FACTORS AFFECTING SISAL CULTIVATION AND ADOPTION IN KIOMO DIVISION, KITUI COUNTY, KENYA

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DECLARATION

Student's Declaration

I understand that plagiarism is an offence and I therefore declare that this thesis report is my original work and has not been presented to any other institution for any award.

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ABBREVIATIONS AND ACRONYMS

ADRA	-Adventist Relief Agency
AGOA	- African Growth and Opportunity Acts
ASAL	Arid and Semi-Arid Lands
CBO	Community Based Organization
ECF	Extended Credit Facility
EPZA	Export Processing Zone Authority
FAO	Food and Agriculture Organisation
FFS	Farmer Field Schools
FGD	Focus Group Discussion
GoK	Government of Kenya
IMF	International Monetary Fund
NALEP	National Agricultural Livestock Extension Programme
NDMA	National Drought Management Authority
NGO	Non-Governmental Organization
PRSP	Poverty Reduction Strategy Paper
PSI	Policy Support Instrument
UN	United Nations
WTO	World Trade Union

ABSTRACT

Sisal cultivation has the potential of contributing immensely towards the economic development of a given country, resulting to improved standards of living. The exportation of sisal fibre can be a great source of foreign exchange in a given country. Further, sisal related industry can be a great source of employment to the global economy. Moreover, sisal is a drought resistant crop, whose cultivation can lead to effective use of the greater arid and semi-arid land in the Sub-Saharan Africa.

Despite the benefits that would accrue to a country as a result of sisal cultivation, the global sisal cultivation has been declining. In Kenya, for instance, sisal production has been on a decline since 1960. The sisal plantations are being replaced by other crops, with the fibre industries turning to synthetic fibres which have been proven to be environmentally unfriendly. Moreover, the vast majority of land in arid and semi-arid areas which are not fertile go to waste.

This study examined the factors contributing to the low sisal cultivation and adoption in Kiomo division in Kitui County, Kenya. During the study, 184 randomly sampled farmers took part in the study. Both the secondary and primary data were used in the study, with the statistical package for social scientist (SPSS) software being used for the analysis of the collected data. The study revealed that 57 % of the respondents were aware of sisal cultivation as a commercial activity. Majority of the respondents were females (90.67%) which signified that gender contributed a lot in sisal cultivation, with the study showing that there was a relationship between gender and awareness of sisal cultivation as a commercial activity (P-Value=.215>P=0.05). However, although more than half of the population were aware of sisal cultivation as a commercial activity, only 1.32% of them were aware of the best +practices in sisal cultivation.it was also revealed that there was a relationship between age and awareness of sisal cultivation as a commercial activity (p-value=0.809>p=0.05).

Further, 30.65% of factors identified to be contributing to the low sisal propagation in the area related to lack of knowledge and 0.77% related to financial constraints. This showed that there was an association between the awareness of sisal cultivation as a commercial activity and a highest level of education (P-value= 0.332>P=0.005). In addition, the study revealed the role of self-help group and development partners like ADRA Kenya in promoting sisal cultivation with over 76% of the respondents identifying ADRA Kenya as the major source of information on sisal cultivation. The study revealed that there was association between the awareness of sisal cultivation as a commercial activity and highest level of education (P value=.332>P=0.05).

This study contributes to the existing literature on sisal production in the world and Kenya in particular. The analysis of the various restraining factors and driving factors will not only create a good foundation for future research but also provide guidance in policy formulation

CHAPTER ONE

1. INTRODUCTION

1.1. Background Information

The cultivation and farming of natural fibres play a crucial role in the economic development of many countries. Their production, processing and export is of great importance in the improvement of economic performance of these countries and in the improvement of the livelihood of the greater population dependent on agriculture. They are a source of income and provide employment to a great number of the population, and their cultivation is cost effective and ecologically sustainable (Srinivasakumar, *et. al*. 2013). Srinivasakumar, *et. al.* (2013) noted that for long time mankind has been associated with natural fibres which have become part of their livelihood. Sisal as a natural fibre, has an edge over other fiber crops as it can grow in wastelands, requires minimum maintenance; withstands many agro ecological conditions and produces continuous fibre for seven to eight years. It is usually grown on land that is unsuitable for other agricultural activities apart from grazing. Another advantage is that the crop is drought resistant, does not require the use of fertilizers, herbicides or insecticides and can be intercropped (Mande, 1998).

Further, sisal cultivation can be a great source of foreign income to a country. In Tanzania for instance, the exportation of sisal contributed to more than a quarter of the foreign income earned by the country in the 1960's and by mid 1960s the production declined drastically where currently the production is a quarter of the production by then(Katani, 2016). Moreover, the introduction of sisal farming in an area indirectly contributes to the development of other socioeconomic infrastructure which are beneficial to the community.

These include the establishment of railway lines and roads, improved building plans, establishment of schools and clinics for sisal workers and the other people living around the sisal estates (Hartermink and wienk, 1995).

The recent global financial crisis saw the retrenchment of many workers, which brought the need for labor intensive commercial activities that would ease the burden of unemployment in the world (Katani, 2016). Activities relating to sisal production, including farming and manufacturing of sisal related products are labor intensive. These have the potential of providing employment to a great number of people in an economy (Dlamini *et al.,* 2013). Generally, labour for agricultural production is severely limited even under high unemployment rates. Therefore, introducing labour intensive production systems may be counter initiative.

On the other hand, sisal is an environmentally friendly crop and is a renewable resource that can form part of the overall solution to climatic change (F.A.O, 2016). Measured over its life-cycle, sisal absorbs more carbon dioxide than it is producing. During processing, it generates bioenergy, produces animal feed, fertilizer and ecological housing materials and at the end of its life cycle, it is 100% biodegradable (Henderson, 2012). Moreover, sisal plant reduces soil erosion through its extensive root system and contributes positively to watershed management. Sisal plant used as hedges acts as an effective vegetative barrier/ fences to protect crops land and forests from predatory animals and intruders (Katani, 2016).

Subbarao (1997) found that Sisal fibre finds its way as environmentally friendly engineering material. After extracting fibre sisal, leaves the huge quantity of residue (biomass) which can be profitably utilized for vermicomposting biogas production and paper-making. These activities are eco-friendly and help in promoting organic farming and non-conventional energy utilization (Muthangya, *et. al.* 2009).

Despite the various economic benefits of sisal cultivation, its production has been declining every year. The global output of the world's sisal production has been below expectation with the majority of manufacturers turning to the synthetic fibres for raw material. In East Africa, sisal production declined in the early 1960s. Consequently, the foreign income derived from the exportation of sisal product dropped, resulting to foreign earnings from other crops surpassing those of sisal (Dellaert, 2014). In Kenya, the decline in sisal production has been witnessed since 1961. According to F.A.O (2016) and Dellaert (2014), Kenya exported 71,300 tons of sisal in 1963, compared to 27,560 tons produced in 2011, indicating a major decline of sisal production in the country (Dellaert, 2014). Kenya sisal board annual report for 1985 indicated that the sisal production for domestic use for the 6 provinces in Kenya was 45.5 metric tonnes. The aim of the study was therefore to investigate that factor which led to the decline of sisal production in kiomo division as a case study.

Common fund for commodities (1990) indicated that between 1970 and 1990, world production of sisal and henequen dropped by about 50 percent reflecting the severe reduction in global demand. Production of these fibres is concentrated in low-income countries of Africa, Latin America and Asia, and hence the depression of the market had profound adverse impacts on the livelihoods and food security conditions of the rural populations concerned (Paola and Shakib, 2007).

The decline of sisal production caused by inadequately organized and inefficient marketing system. The sisal producers depended entirely on marketing agents to sell their produce abroad. The agents look for markets and organize shipping and insurance on behalf of producers. The agents also negotiated sisal prices on behalf of producers. The commission, brokerage, and handling charged by agents in Kenya discouraging small scale farmers from selling their produce abroad (Githire, 1989)

Figure 1.1 below shows the trend of sisal production in Kenya between 1961 and 2011.

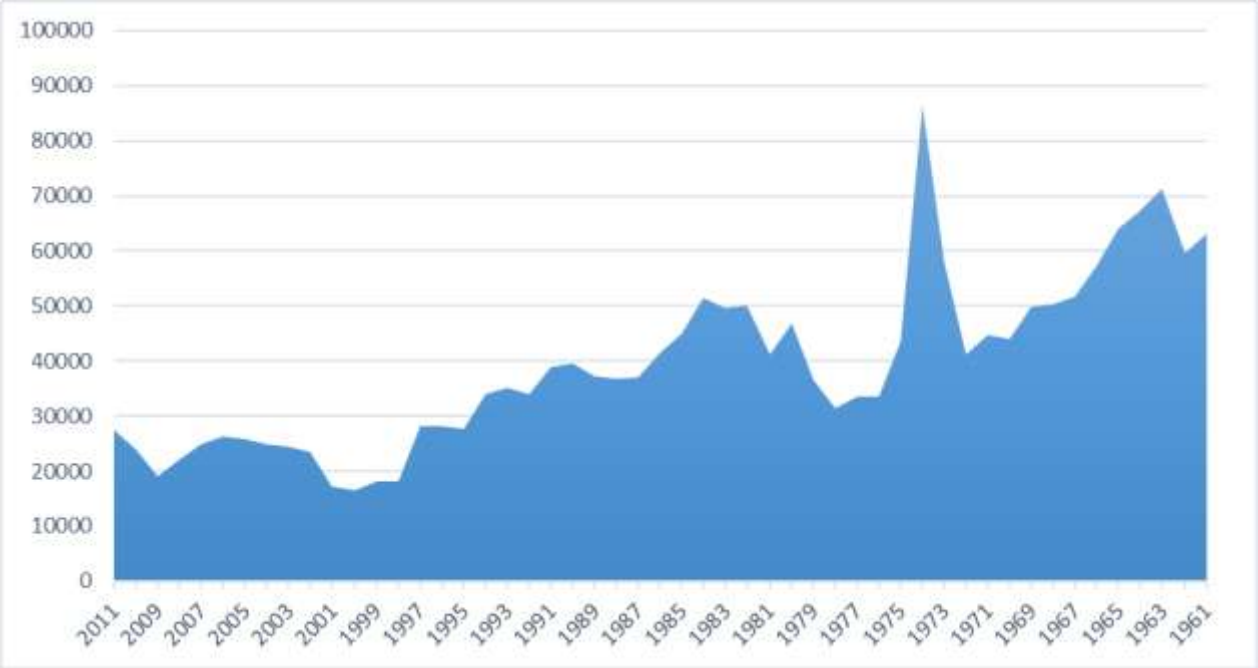

Figure 1.1 Sisal Production in Kenya (Source: FAO, 2016)

