population is considered adequate for descriptive study.

Data Collection Tools

The main tool that was used for data collection was a questionnaire, which was filled by the target population assisted by the interviewers. Observations also played a major role in collection of information. Primary data was collected from the farmers while secondary data was obtained from the District offices and other coconut related offices. The interviewers were trained and the questionnaires standardized. The questionnaire was pre-tested before the actual survey was conducted.

Data Analysis and Presentation

The study generated both quantitative and qualitative data since semi structured types of questions were used to collect data. Quantitative data analysis was carried out by entering the data into the computer and using SPSS, the frequencies were generated. Description statistics (measure of central tendency) and the Analysis of Variance (ANOVA) was used to give the expected summary statistic of variables being studied. On the other hand, qualitative analysis was operationalzed by arranging the data according to the emerging themes or patterns which are assigned numbers to make them measurable. The data is presented in a user –friendly interactive such as graph, charts and tables. Use of graphics to represent data is valuable supplement to statistical analysis (Kothari, 2003).

Results and Discussion

Introduction

The results of the study are shown below. Tables 1-3 show the farmers profiles, their products and prices or costs in terms of income per month. The study shows that, the average age of the farmer in the study area is 64 years. Each farmer has an average of 12 members in the family, with an average farm acreage of 9.39. These findings are also in line with Kadere *et al*, (2009) and Mwang *et al* (2000). The average age of the coconut palm trees in the study area is 36.5 years. According to an earlier study by KCDA in 2009, this is the most productive age of the plants. The prices of the coconut products are seasonal. During the study period, prices were as follows at the farmers level ; Mature nut ksh 3.00 each (Range ksh 3-6.00), One piece of makuti ksh 4.00 (Range ksh 2 - 5.00) , 750ml bottle of Palm wine ksh 25.00 (Range ksh 10-40.00), Copra ksh25 per kg (Range between ksh.7.00 and ksh.25.00 per kg). Copra is no longer a significant product at the farm level, since it would take upto 5-10 coconuts to produce a kilogram of copra. The study also established that two varieties of coconut seedlings, the dwarf variety and the East African Tall are grown by the farmers. No organized marketing system is currently in place for the farmers, legal issues about the products especially the palm wine are unclear although environmental impacts have been reported as minimal in the study.

Farmers Profile

From the 150 farmers sampled, the study shows that the study area hosts coconut farmers of an average age of 64 years, who care for an average of 12 family members. The study also reveals that farms are of an average size of 9.39 acres with an average of 285 coconut trees per farmer. KCDA (2009) in an earlier study had reported an average of 264 plants per farmer in the study region.

i. Profiles of Farmers

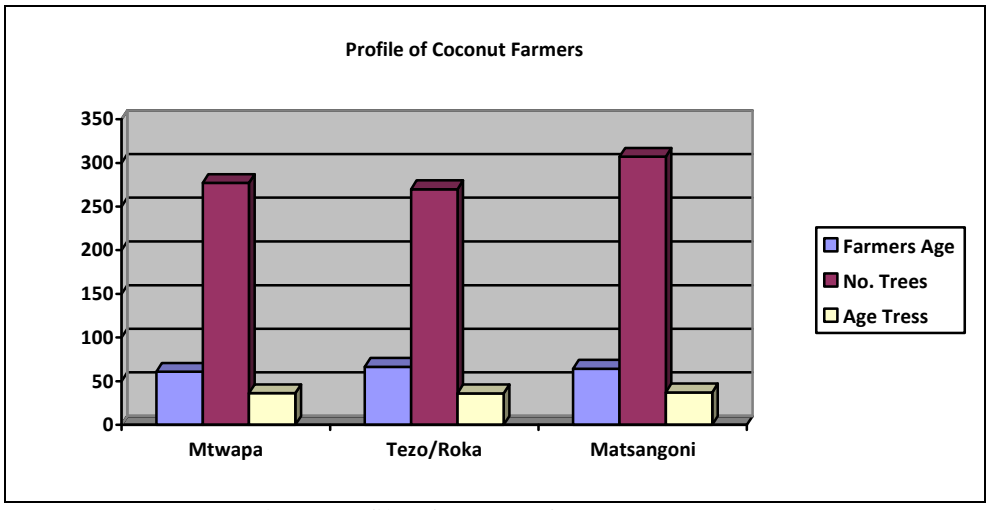

Fig.2: Profile of coconut farmers

Age of Coconut Trees in Kilifi District

Tables 1A (Tezo/Roka), 1B (Matsangoni) and 1C (Mtwapa) comparatively show the ages of the coconut trees in the study area. The results indicate that the average age of the trees under study is 36.5 years old. According to the census of coconut trees in the region (ABD-DAANIDA/CDA, 2007) majority of the trees comprising 31.8% are in the age group between 21-40 years. This is the most productive age of the plants. A smaller proportion of the trees, about 8% are in the category of senile trees (61+ years). The category of 6-20 years comprises 25.8%. The findings of this study are therefore in agreement with the findings of ABD-DAANID/CDA (2007), in that, the coconut palm trees in the study area are in their most productive age.

Table 1 A. Average Profile of Farmers (Tezo/Roka)

Count	Farmers age	No.family members	No. working	No. in school/college	No.coconut trees	Age trees	Acreage of farm
50	66.52	17.38	2.8	5.78	269.6	36.12	9.8

Table 1B. Average Profile of Farmers (Matsangoni)

Count	Farmers age	No.family members	No. working	No. in school/college	No.coconut trees	Age trees	Acreage of farm
50	64.28	11.36	3.2	4.26	307.1	37.24	10.36

Table 1C. Average profile of farmers (Mtwapa)

Count	Farmers age	No. family members	No. working	No. in school/college	No.coconut trees	Age trees	Acreage of farm
50	60.72	7.54	3.12	2.68	277.02	36.24	8

Coconut Varieties Grown in the Study Area

Two varieties of the crop are grown in the study area, the dwarf coconut variety, which produces excellent immature nuts but little copra, and the East African Tall. The East African Tall is grown by over 87% of farmers, whereas the dwarf variety covers 12% of the trees. A hybrid (minazi chotora) , which is a cross breed of the East African Tall (EAT) and the dwarf variety is capable of producing 60 nuts per annum and can live for 60 years (Krain &Kabonge, 1992; Mwangi & Joba, 2000). However, this variety was not observed during the study.

