KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY,

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PROCESSING AND UTILIZATION OF SELECTED LOCAL PLANT FIBRES FOR MACRAMÉ

By

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DECLARATION

I hereby declare that this submission is my own work towards the award of the PhD and that, to the best of my knowledge it contains no material previously published by another person, nor material which has been accepted for the award of any other degree of the university, except where due acknowledgment has been made in the text.

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ABSTRACT

Macramé has grown to be accepted as a potential, versatile, fashionable craft capable of complementing other craft, for the process in product development, which has socio-economic benefits as well as a sustaining culture. This study, dealing with the processing and utilization of selected plant fibres for macramé, attempts to examine two things at the same time. The research capitalizes on the vast natural resources and alternative uses of selected plants other than yarns, cords and ropes for macramé. The main aim of this research is to identify some plants which have high fibre yielding properties, which could be extracted and used for knotting macramé. Also, the research sought to introduce the concept of macramé knotting to two communities in Ghana and finally to examine the socio-economic impact of the use of the fibre on the selected communities. The research questions include: which local plants have fibre forming properties within the Daffiama and Odumase Krobo communities in Ghana; how best can these fibres be harnessed for knotting and how the concept of macramé be introduced to the selected communities using the produced cords from plants. The research design is driven by qualitative research method using experimental and descriptive approaches. The population for the study comprised final year students of St. Theresa's's Vocational School (2015/16 academic year), selected traditional basket weavers and a group of bead makers whom the researcher named *Muɛstɛm*. The target population was hundred and ten (110) but finally sixty-nine (69) was accessible for the study. Information was obtained from libraries and the field (indigenes). The data collection instruments were interviews, questionnaire and observation. The data were organized, analyzed and interpreted. The findings revealed that most of the selected plants found in the communities had high yielding fibre properties which when processed could be used to make cords and ropes for knotting macramé. The exposure the respondents had from the macramé weaving was

very positive using the colourful synthetic cords. This exposed the respondents to macramé knots which would further enhance their local production of craft works within their various communities. In conclusion the respondents embraced the macramé craft to enhance their work and were also encouraged to cultivate some of these fibrous plants not only for fuel, medicinal and the likes but also for their high fibre yielding properties which can feed factories to produce yarns and cords. This would go a long way to engage most of our teeming youth for progressively notable transformation.

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CHAPTER ONE

INTRODUCTION

1.1 Overview

This chapter contains information on the Background to the Study, Statement of the Problem, Objectives, Research Questions, and Delimitation. It further defines the technical terms used in the thesis, as well as the various abbreviations. Assumptions of the final results, the Importance of the Study and the organization of the rest of the text.

1.2 Background to the Study

The art of knotting and working with twines, yarns, ropes and cords is known as macramé which predates recorded history. Knots are used in everyday activities of mankind, for example, tying of shoe laces, tying simple bows on gift boxes (Schmid 2006). The art of knotting whether practical or artistic has to be appealing and can become life-long pursuits.

Again, macramé is the art of joining together pieces of flexible materials such as ropes and forming loops or designs by knotting (Horst 2013). It is one of the oldest human skills and serves both utilitarian and decorative purposes. In some cases, knotting has carried magical or religious significance. It is a vital part of many trades and crafts and is particularly essential to sailors and fishermen as they used the art to tie and mend their nets when at sea. The sailors and fishermen used hundreds of knots and probably are the most accomplished practitioners of the craft (Gentry 1978). According to World Book Encyclopedia (2001), macramé is the art of creating practical and decorative articles by knotting cords, ropes or strings.

The art of macramé and its products is well known as a utilitarian product and a fashion accessory in the developed world but has been inadequately studied among the populace in developing countries like Ghana as an off-loom weaving technique. The macramé technique is extremely versatile, allowing one to create both utilitarian and ornamental works of art, from useful and decorative plant hangers, hammocks, macramé clothes and jewellery to more purely decorative forms such as wall hangers and fibre art. The array of things that can result as art forms in macramé is as diverse as each person.

Other examples of the creative use of knotting in the Victorian era are due to the increased varieties of ready-made materials and the rise of leisure time. The total number of knots, bends and hitches known, many of them are exceedingly complicated and each is designed for a specific purpose. Only a number of these knots have been adopted and accepted as basic knots in macramé (Ledbetter 2012).

According to Woollard (2013) macramé knots are made by using twines, cords, yarns and ropes which are interlaced with one another pulled out tight and making sure they do not slip. Examples of such materials are fishing net cords, cotton cords, jute nylon cords, rayon cords and twines and wool. They come in various sizes or ply (thickness) and colours. High cost, and scarcity of these improved cords has prompted this research to explore locally available fibrous materials to find out how they can be treated, processed and used for cords for making macramé.

The study is targeted at making yarns out of local materials from natural sources and using the end results to make sample weaves in order to assess the malleability and flexibility of the cords on the basic knots. The major source of raw material being considered in this study is from plants.

1.3 Statement of the Problem

Macramé is a foreign craft introduced into the Ghanaian society. This modern art of decorating with knots is believed to have originated with 13th-century Arabian weavers. The weavers knotted the excess thread and yarn along the edges of hand-loomed fabrics into decorative fringes on bath towels, shawls, and veils (Druchunas 2004). The basic material used in the knotting of macramé product is the cord. The cords vary from Crochet cotton cords which is soft and easy to work with to others like Embroidery floss cord which is strong and difficult to untie. Hemp; a natural fibre, and Polypropylene are also available as cords for macramé knotting. The Rattail cord also comes in a variety of colours and sizes. Soutache, waxed linen and wire are other examples of macramé cords used in the knotting of macramé products.

In Ghana 90% of cords used in knotting macramé products are from the synthetic fibre sources and are imported into the country from USA. This argument is supported by studies that have shown that there is mass importation of macramé materials from the USA and other European countries and the high demand of macramé materials especially cords making it very expensive to buy these materials (Colton 1979).

According to Milligan (2009), the biggest problem facing the macramé craft industry is getting enough rope or cord to use in order to achieve the required quality and durability of macramé products. The adoption of local natural plant fibres into the macramé industry and the exploitation of natural resource of the country is a unique approach and is therefore a fertile field for research.

With all the talk about protecting the environment and a move away from plastics and synthetic materials, natural fibres appear to be the materials that have tremendous potential as a substitute for the commonly used synthetic fibres. Doing this requires

mobilizing the communities, training the artisans and equipping them with skills to tap into the market around them and beyond.

The lack of creativity and innovation among craftsmen in utilizing the available natural resources in the country is invariably hindering the growth and expansion of the macramé craft industry in Ghana. In Ghana, like many developing countries, it appears that data on the production and use of macramé are not readily available, this is because the art is seen as foreign. Local plant fibres have numerous prospects that are unknown to the Ghanaian populace; especially the craftsmen. Therefore, there is the need to unearth these prospects and to intensify education on them to make the industry a lucrative venture. Although some information has been gathered by researchers about macramé knotting, the attention has always been on the use of imported synthetic cords. Information available on the processing and the use of local natural plant fibres as macramé cord gathered so far by researchers has not been exploited.

The aforementioned issues stimulated the quest to process and use selected local natural plant fibres as cords for knotting macramé. The study, therefore, seeks to process and utilize selected local plant fibres for macramé.

1.4 Objectives of the Study

1. To identify and describe the local use of the plants with fibre forming properties found within the Daffiama community in the Nadwoli District of the Upper West Region and Manya Krobo community in the Eastern region of Ghana.
2. To examine and experiment with the yarns extracted from the selected local plants to see how the yarns can be used for knotting macramé products.
3. To introduce the macramé concept to two institutions in the Daffiama community in the Nadwoli District of the Upper West Region and Manya Krobo women

community group in the Eastern region through training workshops using selected local plants.

1.5 Research Questions

1. What local natural plants have fibre forming properties in the Daffiama community in the Nadwoli District of the Upper West Region and Manya Krobo community in the Eastern region of Ghana?
2. How best can the identified local plant yarns be used for knotting macramé?
3. How can macramé concept be introduced to the selected communities through training workshops using local plant yarns?

1.6 Delimitation

The study focuses on plants with fibre forming components, which abound in the environment which can be cultivated or allowed to grow in the wild. Secondly, the study covers two communities, Daffiama in the Upper West region and Manya Krobo in the Eastern region of Ghana. Reference will be made to other areas where necessary. This was motivated by the fact that some of the raw materials abound within the locality and the art of macramé when introduced into work already being done by the locals would go a long way to promote or enhance their work.

1.7 The Ethnographic Background of Selected Communities

1.7.1 Daffiama-Bussie-Issa District in Context

Ghana's Upper West Region (UWR) is a geographical area of approximately 18477 km² which constitutes about 12.7% of the total land of Ghana (Luginaah 2008). Upper West Region earns the unenviable title as the poorest region in Ghana as it lags behind other

regions, as indicated by successive surveys of the Ghana Statistical Services and other sources. In terms of per capita income, whilst the national annual average is Gh¢ 397.00, UWR has average annual per capita income of less than GH¢ 130.00. It is the region with the highest incidence of poverty of about 88% (Ghana Statistical Service 2007).

The district census report provides basic information about the district. It gives a brief background of the district, describing its physical features, political and administrative structure, socio-cultural structure and economy. The population of Daffiama-Bussie-Issa District, according to the 2010 Population and Housing Census, is 32,827 representing 4.7 percent of the region's total population. Males constitute 48.7 percent and females represent 51.3 percent. Again, 100 percent of the population live in rural localities. The district has a sex ratio of 94.7. The population of the district is youthful (under 15 years) (42.3%) depicting a broad base population pyramid which tapers off with a small number of elderly persons 60 years and above (9.1%). The total age dependency ratio for the District is 95.3, the dependency ratio for males is higher (102.1) than that of the dependency ratio for females (89.3).

The Daffiama-Bussie-Issa District was part of the Nadowli District, which was established by the District Assemblies Law 1988 (Ghana Statistical Service 2014). The Daffiama-Bussie-Issa District was carved out of the erstwhile Nadowli District in 2012 through Legislative Instrument 2100 with Issa as the capital (Ghana Statistical Service 2012).

The district is centrally located in UWR and lies between Latitudes 11°30" and 10°20"North and Longitudes 3°10" and 2°10"West. It is bordered on the south by the Wa Municipality, west by the Kaleo-Nadowli District, north by the Sissala West District and east by the Wa East District (Ayee 1995).

In terms of size, it covers a total land area of 1,315.5 square kilometres and extends from the Billi Bridge (four kilometres from Wa) to the Dapuori Bridge (almost 28 kilometres from Nadowli) on the main Wa – Tumu Road and also from west to east it extends from the Black Volta to Daffiama-Bussie-Issa, the district capital, is 57 kilometres from the regional capital, Wa (Diedeme 2016).

The district lies within the Tropical Continental Zone and the annual rainfall is confined to 6 months in a year, that is, May to September and is also unevenly distributed. The mean annual temperature is 32°C and the mean monthly temperature ranges from 36°C in March to 27°C in August. The mean annual rainfall is about 110mm with its peak around August. Between October and March, the district does not experience any rainfall and this long dry season is made harsher by the dry north-easterly Harmattan winds. In the absence of irrigation facilities, the population depends on rain-fed agriculture; and this has been the major underlying reason for the massive out-migration of the youth to the southern part of the country (Yelsung 2014).

The district lies within the Tropical Continental or Guinea Savannah Wood land, which is characterised by shrubs and grassland with scattered medium-sized trees. Some economic trees found include Kapok, Shea, Baobab, Mango and Dawadawa, which are resistant to both fire and drought. These trees provide a major source of income to women to enable them provide their household needs such as food stuff, cooking utensils, and the like. These economic trees including Shea, Mango and Dawadawa provide a potential for the establishment of processing industries to increase employment opportunities for the people.