1.2. Statement of Research Problem

Since independence, the importance of sisal production in the economy has been overlooked. The large scale farmers who produce a great percentage of sisal in the country complain of poor prices while the majority of small scale farmers have given up on the economic benefits in the sisal cultivation (Kimaro *at el.*1994). A great majority of people in many developing countries are living below the poverty line. In addition the economic conditions of some sections of society even in developed countries need to be improved. This calls for preparing the people with technical, vocational and entrepreneurial skills aimed at income generation in order to solve the problems associated with acute poverty (UNESCO, 1993). In Mwingi central, the Adventist Development and Relief Agency Kenya (ADRA Kenya) and Tahidi

CBO opened up a plantation in Kiomo division to sensitize the local farmers on the sisal cultivation. However, the communities in the division are yet to embrace sisal cultivation as a commercial crop despite sensitization efforts by these two organization and other development partners. A survey conducted by ADRA Kenya in 2013 showed that 16% of households in Kiomo division are not cultivating sisal for economic purpose even after the sensitization. The farmers have continued with their old economic activities of agro-pastoralism that have failed to alleviate the perennial social economic and ecological problems in the area. Although the community is aware of the various economic benefits of cultivating sisal, they are still reluctant in adopting cultivation of the crop, an indication that necessary steps need to be taken to assist the region and the country as whole in harnessing the benefits of sisal as a commercial crop. Data on factors contributing to the low cultivation of sisal and adoption of appropriate intervention technologies is lacking. Besides, the policy framework guiding production of sisal though the Kenya Sisal Board has not helped the farmers either. Farmer extension services on the best sisal agronomic practices are also lacking. There is currently no county policy guidelines on fibre crops sub sector development. Based on the problems stated, the purpose of this study was to investigate factors affecting sisal cultivation and adoption in Kiomo division of Mwingi central sub county Kitui County, Kenya.

1.3. Study Objectives

1.3.1. General objectives

To establish factors affecting sisal cultivation and adoption in Kiomo Division

1.3.2. Specific objectives

i. To assess the state of awareness, knowledge and skills on sisal propagation and cultivation in Kiomo division.

ii. To establish socio-economic factors affecting sisal cultivation and adoption in the study area.

iii. To establish strategies used by the local institutions to create awareness and transfer essential knowledge and skills in sisal cultivation.

1.4. Research Questions

i. What is the level of awareness, knowledge and skills on sisal propagation and cultivation in Kiomo division?

ii. What are the socio-economic factors affecting sisal cultivation and adoption in the study area?

iii. What are strategies used by the local institutions to create awareness and transfer essential knowledge and skills in sisal cultivation.

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1.5. Significance of the Study

The findings of this study will form a basis to help the policy makers and promoters of sisal cultivation in Kenya re-orient their strategies of raising awareness and imparting appropriate technologies to increase sisal and other fibre crops production in the study area and the county at large. The study has provided information on the community concerns that can be integrated to the public training program, providing a framework for allocating resources to activities that are more relevant to the needs of the community as far as sisal farming is concerned. The study has also generated information to be used as a basis to assist farmers develop new skills on environmental conservation through planting of sisal in their farm. It has provided a platform for informed decision making by policy makers including County and National Governments, NGOs and other stakeholders interested in communities' sisal cultivation schemes.

1.6. Scope of the study

The study was carried out in Kiomo division located in Mwingi Central Sub County and which has very high potential for sisal cultivation.

1.7. Limitation of the Study

The study faced limitations in a number of ways including transport and time management constraints during data collection and interviews were experienced. Low literacy among the despondent was also a problem. In some cases especially among focus group discussants, punctuality was not observed by some members.

The team of data collectors used motor bikes and bicycles where the vehicle could not access in order to manoeuvre rough terrain. The study focused on different age groups and education levels during the discussants Focus Group which mitigated the low literacy levels among some of the interviewees.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Description of the Sisal plant

Sisal is a succulent perennial crop, whose botanical name is *Agave sisalana.* It is a monocotyledonous drought resistant plant that can do well in the arid and semi-arid regions and grows best with rainfall of 1,000-1,250 mm. Sisal can tolerate a temperature of 40-50^{o} C. (Saxena *et al,* 2011). Excessive rainfall is harmful to its growth.

The plant belongs to Kingdom *Plantae,* order *Liliales* and genus *Agave*. Sisal is a short plant that usually grows to an average height of 1-2 feet, with stalk of an average diameter of 38 centimetres. The leaves of the plant are fleshy, with length of 0.6 to 0.8 meters long, their color ranging from grey to dark green. After 4 years, the plant grows yellow flowers with unpleasant smell blossom up (Oyen, 2003). The flowers usually grow from the flowering stalk which usually grows rapidly to a height of 10 meters (Dellaert, 2014). Reproduction is through bulbils where after the bulbils fall on the ground, develop roots and a plant develops which is independent from its parent (Henderson, 2012). The plant develops stem, leaves and after some years developed a pole which give rise to bulbils.

On completion of their life span, the older sisal plants usually wither and dry away (Gentry, 2002). The Sisal plant will grow in tropical or sub-tropical countries in any well drained soil anywhere from sea level to frost line. When planted on rich soil and given some care, the plants grow rapidly, attain a large size and throw up poles when 7 or 8 years old (smith *et al,* 2009).

Plate 2.1 Sisal Plant

2.2 History of Sisal cultivation

In Tanzania where sisal was initially cultivated in Africa, the sisal land was basically a high input, large-scale mono-cropping system, dominating the hotter and drier areas below 900 m above sea level. The sisal cultivating zones have land conditions for good crop growth and performance (Mande, 1998). Srinivasakumar (2013) noted that sisal is a perennial hardy plant, which unlike other fibres is not a seasonal crop. It can establish and easily grow in many geographical areas from covering sub humid to arid and semiarid. It can also survive in almost all soil types and its input costs are least for its survival, regeneration and maintenance. Sisal tolerates prolonged droughts and high temperatures (Srinivasakumar, 2013)

Sisal was introduced in Tanganyika from Mexico by Richard Hindorf in 1893 and was later introduced in Kenya by the Department of Agriculture in 1903 (Kenya Sisal industry, 2005). In Kenya the plant was first grown in the coastal region from where it spread along the

railway line to Voi, Thika, Embu, Nakuru and the lake region. In 1937, Thika High Level Sisal Research Station was established to undertake research and development of the crop. By 1963, there were 64 sisal estates, covering 102,000 hectares and producing 70,154 tons of fibre of which 63,821 tons were exported, this is according to the sisal board of Kenya, (KSB, 2009).

Between 1970 and 1990, world production of sisal dropped by about 50% reflecting a tremendous reduction in global demand. Since production of fibres is concentrated among low-income countries of Africa, Latin America and Asia, the depression in the market had profound adverse impacts on the livelihoods and economic development of the rural populations concerned. Rutherford (2001) projected that the steady downward trend in production is likely to continue in future.

2.3 Introduction of Sisal in Kenya

Sisal was introduced in Kenya in 1903 by the then department of Agriculture, following its successful introduction as a cash crop in Tanzania. After a few years of trials at the Kenyan Coast, it proved successful thus arousing the interest of white entrepreneurs. This culminated in the establishment of the first commercial sisal plantation at Punda Milia near Thika in 1907. A second plantation followed shortly after at Nyali in Mombasa, followed by more plantations in other areas of Kenya mainly along the railway line for ease of transport. The land under sisal quickly grew, that by 1913 it had reached over 28000 hectares (Rutherford, 2001).

From then it grew steadily as witnessed by the first export to Europe in 1914 which led to establishment sisal as a cash crop, in Kenya at that time. This led to ambitious expansion in production of sisal fibres and by 1950s, the number of sisal plantations had increased to fifty-four, which occupied almost 120,000 hectares with exports reaching approximately 60,000 metric tonnes per annum in 1960.This culminated in the opening of a spinning factory in

1954 to process twine, ropes, gunny bags and mats for both domestic and export markets (Kanogu, 2011).

The challenges facing the sub-sector in Kenya hinge largely on politics around land use, particularly in the Coast region, where private sisal farms occupy more than 300,000 acres. . Rapid population growth of 10-30% recorded in the national population census of 1962-1969 led to the decline of farm sizes in 1980s owing to the fact that there were no more new areas for settlement to absorb the excess population (Tiffen *et al.* 2003). Population growth over the years has invariably led to land use changes, labour relationships, increased demand for food and other goods which combined with increased scarcity of land has led to investments beyond land capacity to improve crop yields (Tiffen, 2003).

Despite these hurdles, Kenya is ranked the world's third largest producer of sisal after Brazil and China, with Taita Taveta County producing most of the sisal in the country. The crop does well in arid and semi-arid areas, which constitute about 80 per cent of the country (Pascal, 2014).

Research in improved production and processing system (including propagation of sisal using meristematic tissue culture and harmer mill extraction technology in addition to the conventional decortication) has greatly enhanced production and quality of Sisal fibre as well as improved soil and environmental conservation (GOK, 2005).

In addition, current research shows that sisal has a potential to be used for pharmaceutical purposes for example *Sisalana americana* its juice is an important component in the production of hacogenin and Inulin); in the production of cattle feed, decorative panels, hand bags and fashion accessories for women, as well as geotextiles (Laksesvela and said 1990).

Sisal is a plant with remarkable qualities that allows it to survive harsh arid conditions. The plant is productive for roughly 6 to 9 years, in a 12 year growing cycle (Henderson, 2012).

2.4 Types of Sisal breeds

In East Africa only two breeds of sisal fibre plants are grown, that is *A. Sisalana* and *Agave* Hybrid 11648 (Ikitoo and Khayrallah, 2001). *A. Sisalana* is the ordinary sisal. The ordinary sisal in Kenya is characterized by short stem, a terminal bud from which 3 to 4 leaves grow every month. The leaves are usually 130-150 centimeters long with mature leaves measuring 2 meters long. Each meter of the mature leaves has 1100 fibers (Dellaert, 2014).