The Tables and Figures below show the number of farmers interviewed, their ages and the products from their farms. The study revealed that the average age of the coconut trees is 36.5 years. ABD/KCDA (2009) in an earlier study had recorded that the most productive age of the coconut palm trees is between 20-40 years. Based on these finding, the coconut palm trees in the study area are in their most productive ages. Poor farming methods where the plants are left in the bush for a long time reduces productivity. ABD/KCDA (2009), attributes this bush to poor agronomy practices. The farmers are indigenous members of the Mijikenda community who practice traditional farming. The study also revealed that Coconut farming is deeply entrenched in the coastal farming systems and forms an important component of the coastal economy. The crop is deeply entrenched in their cultures, practices and ways of life such that these cultural values dictate that every farming household in the coastal belt has at least a coconut tree.

This cultural entrenchment goes beyond the cultivation. Many coastal meals will have a taste of the coconut or at least the coconut milk sprinkled on it. The figure and Tables below also show the production of coconuts, makuti, wine, and copra from these varieties. The results indicate that Tezo/Roka has the highest production of Wine and Copra (256.4 litres and 119.1kgs) respectively, followed by Matsangoni (179.6 litres and 92.4 kgs) and lowest production in Mtwapa (109.6 litres and 73.6 kgs) .Wine has the highest income since it is available and sold on a daily basis. Due to the nearness to Mombasa town and the influence of tourists, Mtwapa farmers double up as workers in hotels and industries, thus reducing their engagement in coconut farming, hence the low production. The farms in Mtwapa are also of smaller sizes due to clearing for human settlement and development of Coastal hotels, thus reducing the quantity of the coconut products in the region. Farmers in Tezo/Roka and Matsangoni have bigger farms since this is a settlement scheme developed immediately after independence in the early 1960s. The plots were of 12acres for each farmer, and most farmers have since retained the sizes. KEPHIS together with KCDA have embarked on a program to replace the older coconut trees; hence farmers can benefit and increase productivity.

The Mature Nuts

The number of mature nuts harvested average 183 per farmer per month in the study area (Table 2A, 2B and 2C.The mature nut which is the coconut *per se* is many times considered as the main product of the coconut tree and is regarded as the most important across the board of all farmers. Table 2C, Mtwapa, shows the lowest average production per farmer (151.92) of the mature nut. The region has fewer coconut trees. This is also because of the tourism industry in Mtwapa which influences the drinking of the immature nut fluid as a soft beverage, called "madafu". The farmers in Mtwapa therefore have an option, either to harvest the immature nut and sell it as "madafu" or wait for the nut to mature. All this is dictated by the market. This has also reduced the amount of copra harvested in the area. Copra is the dried flesh of the nut which is used for producing oils and other products in the factory. Matsangoni (Table 2B) has the highest average production (198), followed by Tezo/Roka (Table 2A) recording an average of 197.8 nuts.

Palm Wine

Tables 2A (Tezo/Roka), 2B (Matsangoni) and 2C (Mtwapa) comparatively show the production of palm wine in the study area. The average production is 181 litres per month per farmer. In terms of value of production, coconut wine can be the main product of the coconut tree. It appears to be the one driving growth in the sub-sector. This is however a very difficult product from the crop in that it is embroiled in faith-based (religious) and legal issues. This is perhaps why many Islamic areas have shied away from this growth engine of the sub-sector. Compared to the other products, prices are good, the market is readily available and even most attractive. The flow of income is on a daily basis unlike the nature of the other products such as coconuts and copra which are normally harvested seasonally . From a geographical distribution, it is clear that religion plays a major role and wine production is generally heavy outside areas where the Islamic faith has strong roots. It is perhaps from this consideration, that Mtwapa near Mombasa dominated by the muslim community has fairly small production of the product (Average 109.6 litres per farmer per month). In the high production areas of Tezo/Roka (256.4 litres per farmer per month) and Matsangoni (179.6 litres per farmer per month), the product has found many uses particularly in funerals and other rituals. In a funeral each member of the clan of the dead has to bring five bottles of 750 ml each of the wine , commonly known as" kajama ya mkeke " or " kajama ya matanga " which is shared by members at the funeral.

The wine also finds use during traditional weddings, and other traditional ceremonies. Waijeng (1993) has referred this plant as a "tree of life "The tree is also associated so much with myths. During its planting, the seed is placed in a dug hole prepared for the purpose, facing the Indian Ocean. Then the hole is filled with sand by the person planting it initially using the left knee. The seeds are preferably planted by a person who frequently sweats in his palms. This is associated with the belief that trees planted by people who sweat in their palms or hands will produce more wine. The same belief is held for the positioning of the seed facing the Indian Ocean.

However, even in the districts of low production, such as Kwale and Lamu which are dominated by muslims, the wine is still the product contributing highest to the total value of production. Irrespective of religious, legislative or social prejudices or image of the coconut wine, the reality on the ground is that, this is the commodity that is generating the highest value from the coconut tree. Nathaniel (1955) also reported high toddy yields in the coconut palm *cocos nucifera* in Sri Lanka. Kadere *et al* (2009) in a study in Kenya also obtained similar results.

In the present study, the palm wine production was recorded highest in Tezo/Roka (Table 2A), followed by Matsangoni (Table 2B) and lowest in Mtwapa (Table 2C, and fig 3).