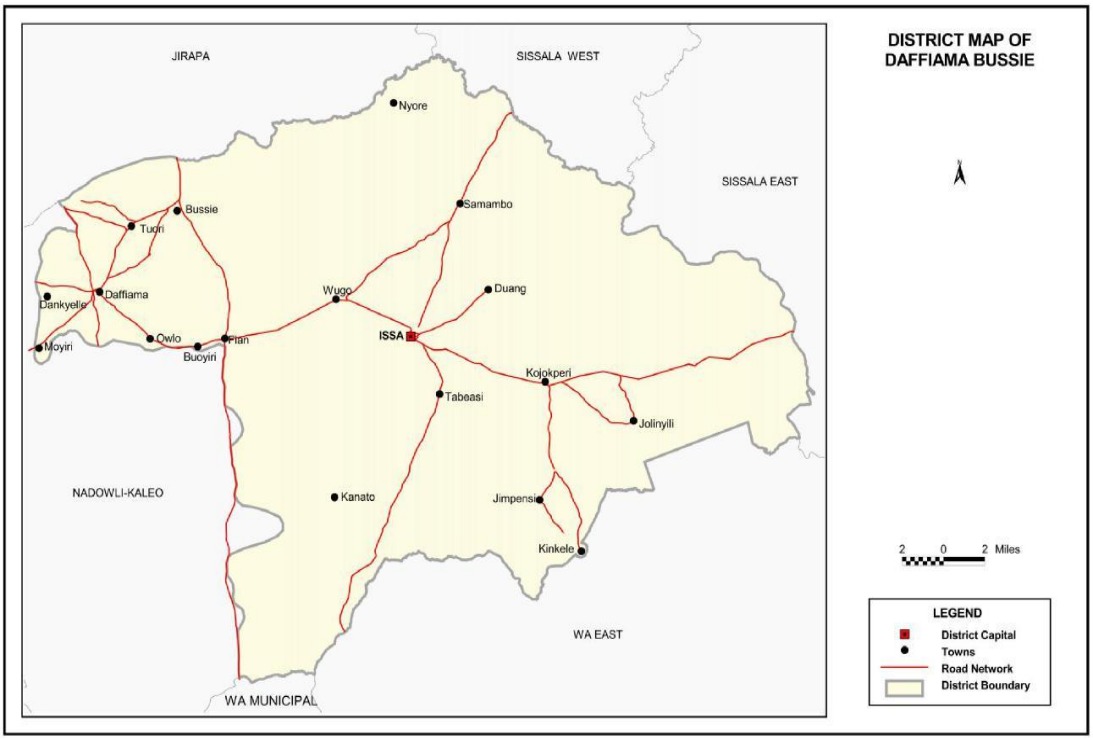

Figure 1.1: Map of Daffiama-Bussie-Issa District

Source: Ghana Statistical Service, GSS

The district is made up of two major ethnic groups, namely the Dagaaba and the Sissalas (Lentz 2006). The Dagaabas constitute the majority (96.0 percent) and the Sissalas who occupy the eastern part form less than five percent. Traditionally, there are three paramount Chiefs in charge of the traditional administration. These paramount Chiefs are the Bussie, Daffiama and Issa.

There are several festivals celebrated in the traditional area and notable among them are the Dunyee and Jinbentim festivals. The Dunyee Festival is celebrated in the month of January and its purpose is to foster unity among community members. On the other hand, Jinbentim is a sacred festival celebrated annually to pacify ancestors and to seek their continual protection.

Available statistics from the 2010 PHC Report identify three main religious groups in the district including Christianity (51.0 percent), Islam (37.0 percent), Traditionalist (8.0

percent) and no religion (4.0 percent). The District depicts a typical rural economy dominated by the agriculture sector with the commerce and industrial sectors as the least developed.

Agyemang (2010) states that the 2010 PHC Report identify commerce or services sector as the second largest employer of labour force after agriculture. It encapsulates a wide range of tertiary activities including petty trading, transport and services provided by civil servants. The sector is dominated by informal small scale trading, especially in agricultural produce and limited modern consumer products. It is characterized by family ownership. The District has seven major periodic markets. These market centres are located in Issa, Bussie, Daffiama, Kojokperi, Tabiesi,Wogu and Sazie. However, these markets are not so brisk to rake in the expected revenue for the District Assembly. Bussie happens to be the market where most of the settlements in the district depend for their shopping needs. The trading activities particularly, in the periodic market centres form one of the major sources of revenue to the District Assembly. There exists one co-operative credit union in Fian, which is the only financial institution in the whole district (Lentz 2001).

The Industrial sector is characterized by small-scale activities and the use of labour intensive production technology. These include basketry, cloth/smock weaving, blacksmithing, and pito brewing, pottery and shea butter extraction. Products from these industries are mainly for the local market since there is inadequate credit and management skills to produce in large quantities for external market.

1.7.2 Manya-Krobo District in Context

Kudadjie (2000) identifies the Krobo as the most numerous among the Dangme speaking tribes (Ada, Ningo, Prampram, Se, Krobo, Osu and Kpone) of south-eastern Ghana.

These include the native inhabitants of both Manya-krobo and Yilo-krobo. The name Krobo which has become the official designation for the tribe follows the spelling of the neighbouring Akan. The people themselves use *"Kloli"* in the plural form and *"Klono"* in the singular. The origin of this name is uncertain but some maintain its derivation from *"Klo"* with the meaning tortoise, considering their tortoise-shaped mountain home.

Others suggest the same root but with the meaning owl, relating that the first settlers when arriving on the mountain met with many of these night birds. This is connected with *AkroMause*, the legendary hunter who according to tradition first discovered the mountain as a suitable dwelling place (Amanor 1991).

The Krobo tribal area extends from 0°18" western longitude to 0°8" eastern, longitude and from 6°2" to 6°32" northern latitude. The neighbouring tribes are to the east, the Dangme speaking Osu, to the north the Akwamu, an Akan race which formerly dominated the area down to the coast, to the west the Akim, Akwapim and a small originally Guan speaking group, Larteh and Kyerepon, to the south the Se, one of the Dangme tribes. The land is flat and dry in the east and have but for some silk, cotton, baobab and palm trees and some cassava and maize plantations near the towns (Dakubu 2006). The more one moves to the western hills to the Up - Countries (Yono) as the area is called, the more one meets with fertile forest land with its many variety of trees, small streams and its rich cultivation. Some of the trees and plants would be of significance to this thesis as most of them are of economic importance to the people of Krobo.

According to Steegstra (2009) the Krobo people are grouped as part of Ga-Dangme ethno - linguistic group and also the largest group of the seven Dangme ethnic groups of south-eastern Ghana. They are a farming people who occupy the Accra plains, Akuapim Mountains and the Afram basin. Most scholars assume that the Krobo migrated from around the regions of Nigeria, crossed the savannah westward, through hostile lands and

crossed the river Volta and settled at the *Tagologo* plains within the Accra plains later called *Lolovor* around the 14th century. After wandering between the present sites of Ada and Lolovor hill, they established their home on the Krobo hill, where to this day, may be seen as the ruins of their old town, built of solid rock, as well as the remains of their ancient ritual shrines (Marshall 2014). The exact plate on which the Krobos divided themselves into Yilo and Manya Krobo is still uncertain. According to one account, the Krobo remained a more or less united nation until 1858 (Arlt 2005).

Ayesu (2011) opines that the Krobo tribe is originally made up of different ethnic and linguistic groups which however do not exactly coincide with the present subdivisions. it is difficult to trace the exact number of the various originally independent kin groups which have united in the two mountain towns and to determine them, the *Klo-ma* (Krobo town) which refers to the two towns on the mountain but comprise also all those who live in the farming villages. The time when they separated into two political units, which were first known as *Nɔwe* (Manya) and *Nyɛwe* (Yilo) is uncertain (Steegstra 2009).

The Krobo broom is made of three top branches of the oil palm which are tied together with the help of their leaves, while the ends of the remaining leaves are cut off. Another broom made from the bunch of *ŋɔwu* grass is intertwined at one end, so that the hand can hold it when sweeping. Baskets for carrying loads are made from palm branches or sticks (*tsokpo*) or a kind of bag (*kpɛ)* woven from the leaves of the *toŋ* tree. Another form of basket (*digblo*) made with leaves of the *Agɔwu - Iolo* palm and the ordinary basket (*kete*) made from the ribs of the oil palm branches, cut into long narrow strips which are interwoven in a manner similar to the common European pattern (Bergert 2000).

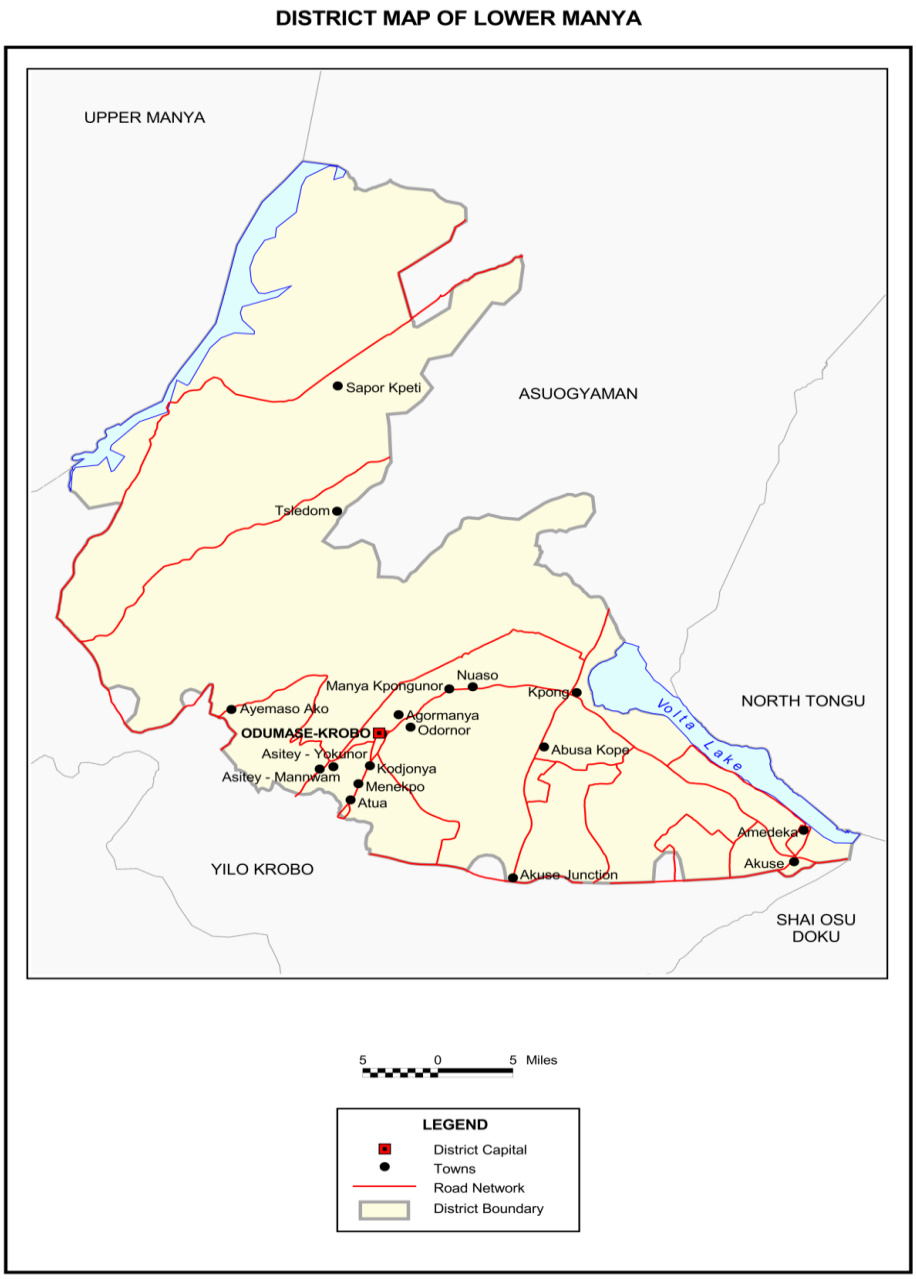

Figure 1.2: District Map of Lower Manya

Source: Ghana Statistical Service, GSS

1.8 Definition of Terms:

Accessories: An extra piece of equipment that is not essential but useful to one's appearance.

Annual Plant: A plant that grows and dies in one season.

Ascending: When the working portion of the cord is going upward.

Cirrus (Cirrhus): A long thread-like organ by which a plant climbs.

Cord: The material used to tie the macramé knots.

Fashion: A popular style of clothes, hair acceptable at a particular time or place. It deals with body art, clothing and foot wear.

Fibre: The smallest unit of a thread or yarn.

Fringe: A decorative feature that results in a large group of dangling ends.

Jute: A strong coarse plant fibre.

Leaf sheath: The lower portion of the leaf stalk of certain plants shaped flat, giving protective clothing to the stem or inner structures of the plant.

Muɛtsɛm: A local name for a group of bead makers in the Krobo dialect.

Pendant: A medium or large size decoration that has a loop at the top so that it dangles below as a cord.

Perennial: A plant whose root remains alive for more than two years but whose stems flower and perish annually.

Scallop: A macramé term referring to a distinct loop of knots created along the edges of crafted items.

Tension: The tightness of the cords as the knot is being made.

1.9 Abbreviations

ASK:	Alternating Square Knot
DHH:	Double Half Hitch.
JK:	Josephine Knot
LHK:	Larks Head Knot
OK:	Overhand Knot
SK:	Square Knot
SPP:	Species

1.10 Importance of the Study

The study is targeted at making fibres from plants within selected communities thus creating awareness on how the fibrous material can be turned into yarns and cords which will reduce the importation of foreign cords.