Agave hybrid 11648 was introduced in East Africa between 1940s and 1950s, compared to the ordinary sisal, it is superior and has a shorter life cycle (Half of that of the ordinary sisal). The plant yield more fibre (Ikitoo and Khayrallah, 2001). Agave hybrid 11648 not only produces large amount of leaves but also has a high level of fibre content those in the ordinary leaves (Osborne *et al.,* 1990).

According to Ikitoo and Khayrallah (2001), the hybrid 11648 is a robust plant with blue-green leaves and virtually free from lateral spines. It has long and thin terminal spine. It is prolific in leaf production and has a high fibre content compared to other varieties like hildana and hybrid 1300. They further noted that it produces a relatively large number of short leaves during the first two years of its production and has a short production cycle (8 Years) than Sisalana (10-12 years).

2.5 Growth habits of sisal

Sisal plant has short roots that grow and feed near the surface. In clay soils the roots usually do not go beyond 10 inches below the ground while in rocky soil, they don't grow beyond 18 inches below the ground. Given enough space, the roots can grow to an area equal to the length of its mature leave (Dellaert, 2014).

After affirming itself on the ground, the undergoing runners (Rhizomes) protrude from the stalk. When these stalks reach the ground, bulbs/ suckers develop. The suckers develop roots that would obtain nourishment from the old plant. When the plant is three years of age, leaves starts developing horizontally, and as the plant continues to mature, longer and wider leaves would continue developing till the plant is six to seven years of age.

After six years of massive growth, the plant develops a stalk. The stalk is usually 4 to 6 inches at the base with a height of upto 30 feet. The stalk bears flowers which are later replaced by bulbils. After the bulbs have grown to 6 inches, they would fall off to produce old plant. At the end of the cycle of the old plant, leaves grow yellow and leathery and there after the whole plant dies off. (Barman, 2006).

2.6 Geographical distribution of sisal

Sisal originated from Mexico and was later introduced in the tropics and the sub tropics. In India, sisal was introduced between 1885 and 1892 while in Tanzania it was introduced in 1893. In Kenya, sisal was first grown between 1903 and 1908. As of 1985, there were over 22 sisal estates and 4 small scale sisal processing factories. Table 2.1 shows the sisal estates in Kenya in 1985.

According to statistics released by the Export Processing Zone Authority (E.P.Z.A), in 2005, Kenya had only 7 sisal producers and 8 marketing agents (Table 2.1).

Table 2.1 Sisal fibre producers and their locations

Company	Location
Rea Vipingo Plantation	Vipingo- Mombasa
DWA Estate Limited	Kibwezi
Teita Estate	Mwatate
Mogotiyo Plantation Limited	Mogotio
Kilifi Plantation Limited	Kilifi
Tabu Estate Limited	Mombasa
Voi Sisal Estate Limited	Voi

(Source: EPZA, 2005)

2.7 Plantation establishment

2.7.1 Soil and Condition of Growth

There is no specific requirement of soil for sisal production. However, the plant does well in well-drained soil rich in moisture and contains lime, magnesia, potash and phosphoric acid (Ikitoo and Khayrallah, 2001; Saxena *et al*, 2011).

Continuous planting of Sisal in one piece of land continuously is not recommended, as these usually exhaust the soil nutrients, the results is reduced sisal harvest per acreage (Saxena *et al* 2011). The fibre yield is greater if cultivation is done on limestone or coral soil, under moist atmosphere and high temperature with minimal changes (Saxena *et al*, 2011).

2.7.2 Nursery establishment

Although sisal can be grown from suckers, it is best propagated from bulbils which have been raised in the nurseries for about two years (Barman, 2006). Sisal waste should be applied in the nursery once in a while to improve the growth of the plant (Oyen, 2003).

Bulbils may be preferred over suckers for planting. Bulbils or suckers can be collected about 6–8 months prior to the planting. The growth of bulbils is improved by mulching sisal nurseries with grass, paper or polythene. The sisal nursery needs irrigation throughout and weeding in nursery beds is necessary. The nursery incubation period is about 8 months depending upon the growth and vigour of the bulbils/suckers. The area of nursery to main plantation field may be approximately 1:10. Before plantation, the roots should be trimmed slightly and the withered leaves pulled off. Plants with damaged boles should be avoided as this poses the risk of rot (Saxena *et al,* 2011).

2.7.3 Field establishment

Before planting, ploughing should be done to clear weeds. Like any other crop plantation, adequate land preparation is required for sisal plantation, with activities like land clearance, ploughing and digging of pits being basic requirements for such plantations. The transfer of the plants from the nursery to the field should be done before the onset of rain. The dry leaves at the base of the root should be removed before planting, and for the larger plants it is advisable that a string be tied around the central spike, these will ease transplanting of the plants to the main field. Spacing within the field would depend on whether farming is mechanized on not. Table 2.2 depicts the various spacing practices (Haque *at.el.,* 2011).

Table 2.2 Sisal spacing

a) Double row spacing	Population (plants/ha)
4m x 1.2m x 1m	3,846
4m x 1m x 1m	4,000
4m x 1m x 0.75m	5,333
3.75m x 1.25m x 1.25m	3,200
3.5m x 1.5m x 1.315m	3,040
3.1m x 1.5m x 1.5m	2,900
3.0m x 0.7m x 0.7m	7,700

b) single row spacing	Population (plants/ha)
3.5m x 0.95m	3,000
3.0m x 1m	3,333

(Dons Fibre limited, 2016)

Plate 2.2 Single spacing

2.7.4 Weeding

Occasionally weeding should be done to remove plants which compete with sisal for food. According to Oyen (2003) various weeds associated with the sisal plant are couch grass (*Cynodon dactylon* (L.) Pers.), nut grass (*Cyperus* spp.), African couch (*Digitaria abyssinica* (Hochst. ex A.Rich.) Stapf), lalang (*Imperata cylindrica* (L.) P.Beauv.), cow-itch (*Mucuna pruriens* (L.) DC.) and Guinea grass (*Panicum maximum* Jacq). However, in hot areas like the coastal region where soil loses a lot of water, low grass can be grown to enable mulching, but during dry season they should be removed to conserve the little moisture available (Oyen, 2003).

2.7.5 Harvesting

A leaf is considered to be matured, when it attains a length about 0.6-1.0 m and forms an angle of 450^0 with the main spike or the colour of the terminal spine changes to ashy brown. Harvesting of leaf starts from the lowermost whorls to upper ones leaving about 20-25 leaves after first cut and about 10-15 leaves at subsequent cuts (Salum, 2012). This facilitates better growth of sisal plant and good fibre yield. A worker uses a sickle or special curved knife to cut leaf at the base and to trim the spine from the outer end of the leaf. The leaf is then thrown into the 3.0 m space between the row pairs. A typical cutting time per plant is 15 leaves. Once plants on both sides of row space have been cut, the worker collects the leaves into bundles of 50 with orienting butt-ends in the same direction and ties the bundle with sisal leaf fibres. The bundling operation consumes about 46 s per bundle. The bundles are then carried manually (2 to 4 bundles at a time) to the end of the row and stacked. Stacked leaf bundles are later loaded manually on to a tractor trolley and transported to the decorticator site (Naik *et al,* 2016)

Plate 2.3. Sisal Harvesting in Kenya

2.7.6 Fiber Extraction and Processing

The most valuable part of the sisal plant is the fibre and therefore fibre extraction is one of the most important aspects of sisal production. The sisal fiber is usually used for the production of ropes, mats and twines. Sisal wastes are usually used as raw material in the production of paper pulp (Saxena *et. al.*, 2011)

Fibre extraction involves two stages, the primary and the secondary stage (FAO, 2013). To avoid hardening of leaves which makes decortication harder, fibre extraction should be done immediately after harvesting of the leaves (Oyen, 2003). Stage one of the processing involves the extraction of the fibres from the leaves, which is either done mechanically or by hand. For extraction of commercial sisal, use of machines is the most preferred since the hand method yields low quality fibre, it is tedious and a lot of fibre is lost due to breakage. A process of decortication is used to extract the fibres from the leaf tissues. Leaves are crushed and beaten by a rotating wheel set with blunt knives, so that only fibres remain. For the case of large plantation decorticators, all other parts of the leaf are washed away by water. Decorticated fibres are washed before drying in the sun or by hot air. Smallholders just decorticate their sisal leaves and sell when they are still wet. This contributes to the poor quality of sisal fibre

produced by smallholder farmers. Stage two is the processing of the leaves in the factories (Ikitoo and Khayrallah, 2001; Dellaert, 2014).

After extraction, fibre is graded according to colour, strength and finesse after which it is packed in bales (Ikitoo and Khayrallah, 2001).

2.8 Economic value of sisal

The sisal fibre and related products have various uses at the industrial level and domestic level. Table 2.3 below is a list of various uses of sisal as identified by the Food and Agriculture Organization of the United Nations (FAO, 2016).

Table 2.3 Uses of sisal

Sisal product	Characteristics	Uses
Sisal Pulp	Contains high cellulose	Substitute in the manufacture of papers and Cardboards
Sisal Paper	Highly absorbent and fold enduring	Making special cigarette papers, filters and tea bags
Sisal fibre	Strong and Soft	Buffing cloths used to reinforcing plastic in automobile, boats, furniture, water tanks Add strength to cement for building low cost housing in roofing and brake pads processing, sisal can replace the asbestos
Sisal waste	Contains various natural ingredients	Making biogas, pharmaceutical ingredients and fertilizers

(Source: Dons fibre Limited, 2016)

2.9 World production of sisal

Sisal provides 2% of natural fibre used in the world and is ranked 8th among the world natural fibres (EPZA, 2005). Tanzania used to be the world leading sisal producer in around 1960s. Currently, Brazil tops the list of countries producing the highest sisal, followed by Tanzania then Kenya (Oyen, 2003). Other sisal producing countries include Madagascar, China, Guinee, Central Africa Republic, Ethiopia, Malawi, Mozambique, Angola, South Africa and Morocco (FAO, 2016).

In 2013, over 281,000 tons of sisal was produced in the world, with Brazil producing 150,584 tons, followed by Tanzania which produced 34,875 tons. Table 2.4 presents the top ten sisal producing countries in the world. (FAO, 2016)

Table 2.4. Sisal production in the world

Country	Production in tons
Brazil	150,584
Tanzania	34,875
Kenya	28,000
Madagascar	18,950
China	16,500
Mexico	12,000
Haiti	9,000
Venezuela	4,826
Morocco	1,650
South Africa	1,360

(Source FAO, 2016)

Internationally, Kenya is ranked top in the production of best quality sisal fibre. The sisal industry in Kenya is made up of both small scale and large scale farmers. The large scale farmers who operate sisal estates account for 80% of the sisal produced in the country while the small scale farmers produce 20%. Moreover, 80% of sisal produced in Kenya is exported. With China, Morocco, Portugal and Saudi Arabia forming the major export markets (EPZA, 2005).