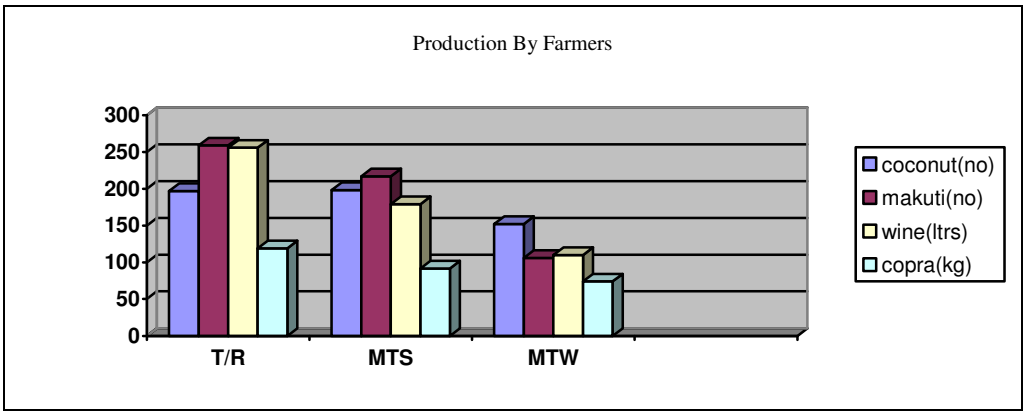

Fig.3: Average monthly coconut production (Tezo/Roka, Matsangoni and Mtwapa)

These high production areas are dominated by Christians and non religious people (pagans) or traditionalists who spend several man hours drinking the wine. It is a taboo for women to take the wine. Such women are usually regarded as community rejects since coconut palm wine is considered unfeminine and inappropriate for women with any social standing. The palm wine despite being natural is still classified as a traditional brew (KCDA 2009).

Roofing Materials (Makuti)

The average monthly production of makuti per farmer is 194, which at an average cost of Ksh.4.00 would fetch the farmer Ksh.770.00 per month. Table 2A indicates that Tezo/Roka recorded the maximum average number of makuti production per farmer per month (259.5).

Makuti is the thatching material made from the coconut leaves twined with rope on a rod of stick with diameter of 2cm and a length of 60cm. It requires special skill and labor to prepare one piece. The amount of makuti made directly corresponds with the number of members in the family. Where the family has more members, the tendency is that they have more labor effort, and can be able to prepare more of this product as compared to families with fewer members as observed in Mtwapa (Table 2C). Makuti as a product of the coconut tree can be regarded as a secondary product. It is not sold exactly in its original form of production. It is generated from the fallen or dry or spent leaves, locally known as "kanja ', which is also sold to those involved in "makuti "making, usually at a fairly low price of Ksh.2.00.

The makuti making process is dominated by women and children, although increasingly, there are also men involved as the value chain has increasingly become commercialized. In table 2A and 2B, Tezo/Roka and Matsangoni have recorded higher values of this product 259.5 and 217 respectively as Compared to Mtapwa which recorded 106nos. (Table 2C). This probably is as a result of lack of labor for the production of this product in Mtwapa. In Mtwapa, many of the farmers have less members in their families and also, they double as workers in the hotel industry and other jobs in Mombasa town as opposed to Tezo/Roka and Matsangoni where the rural fork have no formal employment. Other products which also support this sector are brooms from the leaf stalk of the coconut tree, coco-wood from the trunk of the coconut tree and coconut shell, which finds use in the making of water drinking mugs locally known as " kaha ", cups and embroidery material for ladies.

Makuti are usually the poor man's locally available thatching material, but have now found use in the local tourist hotels around the coast, and the famous "makuti pubs" all over the country. The costs are low, and the thatch recycling period is long; usually four to five years.

Table 2A .Average Products Per Farmer/mth (Tezo/Roka)

Coconuts (Nos.	Makuti (Nos.)	Wine (Ltrs	Copra (kgs)
197.8	259.5	256.4	119.1

Table 2 B .Average Products Per Farmer/mth (Matsangoni)

Coconuts (Nos.)	Makuti (Nos.)	Wine (Ltrs)	Copra (kgs)
198	217	179.6	92.4

Table 2C .Average Products Per Farmer/mth (Mtwapa)

Coconuts (Nos.)	Makuti (Nos.)	Wine (Ltrs)	Copra (kgs)
151.92	106	109.6	73.6

The costs of coconut products are seasonal. Kadere *et al* 2009, reported highest cost of coconuts (Ksh.6.00) per nut in the month of December. This is a festive season of Ramadhan for the muslims, Christmas for the Christians and also it is the period of tourism boom. Matsangoni (3B) recorded highest cost of coconuts at Ksh990.00 per farmer, per month. Tezo/Roka (3A) recorded a high of Ksh.989.00 per farmer, per month. During the study period, makuti cost Ksh.2.00 per piece.Tezo/Roka recorded highest prices (Ksh.1038.00) per farmer, per month.

Matsangoni followed with Ksh.868.00 and Mtwapa was lowest recording a price of Ksh.424.00 per farmer per month. Palm wine is the largest economy of the coconut products. During the study period, a bottle of 750ml cost Ksh.20.00. Kadere *et al* 2009, recorded the highest price of Ksh.40.00 per bottle. Tezo/Roka(3A) recorded the highest average prices of Ksh.8012.50 per farmer, per month. Matsangoni followed with prices of Ksh.6735.00 per farmer, per month. Mtwapa recorded lowest prices of Ksh.2425.00 per farmer, per month. Copras, the dry flesh of the nut cost Ksh.7.00 per kg during the study period. Tezo/Roka recorded highest prices of Ksh.2977.00 per farmer, per month. Matsangoni followed with prices of Ksh.2310.00 per farmer, per month. The study established that coconut products prices were dictated by middle men, who continue to exploit farmers. The government should come up guidelines on pricing policies of coconut products. This will ensure that farmers are not exploited by middlemen.