It will go a long way to create jobs and provide positive results for wealth, making macramé products more accessible and affordable.

Results from this research will serve as a source of information particularly on indigenous textiles for policy-makers and economic planners in formulating economic policies to achieve optimum results.

It will also be useful for government's approach in addressing Human Resource Development and the tapping of expertise for development.

Finally, the study will serve as the basis for further study into the processing of local natural plants in Ghanaian Textile Industry likewise enhancing the teaching and learning of textiles in Schools and Colleges.

1.11 Organization of the Rest of the Text

The thesis is divided into five chapters. Chapter One introduces the thesis with the background information to the study, statement of the problem, it further looks at the ethnographic background of the selected communities for the study, objectives for the research, formulates research questions, outlines research delimitation, defines some technical terms, explains some abbreviations and gives assumptions, finally It states the importance of the study. Chapter Two reviews selected concepts and topics that relates to the study. Chapter Three elaborates the methodologies employed in undertaking the study. Chapter Four gives an in-depth description of the identified local natural plants with fibre forming properties in Ghana based on the data collected through questionnaire, interviews and observations. These are supported with information obtained from literary sources and some photographs from the field. The Chapter also analyses data collected from the field discusses the results and findings relating them to the objectives of the research. Lastly Chapter five summarises the results and findings, draws conclusions and makes recommendations for possible implementation.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Overview

To build theoretical and empirical knowledge for this research, the following sub-topics were reviewed; History of Macramé, the socio-cultural uses of Macramé, history of fibres, fibre forming plants in Ghana, grasses, sedges and rushes, bast fibre, Banana and Plantain, Palm, Rattan and Soft Cane, Leaf fibres, theories applied in the study, populist model, product innovation and the conceptual framework used were reviewed. These plants were classified according to their formation such as grasses, sedges and rushes, bast fibre group, banana and plantain group rattan and soft cane. Finally, the concept of accessories and the theories that supported the study were reviewed.

2.2 History of Macramé

The word macramé is derived from the Arabic word *"migramah"* which is translated as "embroidered veil", "ornamented fringe" and "stripped towel", which basically describes what this knotting technique was first used for. Macramé is believed to have originated around the 13th century when the Arabian weavers started decorating the edges of hand-loomed fabrics such as towels, shawls and veils by knotting the excess thread that was left over along it, coming up with beautiful decorative fringes. Hence, macramé was born as a result of the desire to make a final work look beautiful even up to its finest details, a creative and aesthetic way of dealing with what would otherwise be simple leftovers (Gentry 1978).

According to Blake and Fischer (1994), the art was introduced in Spain during the Moorish conquest and from there it spread to the rest of Europe. The skill arrived in Italy

and France in the early 14th and 15th century and was later introduced into England in the late 17th century at the court of Queen Mary, the wife of William of Orange, where it was used to embellish the elegant dresses and veils of the court members. During the Victorian era, this craft became a favourite, reaching the homes where it was used to decorate curtains, lamp fringes, table cloths, bed spreads and gowns.

World Book (2001) has it that, the sailors had a very important role in spreading this art form around the world, by using the different knots aboard their ships to produce necessary utilities such as hammocks, nets and fix their clothes. They later traded the items produced when they landed. China and America were some of the places where they traded. The Chinese adopted and introduced new knots and designs into their culture. They named their knots and designs according to their shapes, origins or particular uses. This is because Chinese culture makes great use of symbols, thus each knot has a symbolic meaning representing values such as honesty and feelings such as love or friendship. Chinese macramé has been treasured since ancient time for decorative purposes in places like the Chinese Palace halls to domestic homes.

Macramé was popularized in North and South America during the 1960s and the 1970s by the hippie movement. In later years the craze for macramé declined in the US, but it continued in South America (Smucker 2013). According to Schmid (2006), macramé probably originated in the near east in the 19th century BC where warriors wore tunic with knotted fringed ends. Sailors had often enlivened their isolation at sea by making things from cords and ropes for batter trade at ports of call in India and China. Tavin (2005) contends that macramé as the art of decorative knotting, uses series of knots to produce ornamental patterns. Arabian weavers probably developed knotting during the 1200's but macramé was not used until the 1400's. During the 1970's macramé enjoyed

a revival as a modern handicraft. Fibre artist and craft workers developed new patterns and modern uses for the finished fabrics.

Pesch (1976) states that of the many methods of converting fibre into fabrics that have been developed through the centuries, macramé in particular has become extremely popular among textile crafts people. It is one of the most versatile and potentially exciting crafts. Blake and Fischer (1994), introduced knots with a decorative purpose. Any yarn can be used to work macramé depending on the article being made and the finished results required but the most successful are the smooth firm yarns which knot easily and do not slip. Macramé cords should be able to withstand the twists, bends and knotting processes without slipping or breaking. For that matter, cords or yarns to be used have to go through some test to find out their properties, fibre length to width ratio, uniformity, fibre strength and flexibility, fibre extensibility and elasticity, fibre cohesiveness, moisture absorption and desorption, fibre resiliency and abrasion resistance, lustre, resistance to chemicals, density and thermal and flammability characteristics. Today, macramé is enjoying a renewed popularity worldwide. The skill is being revived and revitalized with people appreciating it more and more. The craft is absolutely handmade without making use of any instruments like needles, hooks on hoops making it an alternate to weaving, knitting and crocheting or can even be combined with them.

Macramé is gradually creeping into the crafts business in Ghana. Many youths are taking it seriously with a lot of creativity being put into play. According to (Asmah et al. 2013) there are several known macramé materials in Ghana. These are nylon, jute, rayon, shoe sewing thread, raffia threads, shoelace, cotton threads, fabric strips, leather strips and any other flexible malleable, pliable, strong and hand-friendly material. But the most pleasurable materials to work with are jutes, linen, and cotton because they knot well,

come in a variety of weights, can be dyed and are readily available. Some yarns come with a finish on them such as wax creosote or sizing. In fact any material that can be purchased in great length and is pliable can be used for macramé. Yarns, cords and twines are what seem to play down on the interest of the average learner since most of them are imported and thus come with many economic challenges (Austin 2005).

2.3 The Socio-Cultural Uses of Macramé

Jonathan (2016) states that the art and craft of decorative knotting is macramé. He further stated that the macramé technique is extremely versatile, allowing you to create both utilitarian and ornamental works of art; from useful and decorative plant hangers, hammocks macramé clothes and jewellery, to more purely decorative forms such as wall hangers and fibre art. The array of things that macramé can be used for is as infinitive as the imagination of the human mind, and it can result in art forms as diverse as each person. Since macramé is absolutely handmade, the creation of more complex and intricate designs, consisting of tying hundreds of knots into different patterns, is a very slow and time-consuming process. This adds to the value of this magnificent, ancient skill that has been revitalized by modern times.

Macramé has also proven to be a great natural therapy for those undergoing rehabilitation process and again helps to strengthen the memory, making it a great activity for everyone. Working with the cords and hands, helps to loosen the joints of the wrist and fingers. It also helps calm the mind and spirit as it requires concentration and the repetitive patterns puts the weaver in a meditative mood. Additionally, it is believed to release stress through the fingers, making macramé knotting a relaxing activity. Macramé has the additional benefit of enjoying the process of self-expression through the creation of an inherent objective hidden within (Gentry 1978).

2.4 History of Fibres

Natural fibres have traditionally been used in all cultures of the world to meet basic requirements of clothing, storage, building material and for items of daily use such as ropes and fishing nets. López-Higuera (2002) states that a fibre is a hair-like strand of material. It is a smallest textile component which is microscopic hair-like substance that may be man-made or natural. It is flexible and can be spun or twisted for weaving, braiding, and knotting, crocheting, macramé to mention a few. Fibres can be obtained in natural form from plants and animals as well as in synthetic form (Asmah et al. 2013). Different parts of the plants can be used or extracted. Extraction can be from the bark, stem, leaf, husk, seeds and roots.

Fibre crops can be superior to wood pulp fibre in terms of their performance and distinctive properties, environmental impact (that is positive or negative effects on the environment) or cost. There are a number of issues regarding the use of fibre crops to make pulp; one of these is seasonal availability. While trees can be harvested continuously, many field crops are harvested once a year and must be stored so that the crop does not rot over a period of time. Storage of the fibre source can be a major issue (Asmah et al. 2015). Fibre crops are field crops grown for their fibre, which are traditionally used to make paper, cloth or rope.

2.5 Fibre Forming Plants in Ghana

The main morphological properties determine the suitability of fibres for different uses are the length and width of the individual fibre cells. Cell wall thickness and lumen diameter are generally less important. The chemical properties mainly concern the amounts of cellulose, hemi-celluloses, pectin and lignin in the fibres, the higher the amount of cellulose in a fibre the greater its value. The important physical properties of

plant fibres include strength, elasticity, durability and colour. These characteristics usually vary widely within species even between fibre strands within the same plant.

2.5.1 Grasses, Sedges and Rushes

The cyperaceae are a family of monocotyledonous graminoid flowering plants known as sedges which superficially resemble grasses or rushes. Sedges have edges, rushes are round, and grasses are hollow right up from the ground (McWhorter 2012).

Prina (2012) states that both kinds of plants belong to different botany families. The main differential features are sedges belong in cyperaceae and have spikelet with only one leaflet (glunelas) trigonous stems and only has leaves at the base and at the apex of the plant. On the other hand, grasses belong to poacea has two leaflets (lemma and palea) in each spikelet, stems cylindrical, called culms (canas) and leaves are along the stem.

Another important feature of grasses (poaceae) is that they mainly have a special fruit called cariopsis and sedges (cyperaceae) have a most common fruit called Aquenio (Lekha 2012). Grasses, sedges and rushes can be difficult to tell apart in the horticultural world, we often loosely refer to these three plants as ornamental grasses but they all belong to different plant families. If you look closely, you can distinguish each from the other by their structural differences in their native habitat and distribution. Grasses and rushes can either be annuals or perennials while sedges are all perennials. Grasses and rush stems are typically round or flat, while sedge stems are typically triangular. The stems of sedges and rushes are generally solid while those of grasses are hollow. Grass stems also contain swollen nodes or joints, sedges and rushes do not. In addition, grasses often produce both vegetative and floral stems, whereas sedges and rushes only develop floral stems (Lekha 2012).

Lekha (2012) opines that the leaves on grasses are usually two-ranked which means they occur on two rows on opposite sides of the stems. Leaves on sedges are usually three-ranked where they lie in three vertical planes along the stem. The leaves of rushes are mostly basal and spirally arranged, although this varies among the members of the family. The leaf sheaths (the part of the leaf that hugs the stem) of grasses are usually open, while those of sedges and rushes are usually closed. The flowers of many grasses are relatively shown while those of sedges and rushes are more inconspicuous. Most grasses have bisexual flowers but some are monoecious. Sedges can have flowers that are either bisexual or unisexual. Flowers of rushes are usually bisexual. Grasses and sedges produce single seeds from each flower, while rushes produce three seeds from each flower. Grasses belonging to the gramineae (poaceae) family and are common worldwide, although more species are found in tropical and warm temperate regions than in colder regions. Grasses are most abundant in dry open habitats. The sedge family which also has worldwide distribution is more common in colder, wetter areas. Rushes compromise the smallest family (the juncaceae) which is confined mostly to the colder, wetter and northern parts of the world.

Grasses, sedges and rushes all provide unique texture movement, architecture, colour, sound and year round interest to almost any landscape. According to Madolappa (2013), all three share the following similarities and differences.

Similarities;

1. Lacking colourful perianths (petals and sepals)
2. Having florets comprised glumes which are scales that protect the floret within spikelet
3. Having linear leaves
4. All are wind pollinated

5. Unlike most flowers (dicotyledons), grasses and sedges are monocotyledons, that is, they have one seed leaf rather than two.

Differences

1. Sedges have triangular and solid stems
2. Leaf sheaths that are never split
3. Flowers that are spirally arranged and appearing in four or five rows
4. Flowers are often unisexual, the plant bearing separate male and female inflorescence
5. Flower spikelet's with only one glume

According to Talbot (2006), grasses usually have

1. Cylindrical or flattened and hollow stems
2. Leaf sheaths that are split
3. Flowers and spikelet's that are arranged in two diametrically opposite rows (distichously arranged)
4. Flowers that are bisexual
5. Flower spikelet's with two glumes

2.5.2 Bast Fibre

According to Sen and Reddy (2011), soft woody fibre obtained from stems of dicotyledonous plants (flowering plants with net-veined leaves) and used for textiles and cordage are usually characterized by fineness and flexibility also known as soft fibres distinguishing them from the coarser, less flexible fibres of the leaf or hard fibre group. Examples of useful bast fibres include flax, hemp, jute, Kenaf, ramie, Roselle, sunn and urena. Bast fibre or skin fibre is fibre collected from the phloem or bast surrounding the

stem of a certain mainly dicotyledonic plant (Dusenbury 1992). The bast fibres have often higher tensile strength than other kinds of fibres.