2.10 Regulation of sisal production in Kenya

The regulatory authority for sisal is the Sisal Board of Kenya which is under the ministry of agriculture. Other than regulatory roles, the board is mandated with the task of promoting the sisal industry. Sisal act of 1946 was the first legislation regulating sisal in the country (EPZA, 2005). An act of parliament was passed consolidating and repealing all legislation on crops, this resulted to the crop production and livestock act which regulates all crops including sisal (Kenya law report, 2016).

2.11 Farmers Information and Awareness towards Agricultural activities

Adomi (2003), observed that farmers live in the rural area and they lack necessary information and awareness for better tools and implementation strategies that can improve their means of farm method, marketing and food storage for all year round food sufficiency. According to Low (2000), information is a means of transferring events for better awareness to add new meaning that could change events, lives, or experiences, awareness and use of information produce knowledge.

Sokoya, Onifade and Alabi (2012), observed that interpersonal connectivity between farmers and agricultural extension agents will enhance farmers' information literacy, knowledge and awareness of current trend in farming that will boost stages of faming.

2.12 Transfer of agricultural technologies from change agents to the farmers

Researchers (Daudu and Anyanwu 2009, Oladele 2011, Ota and Shimayohol 2011, Oladeji, 2012) observed that farmers can get needed information through different channels; majorly through agricultural extension agents, mass media, folk tales, social networking, and interpersonal relationship with fellow farmers and relations and agricultural project administrators like ADRA Kenya officials.

Sharma (2003) states that, Quick dissemination of technological information from the Agricultural Research System to the farmers in the field and reporting of farmers' feedback to the research system is one of the critical inputs in transfer of agricultural technology. For the farmers to adopt new agricultural technologies motivation is very important. There are three main types of farmers' motivation in the adoption process, namely: adoption for political and social rewards, adoption for local consumption, adoption for cash income and adoption for a sustainable environment [Clement et al. 2006]. Sisal farmers can be motivated by cash income and sustainable environment adoption.

2.13 Conceptual Framework

Although sisal provides a great percentage of fibre in the world, there has been a decline in its production in the recent past Hertemink and Wienk(2010) identified several factors that contribute to the decline in sisal production, with the decline in area under sisal cultivation and yield being major factors. This study adopted the factors identified by Hertemink and Wienk (2010) in building a conceptual framework. Figure 2.1 below is schematic representation of factors affecting the sisal production as identified by Hertemink and Wienk, (2010).

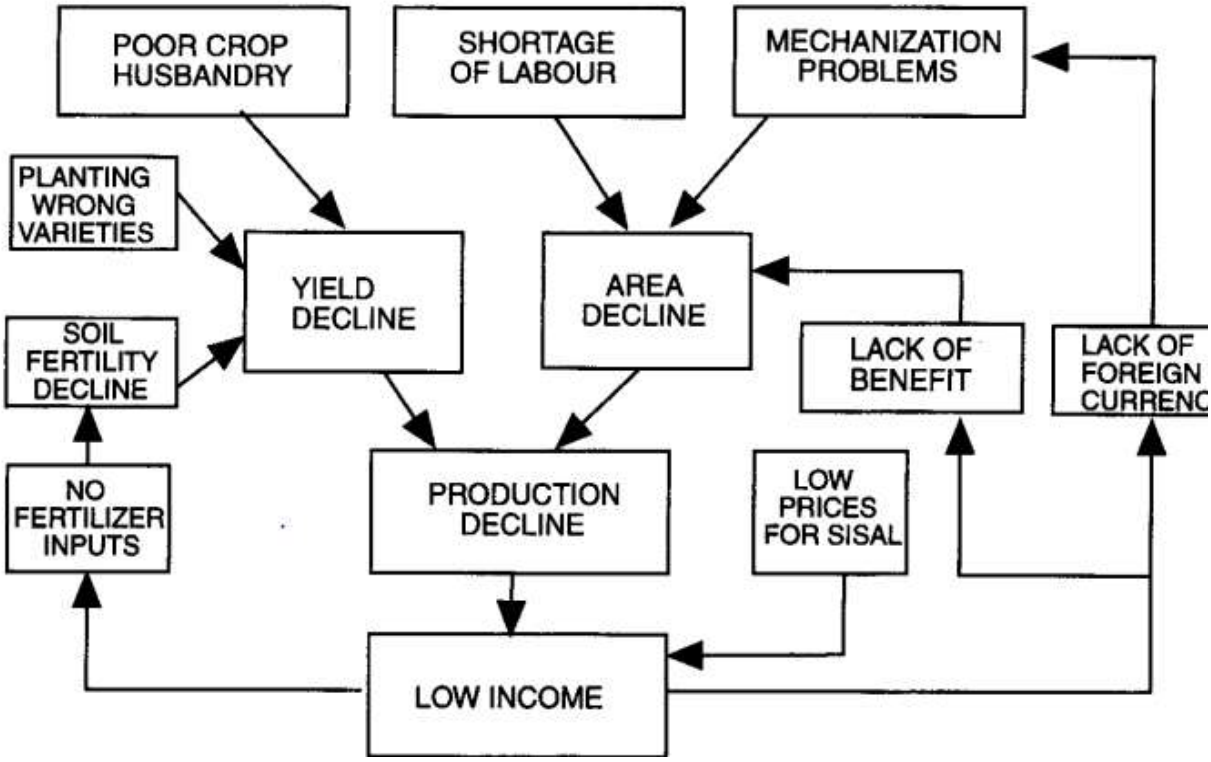

Figure 2.1 Conceptual framework (FAO, 2016)

CHAPTER THREE

3. METHODOLOGY

3.1. Description of the study Area

3.1.1. Location of the study Area

Kiomo Division is in Mwingi Central Sub-County, Kitui County. It lies within the longitude 38^0 01'00' E and Latitude 00^0 55'00'S. It is located about 170km East of Nairobi. The area is part of the arid and semi-arid lands of Kenya. Mwingi Central Sub-County is located in the south-eastern marginal agricultural zone in the Eastern region of Kenya in Kitui County (Figure 3.1)

3.1.2. Climatic characteristics

Temperatures range from a minimum of 14°C to a maximum of 34°C. Highest temperatures are experienced during the months of February and August to October, while lowest temperatures are in the month of July (GoK, 2015)

3.1.3. Hydrological characteristics

The area receives bi-modal rainfall, and has historically received 574mm of precipitation annually (GoK, 2002). Long rains occur between March to May and Short rains from October to November. All the rivers in the region are seasonal they and therefore cannot be relied upon for irrigation since they flow for only two months after the rain season. There is one permanent river, Tana, which crosses at the lower end of the division. The river serves one sub location, Kakongo where some fishing and vegetable production are done. The riverbeds in the area are dry eleven months per year (NDMA, 2014).

3.1.4. Agro-climatic conditions

The vegetation of Kiomo in Mwingi central sub county is tree-shrub-land dominated by *Acacia ssp,* shrubs and grass lands. The region lies at ecological zone IV with savannah characteristic. Agriculture is the main socio economic activity in the area. The field crops which thrive in the area are millet, sorghum, pigeon peas, cow peas and maize. The community also practices some livestock rearing making them to be agro pastoralist.

3.1.5. Socio-economic activities

Generally, in Mwingi central sub county about half of the lands is arable land either under crop or livestock production.

The communities of Kiomo division depend mostly on agro pastoralism. In the recent past, most of the community members depended on crop production but due to erratic and inadequate rainfall in the area, many farmers have shifted from crop production only to mixed livestock production in order to spread the risk. The livestock kept in the area are the zebu cattle and indigenous breeds of goats and sheep. Livestock production has also been declining because of inadequate pasture, which has triggered many farmers to start charcoal burning business to earn for their living. The land tenure system has also contributed to the decline of livestock production since the land has been sub divided to the small portions, which could not accommodate large number of livestock unlike the past where the land was communally owned. This has promoted deforestation and loss of plants diversity due to massive cutting of the indigenous trees.

Some of the community members engage in casual labourers like building and construction of terraces as their livelihood (ADRA, 2013). The overdependence on rain fed agriculture with minimal irrigation and population movement is likely to trigger conflicts over scarce resources (GOK, 2002; Agwata, 2006).

3.1.6. Population characteristics

The study area has a population of 16,267, of which 8% is urban according to the 2009 National population census with 2.1 percent growth rate. Three quarters of the population depend on agriculture either livestock or crop production. Many of the families are female headed households mainly because early pregnancies and men who migrate to towns for search of jobs to cater for their families (ADRA Kenya, 2015).

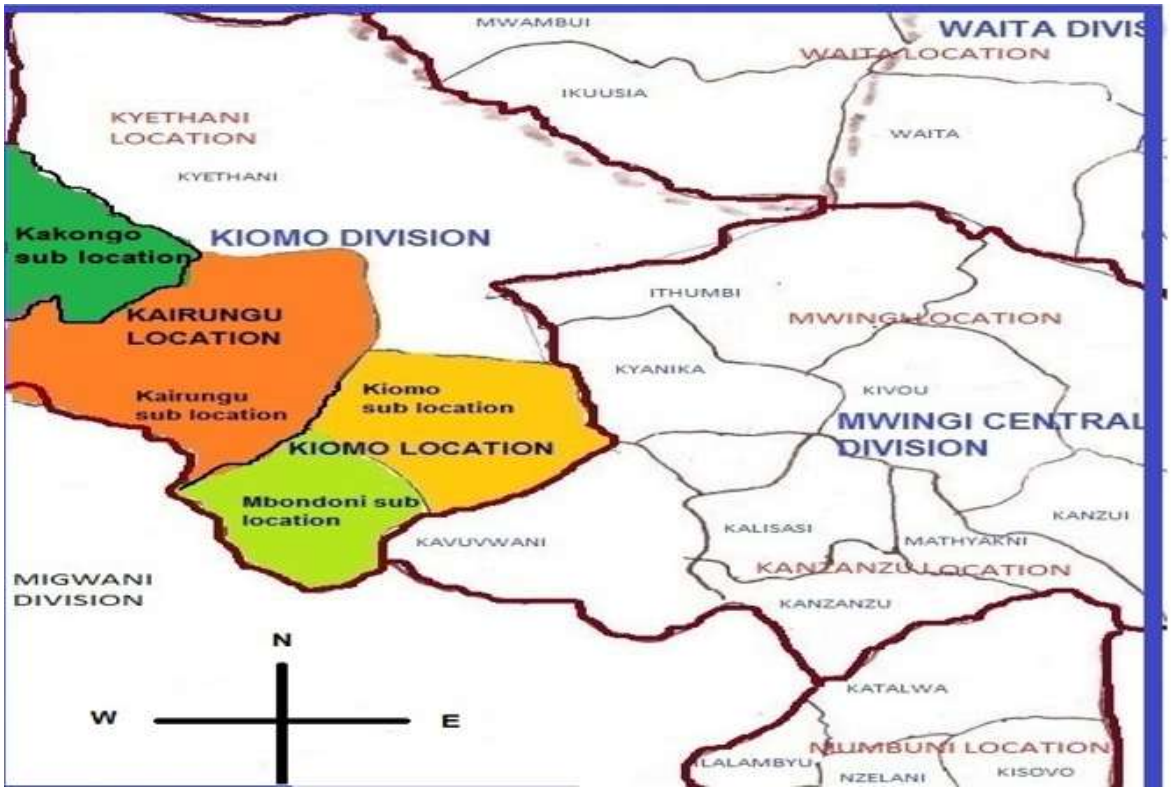

Figure 3.1: Map showing the administrative boundaries in Mwingi Central sub-county