Table 3A. Average Cost of Products Per Farmer/mth Tezo/Roka (ksh)

Coconuts	Makuti	Wine	Copra
989.00	1038.00	8012.50	2977.50

Table 3B. Average Cost of Products Per Farmer/mth Matsangoni (ksh)

Coconuts	Makuti	Wine	Copra
990.00	868.00	6735.00	2310.00

Table 3 C. Average Cost of Products Per Farmer/mth Mtwapa (ksh)

Coconuts	Makuti	Wine	Copra
759.60	424.00	2425.00	1840.00

The levels of production for the 150 farmers interviewed during the study period is expressed statistically as shown below;

Table 4 Descriptives – Levels of Production (Farmers)

LOCATION	PRODUCT	Mean	Std. Deviation	Number
Mtwapa	Coconut	151.92	48.838	50
	Makuti	106.00	46.511	50
	Wine	109.60	55.731	50
	Copra	73.60	26.089	50
	Total	**110.28**	**53.205**	**200**
Tezo/Roka	Coconut	197.80	231.405	50
	Makuti	259.50	206.250	50
	Wine	256.40	220.498	50
	Copra	119.10	102.687	50
	Total	**208.20**	**203.702**	**200**
Matsangoni	Coconut	198.00	61.842	50
	Makuti	217.00	79.083	50
	Wine	179.60	70.998	50
	Copra	92.40	43.545	50
	Total	**171.75**	**80.466**	**200**
Total	Coconut	182.57	141.862	150
	Makuti	194.17	144.822	150
	Wine	181.87	149.286	150
	Copra	95.03	68.308	150
	Total	**163.41**	**136.060**	**600**

Table 5 One-way ANOVA - All products

A one-way ANOVA test indicates that there is significant difference in production of the various products from the three sites (F= 28.93, p<.05).

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	979699.320	2	489849.660	28.928	.000
Within Groups	10109209.820	597	16933.350		
Total	11088909.140	599			

Variations in Production of Coconuts

One-way ANOVA indicates that there is no significant difference in production of coconut between the three cites (F=1.77, p>.05).

Table 6: One-way ANOVA – Coconuts

		Sum of Squares	df	Mean Square	F	Sig.
Coconut	Between Groups	70473.03	2	35236.507	1.769	.174
	Within Groups	2928129.680	147	19919.250		
	Total	2998602.693	149			

Variations in Production of Makuti

One-way ANOVA test (Table 7& 8) indicate that there is significant difference in production of makuti between the three cites (F=18.49, p<..05). Comparison of means shows that Mtwapa produces significantly lower amounts of makuti.

Table 7: Descriptives for One-way ANOVA: Makuti

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Makui	Mtwapa	50	106.00	46.511	6.578	92.78	119.22	50	250
	Tezo/Roka	50	259.50	206.250	29.168	200.88	318.12	20	1000
	Matsangoni	50	217.00	79.083	11.184	194.52	239.48	50	350
	Total	150	194.17	144.822	11.825	170.80	217.53	20	1000

Table 8 : One-way ANOVA: Makuti

PRODUCT		Sum of Squares	df	Mean Square	F	Sig.
Makuti	Between Groups	62815. 333	2	314079.167	18.491	.000
	Within Groups	2496862.500	147	16985.459		
	Total	3125020.833	149			

Variations in Production of Wine

One-way ANOVA tests (Table 9&10) indicate that there is significant difference in production of wine between the three cites (F=14.25, p<..05). Comparison of means shows that Mtwapa produces significantly lower amounts of wine.

Table 9: Descriptives for One-way ANOVA: Wine

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min.	Max.
						Lower Bound	Upper Bound		
Wine	Mtwapa	50	109.60	55.731	7.882	93.76	125.44	0	250
	Tezo/Roka	50	256.40	220.498	31.183	193.74	319.06	30	1200
	Matsangoni	50	179.60	70.998	10.041	159.42	199.78	80	400
	Total	150	181.87	149.286	12.189	157.78	205.95	0	1200

Table 10: One-way ANOVA: Wine

PRODUCT		Sum of Squares	df	Mean Square	F	Sig.
Wine	Between Groups	539141.333	2	269570.667	14.246	.000
	Within Groups	2781536.000	147	18922.014		
	Total	3320677.333	149			

Variations in Production of Copra

One-way ANOVA tests (Table 11&12) indicate that there is significant difference in production of copra between the three cites (F=18.49, p<..05). Comparison of means shows that Mtwapa produces significantly lower amounts of copra.

Table 11: Descriptives for One-way ANOVA: Copra

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Copra	Mtwapa	50	73.60	26.089	3.690	66.19	81.01	40	150
	Tezo/Roka	50	119.10	102.687	14.522	89.92	148.28	0	400
	Matsangoni	50	92.40	43.545	6.158	80.02	104.78	50	250
	Total	150	95.03	68.308	5.577	84.01	106.05	0	400

Table 12: One-way ANOVA: Copra

PRODUCT		Sum of Squares	df	Mean Square	F	Sig.
Copra	Between Groups	52276.333	2	26138.167	5.976	.003
	Within Groups	642948.500	147	4373.799		
	Total	695224.833	149			

Notes: F is a ratio. It is a variation between means of the three cites. F is expected to be large if the null hypothesis is to be rejected. A large F means that variation among group means is more than you would expect by chance. The larger the F, the smaller the P.

The Brokers

Tables 13, 14 and 15 shows the products handled and taken to the processors by the brokers. The study shows that most brokers are found in Tezo/Roka followed by Matsangoni, then Mtwapa. The study shows that Tezo/Roka and Matsangoni are the areas where the middlemen handle the highest production of wine and mature nuts. The lowest production is recorded in Mtwapa (Fig.4).