Fibre bundles are often several feet long and composed of overlapping cellulose fibres and a cohesive gum or pectin which strengthens plant stems. Consequently, there are size effects on these longitudinal tensile strengths of composite fibre bundles (Pimenta and Pinho 2013). The fibres are located between the epidermis or bark surface and an inner woody core. Unidirectional fibre bundles have the tendency to contain load-carrying fibres entrenched in their materials; of which is among the few characteristics of the composition of fibre bundles (Raischel, Kun & Herrmann 2006). In harvesting bast fibre, the plant stalks are cut off close to the base or pulled up. The fibres are freed from the stalk by retting but are sometimes obtained by decortication, a manual or mechanical peeling operation. The released fibre bundles called strands are frequently used without additional separation in which case they are called fibres.

Flax and ramie strands, however, are usually separated into individual fibre cells or true plant fibres. Most bast fibres are quite strong and are widely used in the manufacture of ropes and twines, bagging materials and heavy-duty industrial fabrics. Akpaide (1972) says that Congo jute is a plant that yields bast fibres suitable for art.

Dwomoh (1972) also interacts that kenaf is the most promising substitute for jute and adds that, in the northern and upper regions of Ghana, the fibre is used for making domestic ropes and twines. Sackey (2002) also states that hemp fabrics have superior qualities such as UV resistance, distinctive feel, antibacterial properties and breathability. Hemp fibre can be spun as smooth as silk or as coarse as burlap and used for fabrics, apparel, bags, shoes, socks.

2.5.3 Banana and Plantain

Banana is a popular perennial fruit crop that is cultivated in all regions of Ghana except the Northern, Upper East and Upper West regions where the climate is too dry to support its growth. Banana and plantain have similar external features. The trunk of the plantain and banana is a false stem (Dusenbury 1992). It is an arrangement of elongated and flattened leaf stalks. The real stem of the plants is a disc type of stem called the corm, found at the base of the plant. The two plants bear biological characteristics that are closely similar.

Abbiw (1990) mentions the use of the stem of both banana and plantain yields a fibre that is used in West Africa for fishing tackle and in then Gold Coast as a sort of sponge. Dusenbury (1992) states that the fruit peduncle of the banana and plantain plants are beaten, dried and plaited into long strips used in weaving baskets and for making articles such as fans and mats. Akpaide (1972) confirms the banana and plantain plant as sources of good fibre for rope making.

2.5.4 Palm, Rattan and Soft Cane

The oil palm is found in most parts of Ghana. It is the most popular and commonest palm species in Ghana. It grows abundantly in secondary forests. Dusenbury (1992) states that most palm trees in Ghana are not allowed growing up beyond the height of about six (6) metres. At that height, palm trees on commercial plantations are considered as having exhausted their economic life. They are then felled and tapped for palm wine, which may be sold for direct consumption or allowed to ferment for distillation into the popular local gin, *Akpeteshi*.

Abbiw (1990) mentions the palm as a source of raw material for basketry, adding that the midribs of the leaflets of the oil palm, coconut palm, wild date palm and raffia palm are

used for making the common domestic sweeping broom, he goes on to say that the leaves of the fan palm is a raw material for weaving basketry-related products such as bags, baskets, traps, sieves, mats, fans and umbrellas.

Rattan is the name for the roughly 600 species of palms in the tribe calameae native to tropical regions of Africa, Asia and Australasia (Steiner, n.d). Most rattans differ from other palms in having slender stems, 2 – 5 cm diameter with long internodes between the leaves, also they are not trees but are vine-like, scrambling through and over other vegetation. Rattans are also superficially similar to bamboo with solid stems which need structural support because they cannot stand on their own. However, some genera (for example, metroxyion, pigafetta, and raphia) are more like typical palms with stouter, erect trunks (Steiner, n.d)

They have spines which act as hooks to aid climbing over other plants to deter herbivores. Rattans grow up to hundreds of metres long and are much easier to harvest as they require simpler tools and is much easier to transport not like forest wood. Rattans are threatened with over exploitation as harvesters are cutting stems too young and reducing their ability to re-sprout (MacKinnon 1998). Unsustainable harvesting of rattan can lead to forest degradation, affecting the overall forest ecosystem services. Raw rattan is processed into several products to be used as materials in furniture making.

The various species of rattan range from several millimetres up to 5 to 7 cm in diameter. From a strand of rattan, the skin is usually peeled off, to be used as a weaving material. Rattan mainly is lightweight, durable, and suitable for outdoor use and to some extent flexible. Abbiw (1990) differentiates between two kinds of basketry produced from these canes, heavy-duty and light, fancy basketry. It is also employed in weaving fish traps and also for basketry. In Ghana, rattan grows in the Brong Ahafo, Ashanti, Western, Central, Eastern and Volta Regions and generally thrives in a generally swampy forest habitat.

2.5.5 Leaf Fibres

These are fibres sometimes called hard fibres and are obtained from the leaves of certain monocotyledonous plants. They are harder than bast fibres. They have fibrous forming substances which when treated and given a twist can form yarns which can be used for textile product. Examples of such fibres are sisal, pina, abaca (Manila hemp), corn shucks, raffia, just to mention a few.

Sisal Fibre: It is the most important of the leaf fibres and comes from the leaves of a plant which resembles cactus that grows mainly in Central America and the West Indies (Sackey 2002). After harvesting the leaves, they are beaten and the juices squeezed out then the fibres are dried in the sun.

Pina: This is obtained from the large leaves of the pineapple plant grown in tropical countries, very common in the Philippines. According to Burgos (2010), it is sometimes combined with polyester or silk to create textile fabrics. This natural fibre, after processing appears white, very soft and lustrous.

Corn Shucks: Wyman (2003) describes how most products made from corn value the protein, starch and oils. Although these are relevant, he outlines that unfortunately, the most relevant part of the corn which is mainly its residue, that is, the stalks, leaves, husks and cob are largely underutilized. This is a natural phenomenon amongst most fibre forming plants. The corn shucks form a part of the corn residue and they are the leaves which enclose the corn cobs. According to Wyman, the corn fibre is the fibrous shell that surrounds the kernel. It is typically incorporated in animal feed and other corn products. It is a good idea to de-husk or remove them soon after harvesting the maize since they are more pliable then. Maize or corn shucks are brittle by nature when dry, so before they can be used successfully they have to be wet to make them soft.

Raffia: This is a leaf fibre which can be locally obtained and can also be considered as a fibre from a palm tree (Echols, Shadily, Wolff & Collins 2005). The leaves are cut from the bush and the raffia is skillfully removed with the help of a sharp knife. It is a very tedious work and this probably accounts for its high cost on the market. When the raffia is removed, it is dried in the shade and later bundled for sale.

2.6 The Concept of Accessories

Hebrero (2015) opines that fashion design is the art of the application of design and aesthetics or natural beauty in clothing and accessories. Wanda also explained further that fashion design is influenced by cultural and social latitudes, and has varied over time and place. Jones (2012) stated that fashion designers work in a number of ways in designing clothing and accessories. According to Cummings and Cunnington (2010), fashion accessories are items used to contribute in secondary manners to the wearer's outfit and is often used to complete an outfit and it is chosen specifically to complement the wearer's look. In Victorian fashion, gloves, fans and parasols held some type of significance for how women experienced gender, race and class (Beaujot 2012). Also, according to Leino (2012), in Italy, in the early 16^{th} century, men of higher social status wore hat badges as decorative items. Due to these assertions from history, choosing the right accessory to complement a look becomes a difficult situation for a lot of women as they are unsure about the best way to define their status and personality in the area of grooming. Irrespective of what kind of scenario we find ourselves in, one thing that is bound to draw attention to ourselves is our sense of fashion and style, our clothes, make-up, hair, body language and accessories contribute to our personality and how people see us.

According to Beaujot (2012), there are many types of accessories and these include eyewear, hand fan, scarves, shoes, jewellery, jackets, belts, bags, purses, parasols, umbrellas, just to mention a few. There are guidelines one has to look at when choosing what accessories to go with what clothes. There are some factors which affect our choice ultimately, they include, one's profession, place of work, personality, responsibilities among others (Cooper 2018).

Jewellery: There are extremely useful tools when one wants to compliment clothing. A set of lovely necklaces, earrings, bracelets can dramatically improve the look of one's clothes. For those working in a formal establishment the size in terms of our jewellery needs to be simple, modest and decent. It conveys professionalism at all levels (Cummings & Cunnington 2010).

Bags: Bags are containers to keep one's important items. Bags should be cute, simple and nice. In a formal environment darker coloured bags are more appropriate. Excessively large bags are useful for shopping and travelling (Tschinkel 2018).

2.7 Theories Applied in the Study

Change, context of time and place and novelty; these are the main things that fashion involves including the influence it has on the user (wearer) and the society (DeLong 2006). Blumer (1969) as cited in DeLong (2006) states the influence of fashion is a process of collective selection where tastes are formed and derived from people responding to the "Spirit of the times" or as commonly known "going with the flow". The categorization of macramé falls under the several expanses of fashion and fashion accessories as such the following theories were used to guide the study:

2.7.1 Populist Model

This study hinges on generating a conducive work environment in a cultural setting. The populist model guided the study such that, as defined by Polhemus (1994), it involves "style tribes" who are a distinct cultural group who generate distinct identities by way of dressing or decoration; decoration being the keyword for this study in relation to macramé. DeLong (2005) also classifies this model as being polycentric where different groups characterized by virtue of age, location, socioeconomic status and culture make up their own fashions.

This particular theory guided the selection of the people and communities and the particular fibres selected for the study, taking into consideration the parameters stated by DeLong, that is, age, socio-economic status, cultures and the added opportunity of gender. Polhemus (1994) further states in relation to "style tribes" that they may have their own distinctive combination of existing garments, own colours by tie-dyeing or painting and using recyclable materials. In this study, the focus on materials was with the natural fibre forming plants which were easily accessible due to its location to the users (weavers).

2.7.2 Product Innovation

Innovation in this study involved the adoption and usage of selected natural fibre forming plants as substitutes for synthetic fibres available for the production of macramé items. Lehmann (2000) provides compelling arguments about innovations in fashion, however his stance remains that fashion in itself is contradictory in the sense that, it can randomly quote from the past as well as representing the present. In which case is very common with macramé as there are constant changes and innovations in the cords that are used for weaving. According to Lipovetsky (1994), the main determining factors in

fashion are the novel qualities; this is what makes these innovations aesthetically appealing. The selected natural fibre forming plants and how they will be used will serve this purpose of aesthetic appeal along with serving the need for innovation as, per the literature available at the time of this study, and with respect to the locations selected, there are no works that have applied the use of natural fibre forming plants as substitute for synthetic fibres in the production of macramé items.

2.7.3 Conceptual Framework

The conceptual framework developed by the researcher has five main components: *identification of fibre forming plants, identified plants, plant yarns, teaching and learning of macramé* and *income, employment, education and social cohesion*.

The problem of this study is based on a recent study conducted by Milligan (2009) who claims that the biggest problem facing the macramé craft industry is how weavers can get enough rope or cord to use in order to achieve the required quality and durability of macramé products. This has also been supported by Colton (1979) who argues that there is mass importation of macramé materials from the USA and other European countries used in knotting macramé products which originates from synthetic fibre sources, leading to the high demand of macramé materials especially cords making it very expensive to buy these materials.

Essentially, this study sought to process and utilize selected local plant fibres for macramé and the aim and objectives of the study were as follows: 1) *To identify and describe the local use of the plants with fibre forming properties found within the Daffiama community in the Nadwoli District of the Upper West Region and Manya Krobo community in the Eastern region of Ghana*; 2*) To examine and experiment with the yarns extracted from the selected local plants to see how the yarns can be used for*

knotting macramé products. 3) *To introduce the macramé concept to two institutions in the Daffiama community in the Nadwoli District of the Upper West Region and Manya Krobo women community group in the Eastern region through training workshops using selected local plants.*

The significance of the study is that the adoption of local natural plant textiles fibres into the macramé industry and the exploitation of natural resource of the country is a unique approach. It is therefore a fertile field for research in Ghana and other developing countries where macramé production is undertaken. The populace and the local indigenes stand to benefit from the multifaceted nature of the natural plant fibres used in the production and also other uses of these plants.