3.2. Study Design

Descriptive research design was used in the study. According to Kothari (2004), descriptive design involves surveys and fact finding enquiries of different kinds. Further, he noted that descriptive research is description of the state of affairs as it exists at present. The rationale for the research design was informed by the need to have in-depth investigation of factors affecting sisal cultivation and adoption in Kiomo division. Moreover, descriptive design not only help describe a population as it is but it also helps to report data collected accurately

(Mugenda and Mugenda, 1999) The study was carried out in two locations of Kiomo division (Kiomo and Kairungu locations). Data was collected from all the sub locations of each of the two locations selected. The sub location are Kiomo and Mbondoni sub locations of Kiomo location, and Kairungu and Kakongo sub locations of Kairungu location (GoK, 2009).

3.3. Primary and Secondary Data Collection

The survey method was used for collection of data used in the study (Kothari, 2004). Total of 184 questionnaires were distributed (75 males and 109 females). To increase the response rate, research assistants interpreted the questions in Kamba language for the participants who didn't understand English. After sorting out the questionnaires, 150 were found perfectly filled

The primary data of the study was obtained directly from the residents of Kiomo division and sisal stakeholders working the Division by administering the questionnaire. The stakeholders working in the area include ADRA Kenya, Tahidi Community Based Organisation, NDMA and Action Aid Kenya (ADRA, 2009). The data from the community respondents was analysed using statistical package for social scientists (SPSS) and data form various stakeholders was collected through group discussants to validate the data from the community.

Secondary data was readily available in the past monthly/quarterly/annual reports from the National Drought Management Authority and the Ministry of Agriculture.

The data was collected using semi-structured open-ended interviews. This involved use of three interview schedules for different respondents, individual household interviews (houses head or any other available but responsible house hold member), key informants (chiefs, Assistant chiefs, ward administrators, village elders, local opinion leaders, local government institutions and NGOs) and Focus Group discussions). .

3.4. Sample Size

According to the 1999 national population consensus (GOK, 2009) the target population for the study was 16,267. The total number of households was 2,783 (Table 3.1)

Table 3.1 Population of the study area

Serial number	Sub location	Number of house holds	Total population	Number of the households selected
1	Kiomo	974	5139	64
2	Mbondoni	597	3674	39
3	Kairungu	712	4374	47
4	Kakongo	500	3080	34
Total		**2,783**	**16,267**	**184**

(Source; GOK, 1999)

The formula below was applied to determine the sample size to be used in the study.

$$n = \frac{Z^2 pq}{d^2} = \frac{(1.96)^2 (0.4)(0.6)}{(0.05)^2}$$

Where:

n = the desired sample size (if the target population is greater than 10,000)

z = the standard normal deviate at the required confidence level (1.96)

p= the proportion in the target population estimated to have characteristic being measured

q= 1-P.

d= the level of statistical significance which was set at 0.05

According to Mugenda and Mugenda (1999) the formula is applicable in studies where the target population is greater than 10,000. Using the formula and the figures in the Table 3.1, a total 368 households was arrived at as the sample size, to represent the whole population but due to homogeneity of the target population, half of the sample size was investigated (Kothari, 2004). Thus, a sample of 184 households was used in the study.

3.5. Random sampling procedure

Preliminary survey indicated that the population in Kiomo division was homogenous with most households having same characteristics including that all practiced small scale sisal farming (ADRA,2013). Thus, random sampling procedure was used to select the respondents (Kothari, 2004). Considering that the number of the respondents per sub location was not the same, the sample selected was dictated by the number of households in the sub-location. The village elders, chiefs and assistant chiefs in each sub location assisted identifying households in the sub-location. The "rand" function in excel was used to allocate random numbers to the households in the list. Thereafter, the random numbers were arranged in ascending order and the first 184 households were chosen for the study (CDC, 2008).

3.6. Data Analysis

Analysis of data was done using Statistical Package for Social Scientists (SPSS) Test Editor. Frequencies, percentages, graphs and chi-square tests were used in data analysis and presentation.

CHAPTER FOUR

4.0 RESULTS

4.1 Introduction

This chapter presents the results obtained from the investigation in the form of data analysis and presentation. The results of the study are discussed in the context of the research objectives. Analysis, presentation and discussion of the findings are organized under the research objectives subtitles as outlined in chapter one.

4.1.1 Socio-economic and demographic characteristics of the sample population

Agricultural activity as a source of livelihood was less popular among the youths aged 30 and below.William et al., (2004) found that majority of farmers who mostly depend on agriculture were aged between 45 and 54 years. The study further noted that if this trend continued, there would be adverse effects on global food production as the old people edge out of farming. This results agrees with Anarfi et al (2005) that demand for land by multinationals make land availability a prominent issue for youths and therefore limits them from participating in agric-based livelihood activities. (Table 4.1)

Table 4.1 Summary of respondent's demography

Variable	Details	Frequency	Percentage	Cumulative
Gender	Female	136	90.67%	90.67%
	Male	14	9.33%	100.00%
Age	20-30 Yrs.	7	4.67%	4.67%
	31-40 Yrs.	24	16.00%	20.67%
	41-50 Yrs.	33	22.00%	42.67%
	51-60 Yrs.	42	28.00%	70.67%
	61-70 Yrs.	43	28.67%	99.33%
	Above 70 Yrs.	1	0.67%	100.00%
Education level	Never went to school	51	34.00%	34.00%
	Primary Level	80	53.33%	87.33%
	Secondary	19	12.67%	100.00%
Location	Kairungu	49	32.67%	32.67%
	Kiomo	68	45.33%	78.00%
	Mbondoni	33	22.00%	100.00%
Income level	0-20,000	48	32.00%	32.00%
	20,001-40,000	96	64.00%	96.00%
	40,001-60,000	6	4.00%	100.00%
Dependency on agriculture	Highly dependent on Agriculture	66	44.00%	44.00%
	Slightly dependent on Agriculture	82	54.67%	98.67%
	Least dependent on Agriculture	2	1.33%	100.00%
Size of land	Up to 5 acres	109	72.67%	72.67%
	6 to 10 acres	32	21.33%	94.00%
	11 to 15 acres	9	6.00%	100.00%

The respondents aged above 70 years were 0.67%, 28.67% between 61 to 70 years, 28% between 51 to 60 years, 22% between 41 and 50 years, 16% between 31 to 40 years, while 4.67% were below 30 years. There was a relationship between the practicing of sisal cultivation for commercial purposes and age of the family representative (P value=.904>P=0.05). The Pearson correlation was -.010 indicating that there was a negative correlation between practicing of sisal cultivation for commercial purposes and age (Table 4.2).

Table 4.2. Association between practicing of sisal cultivation for commercial purposes and age of the respondents (house hold representative).

		Age	Practicing of sisal cultivation for commercial purpose
Age	Pearson Correlation	1	-0.010
	Sig. (2-tailed)		0.904
	N	150	150
Practicing sisal cultivation for commercial sisal cultivation for	Pearson Correlation	-0.010	1
	Sig. (2-tailed)	0.904	
	N	150	150

The study indicated that 34% of the respondents never went to school, 53.33% had primary school education while 12.67% had secondary school education. There was a relationship between the practicing of sisal cultivation for commercial purposes and highest level of education (P value= .417>P= 0.05).There was a positive Pearson correlation of 0.067 indicating that there was a positive correlation between practicing of sisal cultivation for commercial purposes and the highest level of education (Table 4.3).

Table 4.3. Association between practicing of sisal cultivation for commercial purposes and highest level of education of the respondents (house hold representative).

		Practicing of sisal cultivation for commercial purpose	Highest level
Are you practicing sisal cultivation for commercial purpose	Pearson Correlation	1	0.067
	Sig. (2-tailed)		0.417
	N	150	150
Highest level of Education	Pearson Correlation	0.067	1
	Sig. (2-tailed)	0.417	
	N	150	150

The study also indicated that there was a relationship between training received on sisal cultivation and awareness of sisal cultivation for commercial activities (P value= 0.000>0.05) (Table 4.4)

Table 4.4. Association between having received training on sisal cultivation and awareness of sisal cultivation for commercial activities.

		Awareness of sisal cultivation as commercial activity	Training on sisal cultivation
Awareness of sisal cultivation as commercial activity?	Pearson Correlation	1	1.000**
	Sig. (2-tailed)		0.000
	N	150	150
Have you ever received training on sisal cultivation	Pearson Correlation	1.000**	1
	Sig. (2-tailed)	0.000	
	N	150	150

**. Correlation is significant at the 0.01 level (2-tailed).

Majority of the respondents (64%) had a monthly income of the house hold of between Kshs. 20,000 and 40,000 followed by 32% who had a monthly income of upto Kshs. 20,000. Only 4% had a monthly income of between Kshs. 40,000 to Kshs. 60,000 (Table 4.1) There was a relationship between practicing sisal cultivation for commercial purposes and the level of income (P value= 0.541>P= 0.05). The negative Pearson correlation was -.050 indicating that there was a negative correlation relationship between practicing of sisal cultivation for commercial purposes and the level of income (Table 4.5).