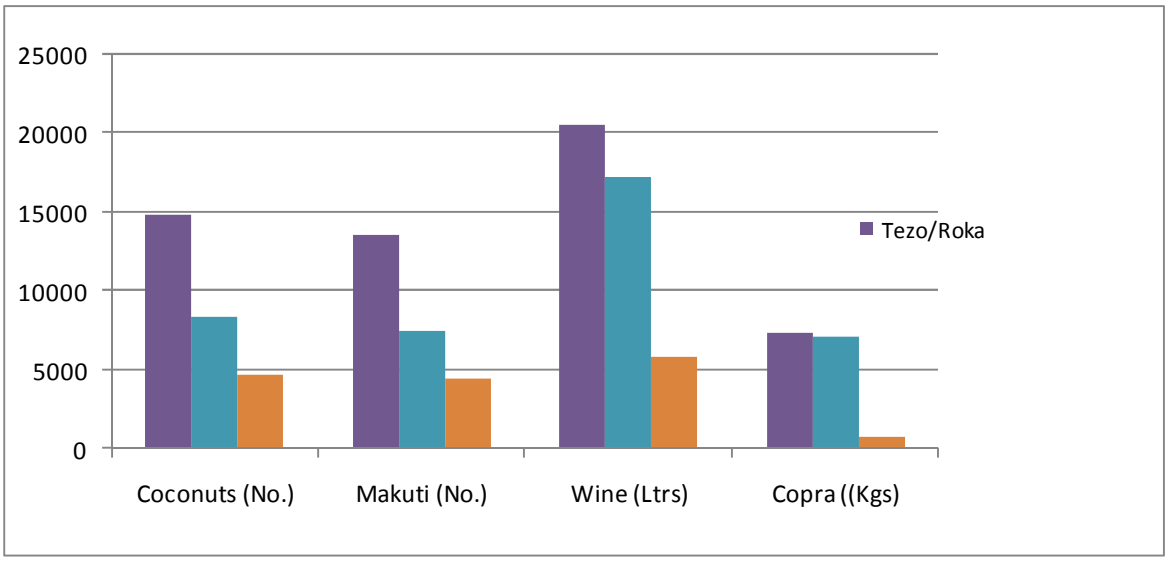

Fig.4: Average Monthly Production by brokers

Brokers are the middlemen who take products from the farmer and sells to the processors, who are manufacturers of finished products. The mature nut is the main product that the middlemen take to the processors. It is from the nut that oils are extracted for domestic use as well as export to foreign markets. The broker buys mature nuts from the farmer at a cost of between Ksh.3.00 to Ksh 6.00 depending on the season and sells to a processor at an average of Ksh30.00 per nut. Wine is sold by the farmer at a fluctuating rate of between Ksh 10.00 and Ksh 40.00 per 750ml bottle depending on seasons. In this study the cost of mature nut from the farmer was ksh.3.00, wine was ksh 25.00 per 750 ml bottle, makuti was ksh 4.00 per piece and copra was ksh 25.00 per kg. The broker would also sell the produce at almost 100% to the consumers in town or processors in factories. The study revealed that coconut palm wine is the main product handled by the brokers and is also the driving engine of the coconut sub-sector, sine it is available on a daily basis and has ready customers. The prices are slightly high compared to the other products and the profit margin is higher. The mature nut is the main product used as raw material by the processors.

Table 13 A: Average Products Per Broker /mth (Tezo/Roka)

Coconuts (Nos)	Makuti (Nos)	Wine (Ltrs)	Copra (kgs)
14900	13560	20500	7420

Table 13 B : Average Cost of Products Per Broker/mth Tezo/Roka (ksh)

Coconuts	Makuti	Wine	Copra
447000.00	54240.00	768750.00	185500.00

Table 14 A : Average Products Per Broker /mth (Matsangoni)

Coconuts (Nos)	Makuti (Nos)	Wine (Ltrs)	Copra (kgs)
8422	7502	17306	7160

Table 14 B : Average Cost of Products Per Broker/mth Matsangoni (ksh)

Coconuts	Makuti	Wine	Copra
252660.00	30000.00	648975.00	179000.00

Table 15 A: Average Products Per Broker /mth (Mtwapa)

Coconuts (Nos)	Makuti (Nos)	Wine (Ltrs)	Copra (kgs)
4742	4420	5820	766

Table 15 B: Average Cost of Products Per Broker/mth Mtwapa (ksh)

Coconuts	Makuti	Wine	Copra
142260.00	17680.00	181875.00	19150.00

The Processors

The coconut products can be processed into various products and by-products for both household and industrial consumption. While coconut provides numerous processing options, Kenya has done little to tap into the processing opportunities through value addition. Huge capital investments and lack of promotion on processing opportunities in coconut sub-sector partly explains the minimal nut processing investments. This was revealed in the study where the number of processors has remained small and mostly involves utilization of older technologies in nut processing. There exists a number of coconut processing plants in the country, although the current study managed to visit four factories which are discussed below. The number of processors in the country total about 25 (KCDA, 2009), the main ones being BICODE, Kentaste product ltd, House of Manji, Lola Lola, Mnazi Development Entreprises, Coast Coconut Farms ltd among others. These companies mainly use the mature nut as their raw product.

Home based processors mainly process simple coconut products such as coconut milk, coconut water, coconut charcoal, shells and coconut cream. Medium scale processors mainly process products such as coconut oil, coconut milk, desiccated coconut, copra cake, coconut vinegar among others. During the study, the following factories were visited:

a) Mnazi Development Enterprise (Kaloleni) – This Company is based in Mariakani and obtains its raw materials from brokers. The main raw material the company uses are the mature nuts or the coconut *per se*. It utilizes a volume of 1,000 nuts per day. The brokers sell the nuts at Ksh.30.00 to the processors (Tables 13, 14, and 15). This company is involved in processing of desiccated coconut, brown testa which is sold as animal feeds and coconut shell powder from the coconut shell (Table 16A) . These products are later sold mainly to confectionery companies which make sweets and cakes, bakeries and supermarkets. According to the management, the company can not currently meet the high demand for its products as it faces a shortage of nuts for various reasons. These products then find their way to wholesalers and retailers. These are the major outlet markets for processed coconut products. These traders stock assorted coconut products (Table 16A), where the major target market is the high income earners. Some of the main coconut products that were identified during the study in the shelves of supermarkets were desiccated stock selling at Ksh.160.00 for 250grams, Renuka (coconut cream) selling at Ksh 122.00 per 400ml, Kara- a coconut milk selling at Ksh.129.00 per 400ml, exotic foods-coconut cream selling at Ksh.150.00 per 400ml and Royal umbrella- coconut milk selling at Ksh.110 per 400ml (Table 16A). Processed virgin coconut oil for export sells at $ 4.15 per kg.