The theoretical lens used for the study involves the populist model and product innovation. When these two concepts are put together, they form the conceptual framework of the study. Figure 2.1 shows the conceptual framework of the study. The methods used in the study for collecting data involved observation and interview. Data was analysed based on thematic analysis and descriptive statistics. Each of the components of the conceptual framework is explained below:

Identification of fibre forming plants was the initial stage and at this stage, natural fibres were obtained from different sources for the study (see Section 4.3 of Chapter Four). The criteria for identification of plant fibres was gathered through field experience, material collected through various explorations, ethno botanical studies, literature surveys and taxonomic identification of materials received through different plant genetic resource activities, which formed the basis for identification and authentication of fibre forming plants. Also, the researcher made use of the chemical properties in relation to the amount of cellulose, hamie-cellulose, pectin and lignin in a fibre.

Plants were identified and this was based on the criteria as captured in Table 4.2 of Chapter Four. Some of the plants include *Hatso, Kpokpotso, Ho, Nyabatso*, Raffia, among others. Concerning the experiment and fibre extraction component of the framework, see Section 4.7 for various fibre extraction processes as undertaken in the study. The names of plant yarns are also mentioned in Table 4.2 of Chapter Four. Teaching and learning of macramé were held in Daffiama and in Krobo among the Krobo Women's Group. The socio-economic impact assessment on the selected communities is also expanded in Section 4.12.1 of Chapter Four and lastly, the income, employment, education and social cohesion component of the framework is also captured in Chapter Four of the study.

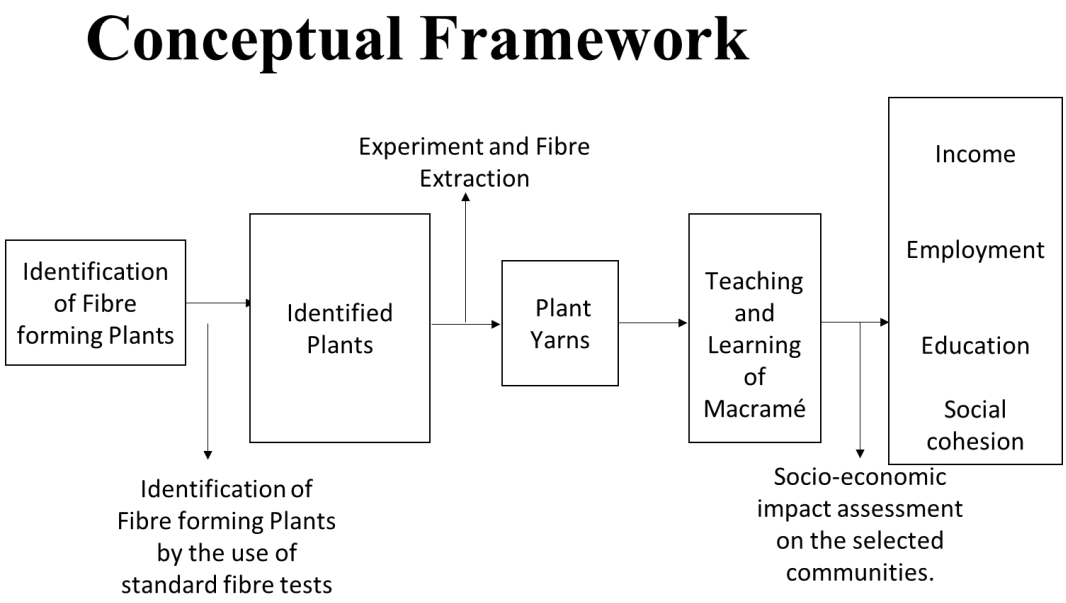

Figure 2.1: Conceptual Framework

Source: Researcher's Construct 2017

2.8 Summary

From the review of related literature, it is quite evident that the most common source of material for the production of macramé products is synthetic fibres. However, in Ghana now, there is the need to support the adoption and usage of products made in Ghana. Hence, the need for a substitute for the synthetic fibres used to produce macramé in Ghana is rather on the high which is the main purpose of this study. This study hopes to achieve this by providing relevant substitute natural fibres that could be used for producing macramé. From the onset, according to Gentry (1978), macramé appeared to be a male dominated skill. This later spanned out as a unisex skill in the 13th century by some Arabian weavers who used them for decorative home products.

Raischel, Kun and Herrmann (2006) state that fibre bundle models provide these characteristics of fibres including the recent additions and developments which have made these fibres more applicable to a variety of experimental situations. This is in line with the main aim of this study, in that, it is to make use of these fibre bundle models and properties in such experimental situations as adopting the macramé technique in weaving.

As obtained from Wyman (2003), using corn as an example, most literary works focus on the health benefits of the fibre forming plants which are eminently essential, however, the residue which also forms a greater part of the importance of the plant is ignored. Most literature available on macramé also tend to focus on teaching of the various knots as a technique that could be used for creating household and utilitarian items. The most common instances are macramé blogs, for example, Modern Macramé (which provides updates, styles, designs, interiors and artist features), Urban Macramé Fibres, Mademoiselle Claudine, Ranran Design and Macramé School. This study therefore hopes to create a platform for bridging this gap by adopting the important parts of these

plants (locally obtained plant fibres) and adopting them in the teaching of the macramé technique to two institutions in the Daffiama and Manya Krobo districts in the Upper West and Eastern regions of Ghana. Using these substitutes for synthetic fibres will birth from the beginning and help maintain the interest of locally derived fibres at a cheaper cost. This goes a long way in promoting the fibres available in these regions for other purposes and also promoting solely made-in-Ghana products.

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CHAPTER THREE

METHODOLOGY

3.1 Overview

Having obtained relevant information on the various components that is necessary to inform the researcher on how to address the purpose of this study, this chapter discusses the research design, population for the study with reference to sampling, data collection instruments, its validation and administration, the data collection procedure as well as data used in this study.

3.2 Research Design

Cohen and Maxwell (2007) assert that research design is governed by the notion of fitness for purpose, and the purpose of the research determines the methodology and design of the research. The research design is however the overall plan for connecting the conceptual research problems to the pertinent empirical research (Van Wyk 2012).

Qualitative researchers study things in their natural settings, attempting to make sense of, or to interpret, phenomena in terms of the meanings people bring to them (Denzin 1994). According to Fraenkel and Wallen (2000), research studies that investigates the quality of relationships, activities, situations or materials are frequently referred to as qualitative research. As stated by Gilbert (1993), qualitative methods provide avenues that can lead to the discovery of deeper levels of meaning into the subject being studied as it investigates the quality of relationships, activities, situations or materials. The ultimate goal of this type of enquiry, according to the literature cited is to portray the complex pattern of this study.

Quantitative research is based on the numerical representation of observations for the purpose of describing and explaining phenomena. In other words, it focuses on studying the relationships between variables and seeks to describe observations through statistical analysis of data. This includes experimental and descriptive research. It attempts to describe the results of the findings from samples.

Qualitative research describes, analyzes and interprets insights discovered in everyday life. In this research, human reaction can be understood by concentrating on the various plant samples. This begins with observation of a phenomenon and its characteristics. Qualitative research is characterised by these advantages (Osuala 2005), the study enables the researcher to gain new insights, develop new concepts and discover problems that exist within the phenomenon. It mostly allows a researcher to view behaviour in a natural setting with influences often associated with experimental or survey research. Finally, it offers a unique and rich approach to understanding what, how and why of events in relation to a particular setting. The researcher believes that the mixed method approach or the combination of the different research approaches and strategies is more applicable in that, one method will suffice where the other may fall short. Owing to this, the researcher used the experimental and descriptive methods.

Research Approaches / Methods

3.2.1 Experimental Research

The experimental research method, according to Ross and Morrison (2003), is a process that provides a systematic and logical procedure of identifying and evaluating the relationship between variables that create a particular state of affairs under controlled condition. The experimental method can therefore be understood to mean a research based on the topic in the hope of making a discovery or as a test of the

research questions of a particular study. The experimental method was employed mainly to gather data to answer the second research question and also meet the demands of the second objective of this study, thus, selected scientific tests have been conducted towards ascertaining the competence of the identified local fibre as a material for the production of yarn for macramé.

True experimental research differs from all other methods of research in that; experimental research requires the manipulation of at least one independent variable. This basically means that researchers decide when variables will serve as the independent variables to be manipulated and which group of participants will receive this treatment (Gay *et al.* 2006). Through the experimental method, the researcher screened all plant samples, extracted all the fibres and found out the various properties of plant samples, that is, elasticity, abrasion, resilience, fibre cohesiveness, moisture absorption, fibre extensibility, density, lustre, chemical resistance, thermal characteristics and flammability.

3.2.2 Descriptive Research

Descriptive research is centred on presenting realistic and detailed explanation of people, events or works of art in details. Again, Descriptive research is written for the purpose of providing the readers with complete detail of events and emotions as they happen. Another function of descriptive research is to try to present events, emotions, sentiments or ideas and images to the reader as realistically as possible (Kerlinger and Lee 2000).

Descriptive research also involves gathering data that describe events and then organises, tabulates, depicts and describes the data collection (Glass and Hopkins 1984). The descriptive research method may be defined as the collection of data for the purpose of describing and interpreting existing condition prevailing, practice, beliefs, attitudes, on-

going process (Ross & Morrison 2003). According to Knupfer and Mclellan (2001), descriptive research method also emerges following creative exploration, and serves to organise the findings in order to fit them with explanations, and then test or validate those explanations. Many research studies call for the description of natural or man-made phenomena such as their form, structure, activity, and change over time, relation to other phenomena.

Thus, descriptive research was used in describing and identifying the various plant fibres, to interpret and report the findings and results of the experiments conducted. This includes fibre reaction to the fibre test performed, that is, elasticity, abrasion, resilience, fibre cohesiveness, moisture absorption, fibre extensibility, density, lustre, chemical resistance, thermal characteristics and flammability. Through the descriptive method, the researcher used visual aids such as plates and figures to help readers have first-hand information on how the fibres would work after they had been transformed into ropes, cords and yarns for knotting.

3.2.3 Action Research

Action research is an interventionist, collaborative approach to analyse social systems by bringing change and generating knowledge about the change (Hewitt and Little 2005). It assumes that social systems can be studied best by altering those. In action research projects, the researcher chooses an inside perspective and becomes actively involved with the research object (Hewitt and Little 2005). Researcher and client work together to examine the practical problem. Action research is in particular useful when processual problems in organisations such as learning and change are investigated (Creswell 2002).

This study was meant to involve two organised groups of Daffiama Vocational students and two groups of Krobo bead makers from the Upper West and Eastern Regions of

Ghana respectively. However, this was not possible due to the large class-sizes. The researcher's values around inclusiveness and the importance of a sense of community, as well as the will to improve the quality of vocational education for the two groups, compelled the restructuring of the original plan by reducing the focus to the Vocational school in Daffiama and selected women from Krobo. This was guided by previous research on the dangers of undertaking large-scale projects, particularly, large number of respondents.

3.2.4 Research Participants

The researcher wished to consider all participants as equal in the research process, and not as objects of the study, and so the researcher sought a form of research that would accommodate her stance on this. Kemmis and McTaggart (1988) describe the features of an action research approach, which appears to commensurate these requirements:

It is not research done on other people. Action research is research by particular people on their own work, to help them improve what they do, including how they work with and for others. It does not treat people as objects for research but encourages people to work together as knowing subjects and agents of change and improvement (p. 22).

This quotation aptly describes the type of equitable and respectful ethos that the researcher hoped would form the framework for the research. In order to avoid the negative effects of a power-based relationship, which could result from doing research on the students, the researcher chose instead to undertake the research with the students, an approach that would regard them as co-researchers.

The researcher wished to consider the two groups as active agents and empowered participants during the course of the research, a hope that the study fulfilled by enabling

the participants to articulate and critique their experiences of discrimination in the educational system. Upon discussion of the issues arising from this research, critiquing about the theory of inclusion assisted in restructuring data collection.

Owing to this, data were collected in the form of field research and were recorded accordingly. These included the main features of the research and reflections during the course of the research process. Other incidents, including peer review, initial interactions with respondents and informal discussions, also with the participants were recorded for easy assimilation and analysis.

3.3 Population for the Study

Population for the study were the students, teaching and non-teaching staff of the St. Theresa's's Vocational School in Daffiama in the Upper West Region, Traditional Basket Weavers in Daffiama, Staff of the Forestry Research Institute of Ghana (FORIG) and the *Muɛstɛm* Women Group in Krobo in the Eastern Region all in Ghana. The target population is the group of respondents that the researcher intends to base the study on and to collect data from. For this study, a target population of 110 participants were to be used in the study as this was the total number of traditional basket weavers, students, teaching and non-teaching staff of St. Theresa's's Vocational School, *Muɛstɛm* Women Group and Staff of FORIG obtained in the preliminary survey (see Table 3.1).