Table 4.5. Relationship between practicing sisal cultivation for commercial purposes and the level of income of the house hold

		Are you practicing sisal cultivation for commercial purpose or have you ever practiced sisal cultivation for commercial purpose in the past two years?	Income Level
Are you practicing sisal cultivation for commercial purpose or have you ever practiced sisal cultivation for commercial purpose in the past two years?	Pearson Correlation	1	-0.050
	Sig. (2-tailed)		0.541
	N	150	150
Income Level	Pearson Correlation	-0.050	1
	Sig. (2-tailed)	0.541	
	N	150	150

Most of the respondents (45.33%) were from Kiomo location, 32.67% were from Kairungu location, while 22% were from Mbondoni location. Majority of the respondents (72.67%) owned 5 acres of land and below, 21.33% owned between 6 acres to 10 acres and 6% owned over 11 acres. The data depicts that 44% of the respondents were highly dependent on

agriculture as their major source of living, 54.67% were slightly depended while 1.33% were least dependent. Further, majority of those aged 50 years and above were highly dependent on agriculture compared to those aged below 30 years (Table 4.1).

The fact that women were the majority in sisal farming corroborates with previous studies that revealed that women account for 43% of the agricultural labour force and form over two-thirds of the poor livestock farmers (GoK, 2017). A research carried by World Bank in 2005 indicated that 21.57% of the female population were employed in the agricultural sector while only 23.44% of males were employed in the sector (ILO, 2005). Studies shows that workers of rea vipingo and Taita sisal estate 56.58% are women (Githire 1987). The study illustrated that 136 (90.57%) respondents were females and 14 (9.33%) were males. There was a relationship between gender and awareness of sisal cultivation as a commercial activity (P-Value= 0.215>P= 0.05). The Pearson correlation analysis was 0.102 indicating that there was a positive correlation between gender and awareness of sisal cultivation as a commercial activity. (Table 4.6).

Table 4.6. Relationship between the gender and awareness of sisal cultivation as a commercial activity

		Gender	Awareness of sisal cultivation as commercial activity
Gender	Pearson Correlation	1	0.102
	Sig. (2-tailed)		0.215
	N	150	150
Awareness of sisal cultivation as commercial activity	Pearson Correlation	0.102	1
	Sig. (2-tailed)	0.215	
	N	150	150

Analysis of the data showed that majority of the respondents were females (90.67%) while 9.33% were males. The respondents aged above 70 years were 0.67%, 28.67% between 61 to 70 years, 28% between 51 to 60 years, 22% between 41 and 50 years, 16% between 31 to 40 years, while 4.67% were below 30 years. (Table 4.1). There was a relationship between the age and awareness of sisal cultivation as a commercial activity (P-Value= 0.809>P= 0.05).The Pearson correlation analysis was .020 indicating that there was a positive relationship between the age and awareness of sisal cultivation as a commercial activity (Table 4.7).

Table 4.7. Association between the age and awareness of sisal cultivation as a commercial activity

		Awareness of sisal cultivation as commercial activity	Age
Awareness of sisal cultivation as commercial activity	Pearson Correlation	1	0.020
	Sig. (2-tailed)		0.809
	N	150	150
Age	Pearson Correlation	0.020	1
	Sig. (2-tailed)	0.809	
	N	150	150

Agricultural activity as a source of livelihood was less popular among the youths aged 30 and below. William *et al.*(2004) found that majority of farmers who mostly depend on agriculture were aged between 45 and 54 years. The study further noted that if this trend continued, there would be adverse effects on global food production as the old people edge out of farming.

The study showed that 18% of the respondents had never practised sisal farming before. Those who had been cultivating sisal for 2 years were 20.7%, 30% cultivated sisal for 4 years while 17% for 5yrs and above. (Table 4.9).

Table 4.8 Duration of practicing sisal farming for commercial purpose

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Never	27	18.0	18.0	18.0
	2 years	31	20.7	20.7	38.7
	21/2 years	8	5.3	5.3	44.0
	3 years	23	15.3	15.3	59.3
	31/2 years	5	3.3	3.3	62.7
	4 years	30	20.0	20.0	82.7
	5 years	26	17.3	17.3	100.0
	Total	150	100.0	100.0	

The study illustrated that 81.33% of the respondents have received training on sisal cultivation while 18.67% have not. It showed that 18.67% of the respondents were aware of sisal cultivation but they did not receive technical training while 81.33% had practical knowledge/training of sisal cultivation.

There was a relationship between the income level and awareness of sisal cultivation as a commercial activity (P value= 0.650>P= 0.05). We had a negative Pearson correlation of -0.037 indicating that there was a negative relationship between the awareness of sisal cultivation as a commercial activity and income levels (Table 4.7). Glewwe *et. al.,* (2001) noted that household income levels have a direct correlation with involvement of local farmers in agricultural activities. William, D. K. (2004) instate working paper found it that changes in the structure of household income and consumption enables to see any changes in the role of agriculture in the portfolio of household income and it provide useful background information on patterns of changes in living standards. (Table 4.10)

Table 4.9. Association between the income level and awareness of sisal cultivation as a commercial activity.

		Are you aware of sisal cultivation as commercial activity?	Income Level
Are you aware of sisal cultivation as commercial activity?	Pearson Correlation	1	-0.037
	Sig. (2-tailed)		0.650
	N	150	150
Income Level	Pearson Correlation	-0.037	1
	Sig. (2-tailed)	0.650	
	N	150	150

Respondents never went to school were 34%, 53.33% had primary school education while 12.67% had secondary school education (Table 4.11)

There was a relationship between the highest level of education and awareness of sisal cultivation as a commercial activity (P value= 0.332>P= 0.05). There was positive Pearson

correlation of 0.080 indicating that there was a positive Pearson correlation relationship at .080 between the awareness of sisal cultivation as a commercial activity and the highest level of education. This shows that more educated people got the idea of sisal cultivation for commercial purpose but adoption level were still very low (Table 4.11).

Table 4.10. Association between highest level of education and awareness of sisal cultivation as a commercial activity

		Aware of sisal cultivation as commercial activity	Highest level of Education
Aware of sisal cultivation as commercial activity?	Pearson Correlation	1	0.080
	Sig. (2-tailed)		0.332
	N	150	150
Highest level of Education	Pearson Correlation	0.080	1
	Sig. (2-tailed)	0.332	
	N	150	150

There was a relationship between the highest level of education and awareness of any legislation governing sisal cultivation (P value=.048<P=0.05) The Pearson correlation was .162 indicating that there was a positive correlation between at .161 the highest level of education and awareness of legislations governing sisal cultivation in the county (Table 4.12)

Table 4.11. Association between the highest level of education and awareness of any legislation governing sisal cultivation

		Highest level of Education	are your aware of any legislation governing sisal cultivation
Highest level of Education	Pearson Correlation	1	0.162*
	Sig. (2-tailed)		0.047
	N	150	150
Awareness of any legislation governing sisal cultivation	Pearson Correlation	0.162*	1
	Sig. (2-tailed)	0.047	
	N	150	150

*. Correlation is significant at the 0.05 level (2-tailed).

At 95% significance level, the result indicated that there was significant relationship between awareness of sisal as commercial activity and cultivation of sisal (p-value= 0.408 >p= 0.05). Further, there was a relationship between source of information and sisal cultivation for commercial reasons. (Table 4.12)

Table 4.12: Relationship between source of information and cultivation of sisal

Source of information	Percentage	X^2
Friends and relatives	6.67%	25.7
From ADRA farmers	11.33%	43.7
Tahidi CBO plantation	10%	38.6
No information	72%	42.0
Total	**100**	

P = 0.000

4.3 Legal Requirements on Sisal Cultivation

The respondents' awareness on national regulation for the sisal trade was evaluated based on the Sisal Board Regulations, 2007. The regulation requires that a person intending to engage in propagation of sisal for commercial purposes applies to be registered by KSB as a sisal propagator. Out of the 42 respondents practicing sisal farming, 9.53% had registered, 42.86% had not registered but are planning to register while 47.61% were not aware of the sisal board Regulations (Table 4.13)

Table 4.13. Summarizes the respondents' awareness on legal guidelines and procedures.

Responses	Frequency	% Frequency
Have registered	1	9.53%
Not yet but planning to register with KSB	2	42.86%
Not aware of registration need	9	47.61%
Total	**11**	**100%**

4.4 Seedling Acquisition

ADRA Kenya through brace project provided 58%, friends and relatives provided 30.67% of seedlings, 6% of seedlings are uproot from the fields of absent landlords,road reserves and other public place, local institutions have established nurseries and provided 4% of the seedlings to the community, Tahidi farmer group provided 1.33%. However, there was no correlation between the farmers sources of seedling and sisal cultivation (P value= 0.474>P= 0.05) (Table 4.14)

Table 4.14. Sources of sisal seedlings

Sources of seedlings	Frequency	Frequency (%)	X^2	P-value
Own nursery	6	4%	2.3	0.474
Tahidi group Farmers	2	1.33%	0.8	
ADRA Kenya Plantations	87	58%	0.8	
From friends and relatives	46	30.67%	0.5	
Uprooting in the fields	9	6%	0.1	
Total	**150**	**100**	**4.5**	

4.5 Agro economic factors affecting sisal cultivation in Kiomo Division

The study revealed that only 1.32% of the respondents who were aware of sisal cultivation had knowledge on the best practices of sisal farming, while 98.68% of them were not aware. Of all the hindering factors identified by the respondents, 30.65% was related to insufficiency of skills, 0.77% related to financial constraints and 17.24% was on insufficiency of water. On the other hand, sisal as a source of income was identified as the major driving factor for cultivation of the crop. 12% was associated to weaving materials where community members use the decorticated fibre as a raw material for making baskets and ropes. Sisal poles and fibre being used as building materials by the local people in the rural area was found as one of the driving factor by 5% in the study area. Further, 31.34% of the respondents acknowledged having received government support while 68.66% had not (Table 4.15).