b) Coast Coconut Farms ltd - Kwale; the processing factory is located in Msambweni in Kwale District. The company uses about 5,000 mature nuts per day as its raw materials. The nuts are used to process Extra Virgin Coconut Oils, soap making, charcoal making and copra cakes. The company sells its products both locally (30%) and internationally (70 %). The main product is extra virgin oil where they export about 20 tones to the UK and USA annually.

c) BICODE- Kaloleni; this company is located in Kaloleni, Giriama, near Mombasa. The company specializes in the processing of Virgin coconut oil among other products. This company was formed through a community based initiative by women groups. These women have been trained to locally manufacture virgin coconut oil from their homes. The virgin coconut oil is extracted from fresh coconut meat without chemical processes. It is said to be the "mother of all oils 'because it is rich in medium chain fatty acids, particularly lauric acid. They use crude locally assembled equipment for extracting the oil. They then deliver it to BICODE production unit who pay them for the raw material at negotiated prices. The company then processes, packages and markets the products to foreign markets.

d) KENTASTE product Ltd (Mazeras); this company is located in Mazeras, Kaloleni District. It has a capacity to process 10,000 nuts per day.

The company processes desiccated coconut, coconut milk cream, coconut virgin oil, activated carbon and coconut shell powder. It has both local and foreign markets in Madagascar, USA and UK. Processed virgin coconut is mainly exported to Madagascar and UK at $4.15 per kg.

Table 16 A: Coconut Products per Unit Cost by Processors

	Item	Unit	Cost (ksh)
1.	Desiccated coconut	250mg	160.00
2.	Renuka coconut cream	400ml	122.00
3.	Kara coconut milk	400ml	129.00
4.	Coconut cream	400ml	150.00
5.	Royal umbrella coconut milk	400ml	110.00
6.	Processed virgin coconut oil (export)	1 kg	$4.15

Table 16 B : List of processors, their products and markets

	Factory	Products	Market
1.	Mnazi Development Entreprise	Desiccated coconut, Brown testa, coconut cream, coconut milk	Local
2.	Coast coconut Farm Ltd	Extra virgin coconut oils, Soap, copra cakes, charcoal	Local USA,UK
3.	BICODE	Virgin oil	Foreign
4.	Kentaste Ltd	Desiccated coconut, coconut Milk, coconut virgin oil, Activated carbon, coconut shell powder	Local Foreign

Marketing of Coconut Products

The coconut sub-sector had well established cooperative societies until the early 1980s. These cooperative societies facilitated the marketing of the coconut products. Notable within the study area was the Kilifi Cooperative Society. Liberalization of the economy as a result of Structural Adjustment Program (SAP) implemented in the country in the early 1980s led to the collapse of the marketing by the cooperative societies in the sub-sector. This has now created an opportunity for the middleman to take advantage of the situation to pay farmers uncompetitive prices for their produce.

Currently,there is no organized marketing system for coconut products and farmers sell their products on individual basis. The scenario has left the coconut farmers at the mercy of the middlemen who have continued to reap the maximum benefit from the products. Lack of marketing cooperatives has denied farmers bargaining power and opportunity to exploit potential markets in the country as well as neighboring countries of Tanzania, Uganda, Rwanda and Burundi where coconut products are either lacking or still under restrictive government policies. Currently, the major destination of the coconut products is the whole markets at Kongowea, Mombasa and the neighboring country of Tanzania (CDA, 2000).

Pricing, Marketing and Value Chain Analysis of the Coconut Products

The nut prices are generally influenced by production seasonality, demand and supply factors. During the high nut production season, the average cost of a nut from the farmer is Ksh.3.00. This season is around July to December. The price however rises steadily to its peak in December when the price shoots to Ksh.6.00 per nut from the farmer. This period is also the period of festivities in the region. This is also the period of the annual Agricultural Show (ASK) in Mombasa, and it is also the period when the tourist high season begins. The prices reach an all time high and stagnate till December where it begins to decline between January to June (ABD/KCDA, 2009). This is when the processors and urban traders become the major buyers. Also during this period, there is less export to Tanzania and other regional markets; hence the low prices.

The Value chain of the dry coconut begins with the harvester. The harvester climbs the coconut tree and drops the nuts. He is generally paid between Ksh. 5.00 to Ksh.10.00 per tree climbed, or between Ksh.1.00 to Ksh.1.50 per four nuts failed. Then the next stage of value addition is the de-husking stage, where the fibre husks of the nut are removed. This task is carried out by individuals referred to as de-huskers.

A de-husker is usually paid Ksh.25.00 for 100 nuts de-husked. Next stage of value addition is assembling of the nuts and packing them into trucks to their final market. This market may be in Mombasa, Taita-Taveta or Tanzania, where a single nut would sell for ksh 30.00 or more depending on other factors like transport costs and distance to the market. Thus again at every stage the value of the coconut and the price increases. The consumer mainly driven by taste, quality and economic level pays the highest price for the commodity.