Table 3.1 Target Population of the Study

Population's Characteristics	**Frequency**
Traditional Baskets Weavers in Daffiama, Upper East Region	12
Students of the St. Theresa's's Vocational School	52
Teaching and Non-teaching staff of St. Theresa's's Vocational School	15
Muɛstɛm Women Group in Krobo	24
Staff of FORIG Institute	7
Target Population	**110**

3.3.1 Accessible Population

Accessible population is a group or section of the target population that a researcher can easily reach for data collection. Despite the expected target population of 110 participants, 69 participants were accessible and willing to take part in the study (see Table 3.2). Since this is mainly an action research, all selected groups constitute part of the population. In addition, all teaching and non-teaching staff were used where applicable.

Table 3.2 Accessible Population of the Study

Population's Characteristics	**Frequency**
Traditional Baskets Weavers in Daffiama, Upper East Region	5
Students of the St. Theresa's's Vocational School	40
Teaching and Non-teaching staff of St. Theresa's's Vocational School.	7
Muɛstɛm Women Group in Krobo	13
Staff of FORIG	4
Total Accessible Population	**69**

3.4 Sample and Sampling

Due to restrictive factors of expenses, time and accessibility, it is not always possible or practical to obtain measures from a population. In this regard, the researcher endeavours to collect information from a smaller group or subset of the population in such a way that the knowledge gained is representative of the total population under study. The smaller group or subset selected for observation and analysis is the sample. By observing the characteristics of the sample, the researcher made certain inferences about the characteristics of the population from which it was drawn.

According to Osuala (2005), sampling is taking a portion of the population as a representation of the entire population. Sampling may be described as relying on a cross section of a target population to perform an experiment or an observational study. This is because it is usually not possible to study an entire population. Therefore, without bias, there is the need to select a representative for the population. Therefore, the accessible population was used as the sample size of the study.

3.5 Instrumentation

The three data collection techniques used by the researcher were observation, interviews and questionnaire. The secondary data were obtained from such sources as art dictionaries, encyclopedias, memos, theses and peer reviewed articles.

3.5.1 Design and Administration of Questionnaire

A five-page questionnaire (see Appendix A) was designed to seek information from the Students of the St. Theresa's Vocational School within the population. Both the closed and opened ended types of questions were adopted to enable respondents equally express their views when applicable. Each of the six sections tackles specific areas of interest in the study.

Some respondents were interviewed while others answered the questionnaire. In all, 46 copies of questionnaire were prepared and administered. The questionnaire was administered as follows, 35 students representing 50.7% from St. Theresa's Vocational School, 4 out of 46 were the teaching and non-teaching staff of St Theresa's Vocational School represented by 5.8%. The remaining 10.1% were represented by 4.3% of the *Muɛstɛm* Women Group in Krobo made up of 3 respondents and 5.8% of the staff of FORIG made up of 4 respondents (see Table 3.3). After giving relevant information on how to complete the questionnaire, respondents were given two to three hours to complete the questionnaire.

Table 3.3 Distribution of Questionnaire

Population's Characteristics	**Frequency**	**Percentage**
Students of the St. Theresa's's Vocational School	35	50.7%
Teaching and Non-teaching staff of St. Theresa's's Vocational School	4	5.8%
Muɛstɛm Women Group in Krobo	3	4.3%
Staff of FORIG	4	5.8%
Total questionnaire distributed	**46**	**66.6%**

3.5.2 Observation

Observation is recognised as the most direct means of studying people when one is interested in their overt behaviour. It is a more natural way of gathering data. Data collection through observation may yield more real and true data than by any other method. As a scientific tool, observation may range from the most casual to the most scientific and precise, involving modern, mechanical and electronic means (Bogen 2017). The degree of observer participation can however, vary considerably. The researcher kept an observation checklist for field notes and observations of the harvesting, twisting, and spinning of the identified plants.

3.5.2.1 Observation Checklist

Fibre extraction and treatment

Participants were allowed to do their own fibre extraction from the various selected plants within their jurisdiction. Most of the plants were very easy for treatment because of its suppleness and flexibility. Others were also very easy for treatment because the indigenes were very conversant with their usage. The only difficulty was the fact that the

peels from the plant barks had to be split into smaller units for easy twisting. For the majority of the plants as the peels dried up, participants found it very uncomfortable to twist. Most of the dried fibres had to be soaked again for them to regain their moisture.

After the plants had gained their fine fibrous nature every participant was allowed to give his or her fibre the basic treatment such as dyeing and twisting. On the other hand, scientific treatment was done by the researcher to find out the strength, elasticity and absorption. The scientific experiments were done to ascertain the various properties of the plants as some of the respondents found it difficult using them.

The participants were allowed to twist or put the fibre together into ropes and cord as they knew originally, some did the twisting to perfection. Most participants in Daffiama twisted the kenaf perfectly to the admiration of the researcher. The only problem was that as a novice it will be very inconvenient to twist fibres on your laps. Also, with the leave fibres it was very supple and easy to manipulate.

Introduction of basic knot and manipulation of cords in macramé

Participants in St. Theresa's's had already been introduced to some basic off-loom knots, so it was very easy working with them. The difficulty came about when the traditional weavers were being introduced as they found the knot time consuming though they appreciated some innovations in what they were doing. To the participants who were making accessories they embraced the need to add more colors to their work but they had problem with choice of colors to complement the beads.

After much practice they accepted the use of synthetic cords which are already coloured and very accessible though expensive, thus adding more value to their finished products. It was not easy convincing them to make their own cords from the plant available.

They rather suggested that if the plant fibre could be made into cords and made readily accessible then they would use them otherwise it was going to be extra work for them. Finally, when samples were made with the help of the researcher they showed appreciation in the end product.

3.5.3 Interview

Interview is the careful asking of relevant questions to interviewees in an attempt to obtain relevant answers. It is an important way for a researcher to check, verify or refute impressions gained through observation. The method provides a means to gain information about things that cannot be observed directly (Fraenkel & Wallen 1996). Interviews involve the researcher gathering data directly from others through face-to-face or telephone contact. The method employed for this study was the face to face interview as it helped the researcher to ask specific questions relevant to the processing and utilization of selected local plant fibres for macramé since it gave the researcher the chance to precisely describe the narrations of interviewees and also allowed the researcher establish rapport with interviewees to gain their confidence and support.

3.5.4 Designing Interview Guide

An interview guide was prepared to avoid irrelevant questions. The guide considered the central issue of processing and utilization of selected local plant fibres for macramé at the two study areas. This technique was first used for the preliminary study to find out how much students know about local plants in their communities that have fibre forming properties. This assisted the researcher identify the real issues which are associated with the processing and utilization of selected local plants fibres for macramé. The rationale

for the preliminary study was to ensure that the questionnaire elicited the right response and gathered valid data for the research.

The purpose was to capture primary data devoid of misinformation and misinterpretation from interviewees regarding their perspectives about the study. To ensure the validity of the interview guides, copies were given out for peer reviewing before submitting to the research supervisors for final vetting to make the guide as objective as possible. Sufficient time was given to respondents to prepare for the interviews.

3.5.5 Interviews Conducted

The face-to-face interview conducted by the researcher was one of the data collection instruments used. In that, most of the respondents turned to have more to offer by way of talking than writing. There was the opportunity to ask leading questions whenever the need arose. The researcher in this instance gained rapport which assisted in obtaining information relevant to the thesis and was permitted to visit interviewees anytime the need arose.

In all, 26 respondents were interviewed 'face-to-face' at their respective workplaces, classrooms, lecture halls and homes. All the 5 of the traditional basket weavers in Daffiama consisting 7.3% were interviewed. Five (5) students of St Theresa's Vocational School also representing 7.3% were interviewed. The remaining teaching and non-teaching staff of St Theresa's's Vocational School who were 3 forming 4.3% and 10 *Muɛstɛm* women, forming 14.5% were all also interviewed (see Table 3.4). The responses of the respondents in the interview have been elaborated upon under the sub-heading Data Collection Processes. Most of the interviews were granted only after a letter of commitment and interview guides (Appendix B) were given to the respondents

on demand to enable them prepare for the interview. Most of the interviews were conducted directly at either offices or homes of the respondents, using a tape recorder.

The interviews were conducted both in English and Twi languages where applicable (for members of both indigenous communities who were familiar with English and Twi). Dangme and Dagaare languages were also used for interviews conducted within the Eastern and Upper West Regions respectively to elicit the views of the respondents on the study. For interviews conducted in Dagaare, these were made possible through an interpreter.

Table 3.4 Interviews Conducted

Population's Characteristics	**Frequency**	**Percentage**
Traditional Baskets Weavers in Daffiama, Upper West Region	5	7.3%
Students of the St. Theresa's's Vocational School	5	7.3%
Teaching and Non-teaching staff of St. Theresa's's Vocational School	3	4.3%
Muɛstɛm Women Group in Krobo	10	14.5%
Total Interviews conducted	**23**	**33.4%**

3.6 Validation of the Findings

Throughout the study, the researcher sought to gather data from many sources and to find ways of triangulating the evidences. The researcher having analysed the study and reflected on it, drew up findings based on the criteria mentioned in this chapter. The researcher had a good supportive validation group for the duration of the study. It consisted of two well-trained research assistants. The researcher then shared the findings

with colleagues and a validation group. When the groups agreed with the findings, the researcher then presented them as evidence.

3.7 Ethical Considerations

It is crucial to abide by certain ethical tenets while conducting research. Nolen and Putten (2007) provide a very clear checklist of points to remember when carrying out action research. The researcher kept in mind the power relations existing in the classroom and tried to avoid abusing one's authority as a teacher for the sake of investigating an interesting question. To this end, it was appropriate in getting permission from the respondents in the research, and to impress upon them that they were "participants and principals (not underlings) in the research" (McNiff et al. 1996; Lomax 1994). To consider participants as potential colleagues and partners in the study thereby showing respect and consideration, the researcher made sure to preface the research by first obtaining their consent.

Finally, participants also had the right to withdraw from the research whenever they wished and must be informed of this right. It was only fair and to the benefit of their continued interest in the research "to keep them involved and informed" (McNiff et al. 1996). The respondents were kept informed and, hopefully, involved in the research and their participation in it. At least, by the end of the research, the same participants were still involved in the enquiry although it required them to be interviewed in their free time. They were under no obligation to do this.

3.8 Data and Treatment of Data

In this research, two forms of data were used: primary and secondary data. The primary data consisted of results from experiments conducted at the laboratory. The secondary data were from theses, books, peer-reviewed publications and e-resources, just to mention a few.

3.8.1 Specific Treatment of Data of Each Objective

Objective one

To identify and describe local plants with fibre forming properties found within the Daffiama Community in the Nadowli District of the Upper West Region and Manya Krobo community in the Eastern region of Ghana.

3.8.1.1 Data needed

This comprised picking 22 samples of plants which abound in the environment, botanical gardens and other natural sources which can be easily cultivated or genetically modified. The plants after identification were subjected to shredding, beating and retting to find out if any of their parts were fibrous.

3.8.1.2 Location of Data

Finally, only 8 were selected due to their availability in the community. Plant samples were taken from the Horticulture Department and Botanic Garden both in Kwame Nkrumah University of Science and Technology (KNUST) and FORIG.

3.8.1.3 Means of Obtaining Data

Collection of plant samples were done at the Horticulture Department (KNUST) and experiments performed at FORIG to find out the efficacy of samples taken. These were closely observed and findings and results were documented by the researcher.

3.8.2 Treatment of Data

The data collected were assembled and documented for objective two.

Objective Two

To examine and experiment with the yarns extracted from the selected local plants to see how the yarns extracted can be used for knotting macramé products.

3.8.2.1 Data Needed

This comprised the use of identified plant fibres and twisting them into twines, cords and yarns. The actual fibre test was conducted at this stage. This was to find out if the yarns and cords obtained can be used for knotting macramé as some of the yarns may not be able to go through the bending, knotting and twisting processes due to their non-resilience, elasticity and abrasion properties.

3.8.2.2 Location of Data

Only selected plants which could be twisted from the above samples were used.

3.8.2.3. Means of Obtaining Data

Results from fibre property test were qualified for cord, yarn or twine making.

3.8.3 Treatment of Data

The data collected were assembled, analysed, synthesized and documented for the introduction of the macramé technique to the Daffiama and Manya Krobo districts.

Objective Three

To introduce the macramé concept to two institutions in the Daffiama community in the Nadwoli district of the Upper West region and Manya Krobo women community group in the Eastern region through training workshops using selected local plants.

3.8.3.1 Data Needed

This involved the introduction of the macramé concept to the selected communities to ascertain the use of the basic knots with the extracted yarns.