Table 4.15 Agronomic factors affecting sisal cultivation

Restraining Factors	**%**	**Driving Factors**	**%**
Small land sizes / Insufficient land	9	Source of Employment	5
Lack of technical skills	31	Soil conservation	3
Insufficient water supply	17	Source of income	41
Lack of seedlings	12	Construction-material (Fencing, Building)	39
Financial constraints	1	Weaving material	12
Lack of Market	15		
Pest and diseases	7		
Slow growth of sisal	3		
Lack of sisal farming machines and Equipment	4		
Engagement in other farming activities	1		
	100		**100**

4.6 Strategies used by local organizations in promoting Sisal cultivation

Available local organizations involved in promoting sisal cultivation in Kiomo division were ADRA Kenya and Tahidi group CBO. The Ministry of Agriculture was collaborating with the two development partners to train and disseminate information on sisal cultivation. Information derived from key informant questionnaires revealed that the two organizations used various strategies to create awareness and promote sisal cultivation in the study area. These strategies included aggregating farmers into common interest groups, farmer field schools, organizing of farmer field days, demonstration plots and marketing of the sisal products.

4.6.1 Technologies used in sisal cultivation

Through focus group discussants, it was found that the local organizations used a variety of farming technologies which included soil conservation, improved varieties, best agronomic practices like pest and disease control, nursery establishment and harvesting, post-harvest handling, market linkages to promote sisal cultivation. Farmers were trained by ADRA Kenya on planting sisal along the contours on their farms to act as soil conservation structures. The technology has led to more farmers engaging in sisal cultivation, not only for commercial purposes but also for environmental conservation purposes. The organizations had introduced new sisal varieties like hybrid 1300 and hildana. These new varieties have added advantages over the local varieties in the fact that they give long and clean fibre, they take short period to mature and harvest, they have long productive period and finally they do not produce pole.

4.6.2 Sisal Marketing outside Kiomo Division

A total of 5.33% of the respondents were not marketing sisal at all, while 60.67% were not aware that sisal is sold outside Kiomo division. In addition 20.88% of those who had no idea of sisal marketing outside the division were aware of sisal cultivation as a commercial activity. Moreover, 20% of the respondents identified friends, relatives and individual business people as a source of market and 9.33 % ADRA Kenya as a source too (Table 4.16).

Table 4.16. Sisal marketing

Source	**%**
ADRA Kenya	9.33
Friends, relative and other business people within Kiomo	4.00
Friends, relative and other business people outside Kiomo	16.00
Don't market at all	5.33
No idea	60.67
No response	4.67
Total	**100.00**

4.6.3 Formation of common interest groups

Tahidi CBO an umbrella body of 16 Common Interest Groups (CIG) in Kiomo division was formed to facilitate development agendas in the area. One of the objectives of the group was to introduce and promote sisal cultivation in the study area. The strategy was to encourage the other CIGs recruit members and train them to embrace various advanced farming technologies of farming including sisal cultivation.

4.6.3.1 Group membership

The results showed that only 10.67% of the respondents were aware of community groups dealing with sisal enterprises in the division and already registered as members, 20% had not yet joined any group but aware of their existence and were thus planning to join, while 63% of the respondents did not know of any relevant group. Table 4.17

Table 4.17: Group Membership

Category	Frequency	%
Already a Member	16	10.67
Not yet but planning to join	30	20.00
Not aware of any group	95	63.33
Not interested in joining	9	6.00
Total	**150**	**100.00**

4.6.4 Demonstration farms and farmer field days

Demonstration farms were established by both organizations for farmer trainings. Tahidi CBO established Kwamunyanzu demonstration farm in Kiomo Location. The Farm was used to establish sisal nurseries and also as a training ground for those interested in sisal cultivation. ADRA Kenya also established their demonstration farm at Mbondoni location. These farms were established purposely to demonstrate advanced farming technologies of sisal and also breeding of improved sisal varieties. However, the organizations had not established a mechanism of follow-ups and thus there was no way of establishing whether the training had impacted in the farmers' adoption of sisal cultivation or not.

Tahidi CBO also participated in farmer field days where different interest groups were invited to showcase different uses of sisal products such as mats, baskets, ropes and sisal waste compost manure. The groups also participated in agricultural shows especially in the annual Kitui Agricultural show and trade fair to showcase their sisal products.

CHAPTER FIVE

5 DISCUSSION

GoK, (2017) women account for 43% of the agricultural labour force and form over two-thirds of the rural farmers. On the other hand, a research by World Bank in 2005 indicated that 21.57% of the female population were employed in the agricultural sector while 23.44% of the males were employed in the agricultural sector (World Bank, 2005). This study showed that there was a relationship between gender and awareness of sisal cultivation as a commercial activity (P value = 0.809 > P = 0.05).

Majority of the respondents practicing farming were aged 40 years and above. Some of the respondents were post retirement age of 65 years. This was a clear indication that less youth are willing to engage in farming. Agricultural activities as a source of livelihood is less popular among the youths aged 30 and below. This is supported by William (2014) who found that majority of farmers were aged between 45 and 54 years. He further noted that if this trend continues, where less youth are involved in farming, we will have more of farmers outgrowing their effective farming stage which is likely to adversely affect food security in the world. From this study, it was realized that there was relationship between age and awareness of sisal cultivation (P value = 0.809> P = 0.05).

Majority of the respondents (64%) earned between Kshs. 20,000 and Ksh 40,000 per month from agricultural activities, 32% earning between Ksh. 0-20,000 per month and only 4% earning more than Ksh. 40,000. This signified that it was the people of low income who mainly depended on agriculture for their living. Highly depended in agriculture means that the house hold depends solely on agriculture as a source of living. Abdullah and Samah (2014), changes in the structure of household income and consumption affects role of agriculture in the portfolio of household income and provides useful background information

on patterns of changes in living standards. As the farming households grow rich, we expect their demand for agricultural goods to change, with implications on agricultural prices and, possibly, cropping patterns (Benjamin and Brandt, 2004).

Glewwe *et al.* (2001) noted that household income levels have a direct correlation with involvement of local farmers in agricultural activities. The study showed that there was a relationship between income level and awareness of sisal cultivation as a commercial activity (P value = 0.650 > P = 0.05).

Majority of the respondents had primary level of education. This category was followed by farmers who never went to school. This showed that most of the community members who engaged in farming activities were semi-literate and illiterate people. This finding was in line with Mburu *et al,* (2014) who found that majority of small scale farmers in Nakuru had only primary level of education. This is likely to immensely negatively affect the agricultural production in the region as many farmers of this kind may not be in a position to readily adoption of advanced farming technologies. The study noted that the level of education greatly affects the level of technology and modern farming methods to be applied. These was confirmed by Yasmeen *et al,* (2011) in their work on impact of educated farmers on agriculture in which they emphasized on the significant role played by educated farmers in improving productivity. They noted that educated farmers plan and cultivate more efficiently than illiterate farmers (Yasmeen *et. al.*, 2011).

However, Mirotchie (1994) cautioned against when making conclusions on the impact of education level on agriculture. According to him, primary schooling has great positive impact on agricultural production since they can assimilate simple training on agronomic technologies. The study showed that there was a relationship between educational level and awareness of sisal cultivation as a commercial activity (P value =.332>P=0.05). It was found

that not all those who were aware of sisal cultivation as a commercial did the cultivation. There was a relationship between practising of sisal cultivation for commercial purposes and the highest level of education of farmer (p value=.417>p=0.05).

It was found that a number of farmers were not aware of regulations governing sisal cultivation in the country. There was a significant relationship between education level and awareness of legislation governing sisal cultivation in the country (p value = .048<p=0.05). Illiteracy on legislations governing sisal cultivation affected both farmers who had some level of formal education and who didn't, majority of them being primary level and below. Nwaru (2007) stated that formal education helps to enhance farmers' abilities to understand and evaluate legal framework on agricultural production. Exposure to formal education according to Otunaiya and Akinleye (2008) would increase farmer's ability to obtain, process and use information relevant to the adoption of improved agricultural technologies.

Generally, the study established that many sisal farmers were not exposed to the statutory bodies governing sisal production. Many sisal farmers had not adequately interacted with the mandated statutory regulatory bodies for sisal production like Kenya Sisal Board and Sisal

Analysis of the data showed that lack of technical skills (20.67%) was the greatest hindrance to many respondents practicing commercial-sisal farming. This was confirmed by Mburu *et al*, (2014) who found that knowledge and skills have great impact on adoption of new farming technologies. Hartermink and Wienk (1995) identified decline in area under cultivation, low price of sisal, poor husbandry, propagation of wrong varieties and decrease in the length of sisal leaves as major factors affecting cultivation of sisal in many countries.

On market information, analysis of the findings found that the role of non-governmental organization like ADRA Kenya in supporting sisal cultivation. Other than being a major source of information for sisal farmers, the NGOs also provide a ready market for sisal products. The government and other multinational corporations also play a very important role on sisal marketing. According to African Growth and Opportunity Act (AGOA), Kenya enjoys duty and quota free access to the United States of America (USA) market for a wide range of products (GoK, 2015). This means that Kenya export processing zones can enjoy marketing of sisal product with ease. This is expected to boost sisal cultivation in Kenya and the rest of the world.

The study also found that the role of farmer groups in promoting sisal cultivation was very fundamental. Data showed that sisal cultivation groups have not only been a source of seedlings for farmers, but also create a forum for the farmers to engage on improving cultivation of the crop. These groups have the potential of becoming informal savings groups which can contribute to improved livelihood of members (Pascal, 2014).

The study indicated that non-governmental organisation were playing a major role in promoting sisal cultivation in the study area. Aggregation of famers into functional group seemed to encourage them to join farming group from where they access trainings on best sisal agronomic technologies. According to classic study of Coleman found that innovation is initiated in interpersonal discussions between close colleagues and that such discussions are more likely to be influential when matters are uncertain rather than clear-cut (Coleman, and Menzel, 1997). The study established that, if well empowered with specific practical skills, the farmers could be best promoters of positive innovations in the community, especially through common interest groups. When farmers make contact with others, they like to talk about farming. Such talk is not abstract; it shares experiences about individual

farms. Farmers and non-farmers alike, are valued for their ability to relay experiences from other farms. The farmers also exchange knowledge directly by visiting each other's properties. In making these visits, they seek learning they can personally transport back to their own farm (Brenno A. et al. 2014).

CHAPTER SIX

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions,

By analysing the various factors affecting sisal cultivation, it is apparent that socio-economic factors (gender, age, education level, land size, income and awareness levels) have a direct implication on farming and adoption of sisal as a cash crop, with high potential to improve farmers' livelihoods. Further, cultivating sisal as a source of income was the major factor encouraging uptake of the crop's cultivation in the study area, though still at low levels.