From the study, the major nuts markets include, the coastal rural and urban markets (Kongowea, Kaloleni, Ukunda, Taveta, Voi, Lamu, Malindi and LungaLunga). Upcountry markets include Nairobi, Kisumu, Busia, Eldoret, Thika, Machakos and Nanyuki. Tanzania constitutes the major market for nuts. During the study, the processors indicated that, their main markets were, Madagascar, UK, USA, and UAE. The market share is estimated as follows; rural low-end (10%), coastal urban markets (25%), upcountry markets (10%), regional export market (35%), processed nut market (5%), home consumption (15%) and post harvest losses. On the other hand, key palm wine markets include; rural low-end market (30%), urban low-end (45%), processed palm wine market (2%) and 18% accounting for home consumption and handling wastage.The factors affecting market pricing include seasonal production variations, middlemen dominance in commodity prices, poor road infrastructure, festivities during the year, normal demand and supply, distance from farm to market and the number of chain actors within the given product chain i.e. the more the actors, the higher the price.

Pests and Diseases

The study has established that several diseases affect coconut production in the District. This has made the plant not to reach the optimal level of production. Bole rot disease caused by a fungus is the most dangerous and is the main cause of many dead standing trees. Warui and Gethi had earlier (1980) made a similar observation. Insect pests have also contributed to the decline of coconut production. The most important ones as observed in this study are the rhinoceros beetle *Orctes monoceros* locally known as "chongwa" and the coreid bug *pseudotheraptus wayi* which kills the tree by destroying the terminal buds . A similar observation was made by Warui and Gethi (1980), while studying lethal diseases of coconuts in the coast province.

Environmental Impacts of the Coconut By-products

The Environmental Management and Co-ordination Act (EMCA, 1999) was established under an Act of parliament to co-ordinate all issues and activities of environmental degradation in the country. Its mandate was to establish NEMA and other bodies including the "The public complaints Committee" and the National Environmental Tribunal to settle environmental complaints from members of the public, who cannot afford cases in court. This Act also established Provincial and District offices to handle environmental issues at that level. In the study area, a good number of the farmers interviewed (about 65%) were aware of the existence of these bodies, particularly NEMA, and they were also aware of the waste disposal methods.

The study established that the coconut palm tree wastes have if any minimal impact on the environment.

Legislation

Before independence, the development of the coconut industry was governed by two Acts of parliament; Cap 331, "The Coconut Industry Act" and Cap 332, "The Coconut Preservation Act'. The Cap 331 was mainly concerned with the marketing of the coconut and coconut products, while Cap 332 concentrated with the crop husbandry/management. In post-independence, powers were vested in the Minister of Agriculture who has never gazetted coconut as a special crop. The gazetement would facilitate the establishment of a Board to oversee the development of the sub-sector (ABD-DANIDA/CDA, 2007). Lack of institutional support for the coconut sector has greatly contributed to the low moral of the farmers, low production, poor marketing and lack of research and development for the coconut palm tree in Kenya. In the present study, many farmers are aware and acknowledge the existence of NEMA, KCDA and other Institutions that could assist them in enhancing their productivity, but many have denied assistance given them even by the government, particularly financial in form of loans. However, Government agencies and other regulatory bodies dealing in coconut products have been working round the clock to ensure that proper regulations are put in place for the coconut sub-sector.

Challenges Facing the Coconut Palm Tree Farmers

The study revealed that low productions lead to the coconut sub-sector not to be fully exploited. Looking at the average productivity per farmer (Table 2A, 2B and 2C), it is obvious that there are a number of challenges facing the farmer.

These include:

a) Production related challenges: The study revealed obvious neglect of the coconut tree from an agronomy perspective. While you notice a lot of trees, you also notice that most of these trees are totally in the bush, with the land around them hardly ever cultivated or cleared. From an understanding of the effects of good, agricultural practices in increasing quality and productivity, abandon and neglect of the coconut tree is perhaps the most pressing challenge facing the farmers in this region. From the farmer's perspective, there are three major challenges that they face at the production level viz: harsh weather conditions, pests and diseases and accessibility to quality planting materials.

1. The unfavorable weather or drought: although rainfall is heavy, most of the study area goes dry in the months of January, February and March, causing drought in the area thus affecting the production. However, this is a blessing in disguise for the "makuti" processors because this is the time the leaves dry off and drop in plenty. The makuti production thus has a seasonal trend, more during the dry season and less during the rainy season.
2. Pests and diseases: Like in other crops, pests and diseases is one of the major challenges for the farmers. Some of the main diseases include Bole rot, a fungus that can wipe out many trees in a short period and is the one responsible for the dead standing trees observed in the study area. Lethal yellowing (LYD) is also one of the other common diseases affecting coconut. Pests include the Rhinoceros beetle *Orctes monoceros* and the Coreid bug *Pseudotheratus wayi* , which also attacks the terminal bud. The fungus and the beetles are the most dangerous affecting the coconut palm trees in the study area.
3. Access to planting materials: Unlike in the past, there are no longer well established nurseries with good supply of planting materials. Farmers generally rely on their current crop to get seedlings, by merely picking up what has fallen down and germinated on itself, thus there is no determinant to yields. The trees in the study area have been planted based on such a criteria of selection of seeds.

b) Markets and marketing problems: These constitute the second most pressing challenge facing the coconut farmers. These include low prices for products, poor market outlets, high transportation costs, and poor roads to markets.

1. Prices: Prices are among the top-list issues facing farmers. Low and unreliable prices for their products affect the income of the farmers, particularly since farmers sell un-collectively. To the farmer, the generally low price, and the fact that they are not sure of what the price will be tomorrow is the major challenge discouraging them in their coconut farming activities.
2. Poorly developed markets: The farmer's other problem is their inability to sell all their products. This particularly applies to their dry nuts. Market access and development is therefore a key problem facing farmers and perhaps the key to adoption of good agricultural practices in the cultivation of the crop.
3. Poor road infrastructure to markets: The poor roads to markets sometimes completely wipe up the profit margins. In extreme cases, roads are totally impassable and the farmer cannot get his products to the market, leading to great losses.

Other challenges facing farmers as observed in this study include accessibility to credit and other financial services. Farmers have no access to loans, and the government has not come out clearly on borrowing policies for the coconut farmer. The interest rates on bank loans is too high for the indigenous coconut farmer, hence inaccessible. This came out very clearly in the questionnaire under additional comments, where almost all the farmers interviewed complained of non-government support and inaccessibility to financial assistance.