3.8.3.2 Location of Data

Data for this objective were collected from the Daffiama community in the Nadwoli district and the Manya Krobo community in the Eastern region.

3.8.3.3 Means of Obtaining Data

Responses gathered from interviewees such as trainees in the Daffiama community about the appropriate and alternative uses of the macramé technique were documented by the researcher.

3.9 Summary

This chapter has given an account of the methodology employed for this research. It has discussed how the data were collected, organized, discussed and analyzed in the context of the research questions and the set objectives for the thesis.

The methodology has been treated under the subheadings: research design, population for the study, sampling, and instrumentation, validation of the findings, ethical considerations, data and data treatment.

The population for the study was final year students of St. Theresa's's Vocational School (2015/16 academic year) in the Upper West Region and selected basket weavers, finally a group of bead makers at Krobo in the Eastern region of Ghana.

The target population was one hundred and ten (110) and 69 was accessible for the research.

CHAPTER FOUR

PRESENTATION AND DISCUSSION OF FINDINGS

4.1 Overview

This chapter discusses the criteria of the respondents and their responses. The identification of twenty-two plants, testing of the various plants, then the selection of the eight plants which were used for the study, from the extraction of the fibre through to the making of yarns or cords which were finally used for the macramé weaving.

4.2 Demographics of Respondents

Table 4.1 shows that 65 of the participants are females whiles 4 of the participants are males. It implies that more women are using or producing artefacts using fibres than men. This phenomenon can be backed by the fact that it is a taboo for men to engage in beading for that of the people of Krobo and also vocational studies has a perception of it being associated with females. St. Theresa's Vocational School in Daffiama, the Upper West Region is predominantly an all-female institution with all instructors being females. However, when it comes to the experimentation of the plants it is predominately male dominated as a result of the fact that most of these fibres grow in the wild. The working experiences of the respondents ranges between 1-30years with the oldest working experience coming from the northern region. With these results, it can be concluded that younger people do not find themselves working with natural fibres due to the laborious nature of fibre extraction from plant into yarns. In the future, if the industry in contention are not given the boost or the youth are not encouraged, then the industries will become defunct.

Table 4.1: Demographics of Respondents

Characteristics	Gender	Educational Background	Work Experience (Years)
Traditional Baskets Weavers in Daffiama, Upper West Region	5 Females	MSLC	25-30
Students of the St Theresa's's Vocational School	40 Females	SHS	1-3
Teaching and Non-teaching staff of St Theresa's Vocational School	7 Females	Tertiary Level	5-15
Muɛstɛm Women Group in Krobo	13 Females	-	5-30
Staff of FORIG	4 Males	Tertiary Level	10-20
Total	69	-	-

4.3 Identification and description of local plants with fibre forming techniques

Natural fibres are hair-like threads obtained directly from plants, animals and mineral sources. Botanically, a natural fibre is a collection of cells having long length and negligible diameter. They are obtained as continuous filaments or discrete elongated pieces similar to thread. They can be spun or twisted into yarn. For the sake of this study, the resultant fibre obtained must be sufficiently flexible to go through repeated bending without significant strength deterioration or breakage. The fibre must be able to undergo slight extension in length, without breakage. In other words, the extension deformation of the fibre must be nearly elastic. Fibres from tree sources were obtained from the wood

pulp. Kraft and sulfite also called sulphite refer to the type of pulping process used to remove the lining, bonding the original wood structure thus freeing the fibres for use. Since the valuable fibres are located in the phloem, they must often be separated from the xylem or woody core and sometimes from epidermis, by retting. In the phloem, bast fibres occur in bundles that are glued together by pectin and calcium ions. Often bast fibres have higher tensile strength than other kinds of fibres.

A mallet or beating stick was used for beating the soft woody barks into a pulp. Discarded fufu pestles or mallets were used for this purpose. Sisal leaves when harvested were placed on a hard, regular surface such as a flat stone, a log of wood and the mallet was used to beat the leaves into a soft pulp making sure that the fibres are separated from the pectin. After beating, the fibres were washed and dried. Sometimes the leaves were allowed to be retted. Retting produces a dark coloured fibre, since the leaves were allowed time to decompose. Bleaching thus produces the best colour. For very fine fibres to be used for threading beads, the fibres were combed with a hair comb. They were then plied and twisted together for use. The fibres were hooked to the big toe and both ends were held, depending on how long the rope to be made is, it was then twisted clockwise till all length was made. The rope was plied three times by inserting another strand, twisting it anti-clockwise and twining it clockwise around the first two.

4.4 The Criteria for Identification of Plant Fibres

The identification of the plants, including major and minor cultivated and wild, indigenous and exotic plants worth exploiting for fibres in Daffiama (Upper West) and Krobo in the Eastern region. The information was gathered through field experience, material collected through various explorations, ethno botanical studies, literature survey and taxonomic identification of materials received through different plant genetic

resources activities, formed the basis for identification and authentication of fibre forming plants.

The researcher also identified plants with fibre forming properties based on the bark of the plant with thick walls, long cells and small cavities and using pointed ends. Cellulose is the main component of plant fibres, and the higher the cellulose content of a fibre the greater its value (Brink & Achigan-Dako 2012).

4.4.1 Identification by the use of Chemical/Scientific Procedures

Another criterion used by the researcher to identify fibre forming plants is its chemical properties in relation to the amount of cellulose, Hamie-cellulose, pectin and lignin in a fibre. Pectin bind fibre cells together. Lignin increases the rigidity of the cell wall, makes it less susceptible to predation and less permeable to water (Brink & Achigan-Dako 2012). Based on the criteria the researcher identified the following plants.

Table 4.2: Locally identified Plants in Ghana with the potential of producing fibre

SN	Local Name (Krobo/ Daffiama) English Name	Part of Plant that Contain Fibre	Scientific Name
1	*Hatso* (Krobo) / Congo Jute	Stem	*Urena Lobata*
2	*Kpokpotso*	Stem	*Hildegardia Barteri*
3	*Ho*	Stem	*Veronia Auriculifera*
4	*Nyabatso*	Stem	
5	*Torkojo* / False Baobab	Stem	*Sterculia Africana*
6	Paper Mulberry	Stem	*Broussonetia papyrifera*
7	*Bu*	Leaves	*Sansevieria Atheopica*
8	*Blefota*	Leaves	*Ananas Comusus*
9	*Kutsa-Tatɛɛ*	Stem	*Acacia Kamerunensis*
10	*Bigre* / Kenaf	Stem	*Hibiscus Cannabinus*
11	Rice	Leaves	*Orzya Sativa*
12	Banana (*Koduu*)	Stem	*Musa Sapientum*
13	Plantain (*Madaa*)	Stem	*Musa Paradisaca*
14	Raffia (*Tonto*)	Leaves	*Raffia Fernifera*
15	Corn Husk (*Blefoba*)	Leaves	*Zeamays*
16	Bu (Mother-In-Laws tongue)	Stem	*Sansevieria Aethoiopica*
17	Palm	Leaves	*Arccaceae*
18	Fan Palm (*Womla*)	Leaves	*Filifera (Washintonia)*
19	Oil Palm	Leaves	*Elaeis Guineensis*
20	Coconut Palm	Leaves	*Cocus Nucifera*
21	Sisal	Leaves	*Agave Sisalana*
22	Guinnea Grass (*Chacha*)	Leaves	*Panicum Maximum*

***Source*: Field Research (2015)**

4.5 Identification and description of the Plants

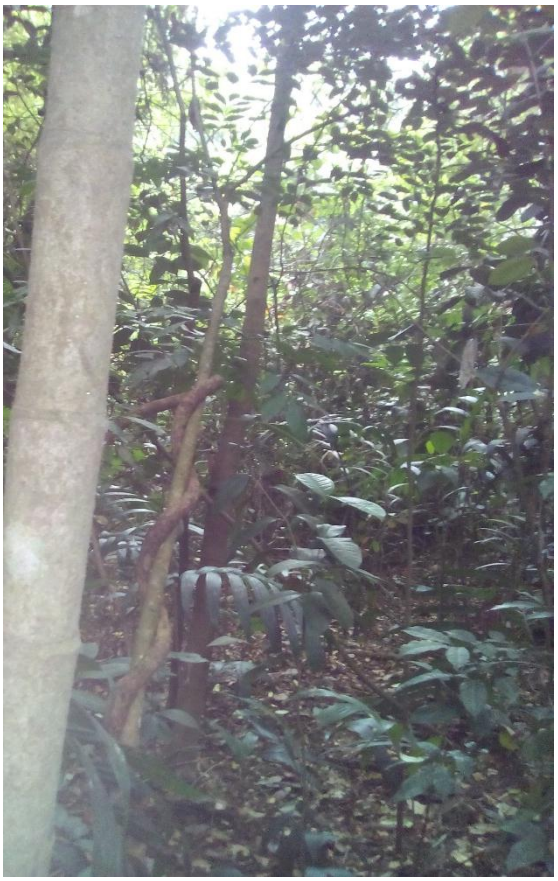

Plate 4.1: Kutsa-Tatɛɛ (Acacia Kamerunensis)

Source: Field Research (2015)

Kutsa-Tatɛɛ ***(Acacia Kamerunensis)***

Family Name: Mimosaceae

Synonyms: *Acacia Pennata*

Locality: Odumase Krobo

Description of Acacia Kamerunensis

Acacia is a wild Liana or scandent shrub with a rough bark, longitudinal bands with downward curved prickles, and greyish in colour and grows up to 5 metres tall. It is a climber which attaches itself to the trees. Its leaves alternate with flowers being bisexual.

It grows in the lowland rain forest and secondary forest. The stem yields a strong fibre which is used for cordage and fishing gear. In Ghana, the fibre is used to make mats for drying cocoa beans. When the lianas are twisted together, the strength increases. The interior part of the stem is chewed by the local people as chew-sticks for cleaning the teeth or beaten into finer fibres and used as chewing or bath sponges. The pods of acacia are used as tannins in Ghana for tanning leather and the leaves are fed to livestock. The leaves can also be used when dried, ground and boiled in water and can be drank, in its liquid state, to cure measles.

To ease toothache, the roots are pulverized and dissolved in a palm wine and cotton wool is dipped into the concoction and inserted into the aching tooth. The leaf sap is applied as a liniment to treat skin diseases. Finally, when peeled off, the stem can be used to tie farm produce. Acacia pennata is a flexible climber whose stem yields a strong fibre. In order to get the fibre out of the stem, the plant is cut about 1 metre from the ground and the stem is cleaned using a sharp cutlass. It is then roasted slightly on fire to make the removal of the bark easier. After peeling, a wooden mallet is used to beat the peeled bark to separate the fibres from the phloem.

When the fibres are separated, they are then washed and dried. Acacia come in two colours, reddish-brown or yellowish-cream. The cream one is often chewed or used to clean the mouth as it has a slight sweetness to it and the reddish one is mostly used for bathing. The fibres does not rot or ret in water, hence its use as bath sponge. Acacia when harvested and to be used as fibres has certain prickles to be scrapped off. When peeled into splits, they are then twisted together into two plies to make them strong. The fibre at this stage is very strong; when dry, it is still strong but not lustrous. The fibre is placed in caustic soda solution, this makes the fibre swell up thus opening up the ply after the first 30 minutes. After this period of time, the fibre shrinks back to its original

size. However, when taken out of the solution, the fibres get smaller than the original size.

When bleached with fabric bleach, it turns cream in colour and it becomes weak as it stays longer and thus at every stretch, it breaks. The fibre at this point does not exhibit any form of elasticity but it absorbs moisture when left in water over a period of time. The fibres burn slowly leaving behind the smell of burning wood. When dyed in a vat or suede dyes, its affinity to the dyes are very good.

Local Usage

Acacia Kamerunensis is located in the Manya Krobo District of the Eastern Region in Ghana. The leaves and bark of these plants are boiled and drunk for treatment of malaria, post-partum pains and the poultice used on wounds. The indigenous people found the barks of the above-mentioned plant as very handy. Their barks are quickly peeled off for tying farm produce, for making traps for catching game, and used as ropes for drawing water from wells. In the case of Acacia, the flexible stem is very spongy therefore, the plant is slightly roasted to make peeling and beating into a pulp easier as well.

Plate 4.2: Sisal, Hemp or Tangme (Agave Sisalana)

Source: Field Research (2015)

Agave Sisalana

Family Name: *Agavaceae*

Synonyms: *Agave Rigida*

Locality: Daffiama and Odumase Krobo

4.5.1 Description of Agave Sisalana

Agave is a robust, monocarpic, perennial herb which grows to about 9 metres tall when matured and flowering. Its leaves are crowded in a dense rosette. The leaves are succulent, arranged in an ascending spiral. The leaves are dark green but covered with a white waxy layer. Sisal is a hardy tropical plant needing full sunlight and moderate relative humidity. Sisal plants have a short stem on which the leaves and the central bud (often called ‘spike’) are borne.