The study indicated that the majority of the sisal famers were the aged with youth being less involved. This necessitates the need to revolutionize sisal farming into a commercially viable venture where many youth can be interested and thus get involved. However, active involvement of many farmers could be enhanced through county and/or national government and other non-governmental organizations creation of a sisal farming incentive or subsidy kitty, which is currently lacking in the study area.

The study also found that there was neither strong legal frame work nor established county policy on fibre production especially in the sisal sub-sector. This has led to very little or no research done on promoting sisal cultivation, with minimum or no resources allocated to develop the sub-sector. In addition the development partners have yet to introduce advanced value addition like product diversification, sisal waste utilization in bioenergy production.

It was realised that value addition of sisal products in the study area was very minimal, with most farmers mainly relying on middle-men in buying sisal from their farms, thus fetching

very low farm-gate prices and consequently discouraging many people in engaging in sisal farming.

Most of the sisal farmers in the study area did not benefit from the agricultural extension/advisory services by the government. The Ministry of agriculture has been using demand driven farmer-approach which has led to extension services being directed to other common food crops like maize and little or no attention given to sisal farming.

6.2 Recommendations

Government agencies and development partners promoting sisal propagation and cultivation should study and analyze the factors affecting sisal cultivation and adoption in all the ASALs areas in Kenya for strategic planning. Due to illiteracy level of the community media channels should be explored to create awareness in local language to encourage understanding and implementation of ideas and programs in the easiest ways possible.

The government should devise effective communication mechanism to the community regarding all the legal requirements and procedures regulating sisal cultivation and trade in the country. The communication should prioritize public training. The training should aim at achieving voluntary compliance because of realized benefits as opposed to enforced compliance by policing.

The institutions promoting sisal cultivation in the country should provide technical support as well as favorable market and marketing channels.

The government through the Ministry of agriculture should consider offering government incentives to the sisal farmers in order to encourage them to participate more in sisal

production. This can be done by issuing the farmers with free sisal seedlings/suckers, fertilizers and farm tools and equipment.

The Government should investigate on the effectiveness of the demand driven extension services, especially where new technologies and innovations are being introduced for adoption. The approach can also be applied to sisal cultivation in order to improve on its production.

There is need to establish a development authority modeled to bring together small scale sisal farmers in the ASALs areas for the purpose of forming sisal cottage industries and for joint marketing. This would dislodge middlemen from the sisal value chain, thus ensuring farmers of higher returns which would motivate many to engage in sisal farming.. The sisal development board should be charged with the responsibility of developing technologies and innovations aimed at value addition of sisal fiber as outlined in Kenya's vision 2030.

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APPENDICES

APPENDIX 1: INDIVIDUAL RESPONDENTS INTERVIEW QUISTIONNAIRE

The purpose of this interview schedule is to collect information on sisal cultivation in Kiomo division for the purpose of assessing the factors affecting its cultivation and adoption. The information collected will be treated with confidentiality and used for the purpose of this research.

PART ONE: BIO DATA

1. Farm details and Personal data

Location.....

Sex: Male Female

1.1 Age of the farmer.....

a) 20-30 Yrs b) 31-40 Yrs. c) 41-50 Yrs.

d) 51-60 Yrs e) 61-70 Yrs f) 71 and above Yrs

1.2 Income level:

- ☐ Between 0 and 20,000 shillings
- ☐ Between 20,001 and 40,000 shillings
- ☐ Between 40,001 and 60,000 shillings
- ☐ Between 60,001 and 80,000 shillings
- ☐ Above 80,000 shillings

What is the percentage portion of income is derived from agricultural activity

1.3 What is the highest level of education achieved?

- ☐ University level
- ☐ College level
- ☐ Secondary level
- ☐ Primary level
- ☐ I never went in school

PART TWO: SOCIO ECONOMIC INFORMATION

2.1 Size of the farm in acres.....

a) Up to 5acres b) 6 to 10 acres

c) 11to 15 acres d) above 15 Years

1.3 Any other occupation apart from farming:

Yes No (If yes, which one .....

2.2 Economic activities currently in the farm

a) Cash crops.....

b) Food crops.....

c) Fodder crops.....

d) Dairy cows.....Yes No(If yes how many.....

e) Beef..... Yes No (If yes how many .....

f) Poultry..... Yes/No (If yes how many .....

g) Bee hives.....Yes/No (If yes how many hives.....

h) Others.....

2.3 How long have you used the farm in the above identified economic activities?

a) 1 years

b) 2-5years

c) 6-10years

d) Over 10years

2.4 What has the above economic activities enabled you to achieve?

a) Enough for education of my children and all my domestic needs

b) Enough for education of my children only

c) Enough for my domestic needs only

d) Not enough for my domestic needs.

e) Neither of the above

2.5. Do you have constrains associated with economic activities you have identified above?

Yes/No : If yes, which are these constraints?.....

.....

.....

2.6. How do you handle the constrains identified above

.....

.....

2.7. What do you think are the solutions to the above constrains

.....

.....

.....

2.8. Do you market your farm products: Yes... No.....If yes where do you market

....

2.9. Do you face challenges in marketing these products: Yes.... No.....

If yes state the challenges.....

.....

2.10. Is there other vegetation growing in the farm other than crops? Yes... No.....

Name the vegetation (Can be observed)

a) Grasses.....

b) Shrubs.....

c) Trees.....

2.11. Is there evidence of soil erosion due to any of the following (Can be observed

a) Storm water.....

b) Wind.....

c) Overgrazing .....

d) Others.....

2.12. Give a brief description of the activities involved in soil erosion prevention and control.....

2.13. Is the farm mechanized?

Highly ____ Slightly_____ None_____

PART THREE: AWARENESS OF SISAL CULTIVATION AS A COMMERCIAL ACTIVITIES

3.1. Are you aware of sisal cultivation as a commercial enterprise? YES/NO

a) Yes and already farming (Year of planting .....

b) Yes with interest but not started farming

c) Yes and already growing naturally in my farm

d) Yes but have not had interest

e) No but already growing naturally in my farm

f) Not at all

3.2. If you are aware of sisal cultivation how did you learnt about it?

a) From Tahidi CBO plantations

b) From ADRA kenya Farmers

c) From a friend or relative within Kiomo

d) From a friend or relative outside kiomo division

e) Media

f) Not aware

3.3 If you have planted or wanted to plant sisal, where would you get the seedlings?

a) Own nursery

b) From Taihidi sisal plantation

c) From ADRA Kenya farmers

d) From a friend or relative within Kiomo

e) From a friend or relative outside Kiomo

f) Uprooting from the wild

g) No idea.

3.4 Sisal cultivation may require several activities from planting to maturity. Describe the various steps and activities involved from land preparation to harvesting?.....

……

……..

3.5. The government engages extension services to train farmers on farming activities including how to market their products. Has the extension services assisted you in your

farming activities? YES/NO

a) Yes, (how and when.....

b) Sometimes (give last time.....

c) Rarely. Can't recall when last.....

d) Never.....

e) No idea the services exist.....

3.6, If you have not been assisted, what areas do you feel the extension services would assist you?

- .....
- .....
- …….

3.7 If you have been growing sisal, where do you market your products?

a) To Tahidi CBO plantation

b) ADRA Kenya framers

c) Through a friend, relative or business person within Kiomo

d) Through a friend, relative or business person outside Kiomo

e) Don't market at all

f) No idea it's sold.....

3.8 If you have not started growing sisal are there plans to start and when

a) Yes this season,

b) Yes next season

c) Yes within five years

d) Yes after market has been established

e) Not sure of future plans

f) Never (give reasons.....

3.9 Are you registered as a sisal farmer?

a) Yes (Name registering authority).....

b) No but have applied to.....

c) No but planning to apply.....

d) No I'm not aware of any registration required.....

3.10 Are you a member of a group that promotes the sisal cultivation and marketing activities?

a) Yes already a member (Name of the group.....

b) No but planning to join (Name of the group.....

c) No (I don't know of any group)

d) No and not interested in joining any

3.11 If you have planted what reason has made you plant and if you have not planted what reason would make plant sisal.

i. .....

ii. ....

3.12 What reason discourages you from planting sisal in your farm

…….

4.4. Any remarks and observation useful for this study

.....

.....

Thank you

APPENDIX II. FOCUS GROUP DISCUSSANTS INTERVIEW QUESTIONNAIRE

The purpose of this interview schedule is to collect information on sisal cultivation in Kiomo division for the purpose of assessing the factors affecting its cultivation and adoption. The information collected will be treated with confidentiality and used for the purpose of this research.

1. What are the major economic activities in this area?

i. …….

ii. ……

iii. …….

iv. ……..

2. Do you have constraints associated with economic activities you have identified above? Yes /No ; if yes, which are these constraints?.....
.....
.....

3. How do you handle the constrains identified above
.....
.....

4. What do you think are the solutions to the above constrains
.....
.....

.....

5. Do you market your farm products: Yes... No.....If yes where do you market ....

6. Do you face challenges in marketing these products: Yes.... No.....

If yes state the challenges.....

.....

7. Is there other vegetation growing in the farm other than crops? Yes... No.....

Name the vegetation (Can be observed)

8. Are you practicing sisal cultivation for commercial purpose or have you ever practiced sisal cultivation for commercial purpose in the past two years?

……

…….

9. Have you ever received training on sisal cultivation

☐ Yes

☐ No

If yes, who organized the training _____

10. What factors hinders sisal cultivation in your area?

i. _____

ii. _____

iii. _____

11. Are you aware of any legislation governing sisal cultivation? _____

If yes name them _____

APPENDIX III: INSTITUTIONS' INTERVIEW QUESTIONNAIRE

The purpose of this interview schedule is to collect information on sisal cultivation in Kiomo division for the purpose of assessing the factors affecting its cultivation and adoption. The information collected will be treated with confidentiality and used for the purpose of this research.

1. How was ADRA Kenya started and why was it formed?

.....

.....

2. What is the membership of the group?

.....

.....

3. Are there training programmes for the farmers

.....

.....

4. What training methods do you use in training the farmers

.....

.....

.....

5. How would you rate sisal cultivation in Kiomo.....……

……

6. What activities is ADRA Kenya Farmers involved in

.....

.....

7. Are you the one who does the marketing for the farmer

.....

.....

8. Where do you get marketing information from

.....

.....

9. What is the cost of running the organization

.....

.....

10. Do you process sisal products or do you sell them raw

.....

.....

11. Additional comments or observations

.....

.....