Summary, Conclusion and Recommendations

The coconut industry has not benefited the members of community of Kilifi District mainly because, the coconut sub-sector is not mainstreamed, and simply because it has not been visible. This may be due to local or national politics where the coconut tree was scraped as a protected crop in 1997 (ASPS-ABD/KCDA, 2009). This made the situation worse. The coconut sub-sector continues to be embroiled and held back by legality questions. From this study, it is clear that the driving force of the coconut sub-sector is the palm wine, and unless there is a clear legality stand on this product, development of the sub-sector will have no proper structures and business support systems. Unless the law allows coconut farmers to use their wine production ventures openly, the farmer will continue living in a state of poverty. Low prices of the coconut products, harsh weather conditions, poor infrastructure, poorly developed markets, poor agricultural practices, reliance on local seedlings and inaccessibility to financial assistance are some of the factors that have contributed to the coconut palm tree farmer not to benefit from this "tree of life".

Conclusions

The coconut plant has not benefited the indigenous community of Kilifi district simply because ;
the prices of the coconut products are still very low, there is poor infrastructure and poor marketing strategies where the farmers are not advised about the plant. The plant is still embroiled in legal, religious and cultural issues. There is government reluctance to assist the farmers who still use very ancient farming methods and old varieties of seeds. The coconut plantations are left in the bush with no signs of any cultivation in the last several years. The coconut growers still live in communal homes with a lot of responsibilities hence the earnings from the coconut products are not enough.

Recommendations

The study recommendations the following about the coconut sub-sector:

1. Establishment of Pricing Policies;

Prices are among the top-list issues facing the farmers. The study has established that the prices of coconut products are seasonal and low. The government along with lead agencies such as KCDA should come up with guidelines on pricing policies of coconut products. This will ensure that farmers are not exploited by middlemen.

2. Marketing of Coconut Products

The inability of the farmers to sell all their products affects their profit margins. The farmers are not advised on proper marketing of their produce since there is no organized marketing system. As a result of this, farmers sell their products as individuals thus again benefiting the middlemen. The government should therefore either re-instate the District cooperative societies, or come up with alternative arrangements so that the farmers can be assisted to find markets for their produce.

3. Establishment of Farmer Organizations and Collection Centers

One of the major findings of this study is that, the farmers are the most disadvantaged lot in terms of returns from investment in the coconut sub-sector. They are not in control of market forces and prices which are dictated by middlemen or brokers. Individual sale of products by individual farmers greatly reduce their bargaining power. KCDA must spearhead initiatives to organize farmers to commercially viable groups to facilitate fair trade in the coconut sub-sector. There is also need to establish commodity collection centers in all economically viable coconut tree clusters. Collection centers should have storage facilities for members to avoid post harvest losses.

4. Policy and institutional support

It is clear from the study that the coconut sub-sector operates within undefined regulatory framework. The most affected is the coconut palm wine, which remains classified as a traditional brew. Although some of the legal issues have been addressed by the repeal of the traditional Liquor Act in 2007 and the creation of KCDA (2009), the situation on the ground is still shrouded with a lot of hindrances that have negatively impacted on the palm wine business development. KCDA and other relevant authorities and stakeholders must put in place the necessary arrangements to facilitate business growth in the coconut palm wine product line i.e. campaign for inclusion of coconut palm wine under the Liquor Licensing Act. They should also carry out awareness creation activities and educate farmers and traders on their rights. The government should legalize the palm wine, so that it can be produced in a more hygienic condition.

5. Production and extension services

The low yields that characterize coconut production are not tenable in commercial agriculture. The Ministry responsible for Agriculture and other farm service providers including KCDA, CDA, and KARI must spearhead efforts geared towards improving nut and wine production. Programs to achieve this should include establishment of strong and consistent extension services provision, farmer education in tree crop husbandry and agri business mindset.

6. Research and development support

Information generated from the study indicate that the key challenges in the coconut sub-sector include ; lack of quality planting material or seeds, low yield per tree and the menace of pests and diseases. These are issues that should be addressed through Research and Development initiatives, a task that is well beyond the reach of the farmer. KARI and other related institutions must lead the initiative towards the development of appropriate cultivars i.e. high yielding, drought resistant seeds and seeds that are resistant to pests and diseases. Once developed, the planting materials should be made available and affordable to the farmers.

7. Appropriate processing technology development

For the coconut sub-sector to benefit from processing opportunities, it is important to develop appropriate processing technologies for various products.

KCDA should work closely with technology providers and research institutions such as KIRDI, JKUAT and APROTECH to develop and utilize technologies best suited for the coconut industry. Such technologies should be efficient and affordable.

8. Role of service providers: credit facilities, input suppliers

It is evident from the study that credit facilities providers and input suppliers are not actively involved in the coconut sub-sector. Access to finance and credit facilities have become increasingly difficult for the coconut farmer. Apparently both micro-finance and banking institutions consider coconut farming as an unprofitable economic activity. The low production levels, the poorly developed marketing structures and lack of commercially viable farmer organizations are the major reasons for low income levels among coconut chain actors.

9. The Vision 2030 and the coconut sub-sector

The coconut sub-sector has the potential to play a lead role in the coast region in the realization of the vision 2030 goals which seek to transform Kenya into a newly industrializing middle income country by the year 2030. Enhanced processing and value addition in the coconut sub-sector has potential to generate huge sums of income for the country. KCDA and other actors must encourage the private sector to promote coconut processing and value addition initiatives. Cottage industries should be encouraged and enhanced using low cost or locally available equipment. These initiatives must be developed within the identified economically viable tree clusters in the coconut belt. In addition, the coast leadership must come up with strategies to make the coconut industry a key project in vision 2030 program as this would attract financial and policy support for the sub-sector.

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