The main sisal product is the long fibre from the leaves which constitute the major part of the hard fibres of commerce. The fibre is mainly used to make twine, ropes, and strings, fishing nets, buffing cloth, dart boards and hammocks. It is also used to make binder and baler twines, carpet-backing, sacks and upholstery. Sisal fibres are used for making special papers like cigarette paper, newsprint, bag paper, carbon paper, banknote paper, filter paper and tea bags. Sisal leaves are harvested at regular intervals during the life-cycle of the crop. The total number of leaves produced during the life of the plant is constant and the rate of leaf emergence is affected by temperature and rainfall. From planting to the first harvest, the total production period and the number of cuttings depend on the environmental conditions. An early start of cutting gives better yields, provided the plants are not cut too severely. Over-cutting results in the formation of more but smaller leaves with lower fibre content. Fibre extraction should be carried out as soon as possible after cutting because leaf juices tend to harden. The fibre is manually extracted by scraping away the leafy parenchyma with a blunt knife or a piece of wood. This method is done for immediate use after which the fibre may be washed and dried either in the sun or an airy place. Excessive drying in the sun may lead to deterioration in colour.

The dried fibre which has become stiff may be beaten slightly with a mallet to free the bundles into fine fibres. This process combs the fibres and the short ones are twisted together to get long yarns which can be used for stringing beads. To obtain large quantities of sisal fibre, retting is recommended. Sisal leaves when harvested are allowed to ret for a few days since when treated fresh it causes itching of the skin (the leaves are therefore roasted or boiled to destroy the acid that causes the itching).

The retted leaves are beaten with a baton into a pulp for the fibres to be separated, it is then washed and the fibres are twisted into twines and used for threading beads and ropes

for tying and weaving. When the fibres are soaked in caustic soda they are rendered weak and when they are immersed in the solution for a long period of time the colour becomes yellow. It becomes whiter when washed in detergents. It is a very strong fibre; whether wet or dry. However, it exhibits very little lustre when dry. Also, when left in bleach, it becomes very white. It exhibits some elasticity when twisted together and is able to absorb moisture when fluffy or beaten into a pulp. It also flames up quickly when dry and smells like burning paper. It dyes very well in vat and suede dyes.

In Ghana, sisal grows wild in the coastal, transitional and forest areas. In the coastal savanna, it is grown widely around the enclosures for cattle. It resembles an oversized pineapple plant. For the cultivation of the plant, suckers are used as in the case of plantain or banana. Sisal may be harvested at any time of the year, however it is recommended that the first leaves are cut when they measure 60 cm or more in length, when they begin to touch the ground or when such leaves begin to wither or rot. At least 25 leaves should be left on the plant after the first cut and 20 leaves at subsequent cuts. Sisal leaves should be cut close to the base. Care should be taken not to cut through the leaf blades because it is preferable to have the full lengths of the fibre intact.

Local Usage

Agave Sisalana popularly known as Sisal is used by the people of Daffiama in the Nadowli District of the Upper West and Odumase in the Manya Krobo District of the Eastern Region. Sisal fibres are used in weaving traditional baskets, making ropes for tying various items, twines for stringing beads, also for tying around the wrist and neck of newborn babies, during puberty rites, the sisal yarns are tied around the neck or upper arm of the initiates. People who use it are mostly the locals from the two communities for study. In Eastern Africa a root decoction is drunk as a diaphoretic and a leaf

decoction as a diuretic, while sap from the leaves is taken to treat constipation and stomach ache and also applied to minor cuts on the body.

Plate 4.3: Kenaf, Bigre, Guinea Hemp (Hibiscus Cannabinnus)

Source: Field Research (2015)

Hibiscus Cannabinnus

Family Name: *Malvaceae*

Synonyms: *Hibiscus Sabdariffa*

Locality: Daffiama (Upper West)

4.5.2 Description of Hibiscus Cannabinnus

Hibiscus Cannabinnus is a common wild plant in most African countries. Kenaf is now widespread in the tropics and subtropics. Kenaf grows naturally in grassland and as a weed in fields and wasteland. It is an annual herb, which grows up to 2 metres tall in the wild and up to 5 metres when cultivated. It has an erect stem, slender and cylindrical, prickly on wild accessions. Its leaves alternate and are simple. It has taproots when well-developed which spread horizontally to 1 metre. It is bisexual, flowers are axillary, solitary or sometimes clustreed near the apex of the plant. Kenaf is usually propagated from seeds, but may also be propagated through cuttings. It survives on well-drained, neutral sandy loams rich in humus. Kenaf grows well in the northern, upper west and upper east regions of Ghana for its food.

Hibiscus Cannabinnus, Kenaf locally called *Bigre* by the locals is a vegetable plant cultivated in the northern part of Ghana. The stem is a source of fibre used in the manufacture of twines, ropes for weaving and tying. The plants are cut near the ground or even sometimes pulled from the ground after the leaves have been eaten as a vegetable and the pods harvested for replanting. They are tied into bundles of even stem thickness. For fibre production the stems are retted in water and decorticated (ribboned) using a small knife and stripped manually from the stems washed thoroughly and twisted into 2 or 3 plies depending on what the yarn would be used for. Sometimes the twisting is done on the thighs. After the fibres have been removed the stems are used for wood fire.

Kenaf are valued for their leaves. After they have been exhausted of their leaves, they may be harvested for their bast by uprooting the whole plant. The leaves are also eaten as vegetables, its bast fibre is used for weaving and tying. When the stems are dried, they are used as fuel for cooking. It is also very strong when wet and when dry. When twisted the ply open up in caustic soda solution. The fibre darkens and becomes slippery and

elastic. It swells up during the first 30 minutes of soaking, then shrinks to smaller than its original size when taken out of the solution. It exhibits some elasticity when in the caustic soda solution and is able to absorb moisture, it also twists well when moist. It flames up when it comes into contact with fire and smells like burning wood. It bleaches well, leaving a creamy, non-lustrous surface. It dyes well in suede dyes even after 15 minutes. On the other hand, it does not do well with vat dyes as the dyes wash out fast. It is also said to be able to resist termites and water.

Local Usage

Bigre as it is locally called is used by the locals for widowhood rites. The fibre from the plant is tied around the waist of the widow. Also the fibre is tied around the left hands or legs of bereaved members of the family. The fibre tied round the waist of a widow is said to ward off the spirit of the dead husband from her. Also, it identifies the chief mourners of the bereaved family from the rest of the members. It is also used to tie up the straw mat on which a dead person is put or laid in state. This is only done to cut down cost due to the abundance of the fibre within the locality. Hibiscus Cannabinus is eaten by the locals as a green leafy vegetable. They are diced and put in soups and stews as a source of vitamin C and K. The seeds of the plants when ground is used for oil extraction and the chaff is fed to the animals. Kenaf produces a bast fibre similar to jute, but with a greater tensile strength, somewhat coarser and more brittle. Fibre extracted are used in making non - textile goods such as weaving baskets, pens for fowls, ropes for tying, bags, mats to mention a few. These ventures are a source of livelihood for the people of Daffiama. Items made from Kenaf are mostly sold on the local market and exported through NGOs into the European markets. In Africa, production is limited and practically all Kenaf fibre is produced domestically, industrial production is reported

from Nigeria and Sudan. After the fibre have been peeled off the stalks or stems are used as wood for fuel for domestic purposes. In so doing, money is saved for burning fuel. Kenaf is a high-yielding plant fibre for the market. At present its main constraint is its sensitivity to nematodes. Kenaf fibre is a biodegradable and environment-friendly raw material suitable for many applications, such as woven and non-woven fabrics, Geotextiles and semi-rigid and laminated sheets for packaging and paneling. Kenan stems are excellent substitute for soft wood as raw material for the pulp and paper industry (PROTA 16).

Plate 4.4: Hu, Ho (Vernonia Auriculifera)

Source: Field Report (2015)

Vernonia Auriculifera

Family Name: *Asteraceae*

Synonyms: *Vernonia Biafrae*

Locality: Odumase Krobo

4.5.3 Description of Vernonia Auriculifera

Vernonia is a small tree, shrub or woody herb which grows up to 9 metres tall. It grows in open grassland or at the margin of forest in mountainous areas. When plantations are abandoned, it is likely for Vernonia to sprout. The plants may be propagated by seed and they grow fast yielding fuel wood in 3-5 years. It sprouts wherever it is cut.

The stems, leaves and flowers yield a dye, green or gold, which dyes well without a mordant. It is said that Vernonia improves the soil or gives shade to nursery crops. The root of the plant is used in treating toothache. The sap in the bark of the stem is also used to treat headache. Leaf extracts are drunk as oxytocic and abortifacient and against post-partum pains. The erect stems yield a strong fibre which does not rot in water, hence it is used to draw water from wells and is also used to make ropes to tie around the necks of livestock such as goats.

When put in a solution of caustic soda it does not react due to the structure of its fibre bundles, in that they are not receptive. It is not lustrous and is very strong when wet. It has been able to retain water for a long time. When it comes into contact with fire, it flames up quickly when dry so it is best used as fuel wood and it also smells like burning paper. It dyes well with both suede and vat dyes. It bleaches very well and leaves a creamy surface.

Local Usage

Vernonia Auriculifera is located in the Manya Krobo District of the Eastern Region in Ghana. The leaves and bark of these plants are boiled and drunk for treatment of malaria, post-partum pains. Some of them are provided and the poultice used on wounds. The

indigenous people found the barks of the above-mentioned plant as very handy. Their barks are quickly peeled off for tying farm produce, for making traps for catching game, and used as ropes for drawing water from wells. It is gummy and must be used immediately after harvesting before it rets or dries up

Plate 4.5: False Baobab, Tokokzo, Tokojo (Sterculia Africana)

Source: Field Research (2015)

Sterculia Africana

Family Name: *Sterculiaceae*

Synonyms: *SterculiaTragacantha, Triphaca*

Locality: Odumase Krobo

4.5.4 Description of Sterculia Africana

Sterculia is a deciduous, monoecious and a small to medium sized tree which grows up to 12metres tall. The bark surface is whitish grey, which peels in papery flakes, inner bark, green and crown rounded, branches spreading with young hairy branches. The wood is soft, not too strong, and lightweight when dry. The bark fibre is used for making mats, strings and ropes. The wood is used for constructing fences also as pegs for yam climbers or for stems of creeping plants to climb on.

The stem contains gum thereby making the stem very sticky when peeled fresh. Sometimes the gum, which cannot be exploited commercially (due to the amount of work that goes into its harvesting) is added to the medicine. The leaves of sterculia are used to treat leprous sores. The pods of the plants are used as amulets and snuff boxes. The ash of the burnt fruit is used as cooking soda and used for cooking vegetables. Sometimes the dry seeds are used as beads. The bark and leaves are boiled together and the vapour inhaled for the treatment of influenza and fever. The root decoction is drunk for the treatment of postnatal and stomach pains. A leaf infusion is drunk against cough and chest pains. Sterculia tragacantha is a gummy plant, its fibre extraction is done by cutting the base of the plant when it is not overgrown since it has a weak stem. It can be cut easily and peeled for its fibre which because of the gummy nature sticks easily to each other. The indigenous do not normally beat it up for its fibrous spongy nature, they are just peeled into any thickness and twisted together. The stems are normally used as pegs for yam stems as climbers. The leaves are used to treat leprous sores.

The fibres of sterculia swell up in caustic soda opening up the marshy nature of the fibres. When taken out of the caustic soda solution and stretched horizontally the mesh disintegrates. It is non-elastic and able to retain water very well. It burns slowly when

dry, leaving the smell of burning paper. It has good affinity for dyes and bleaches very well, leaving a creamy surface.

Local Usage

Sterculia Africana is also located in the Manya Krobo District of the Eastern Region in Ghana. The leaves and bark of these plants are boiled and drunk for treatment of malaria, post-partum pains. Some of them are provided and the poultice used on wounds. The indigenous people found the barks of the above-mentioned plant as very handy. Their barks are quickly peeled off for tying farm produce, for making traps for catching game, and used as ropes for drawing water from wells. In the case of Acacia, the flexible stem is very spongy therefore, the plant is slightly roasted to make peeling easier and beating into a pulp easier.

Plate 4.6: Mother in Law's Tongue, Bow-String, Hemp, Bu (Sansevieria Aethiopica)

Search (2015)

Sansevieria Aethiopica

Family: *Dracaenaceae*

Synonyms: *Sansevieria Desert*

Locality: Odumase Krobo

4.5.5 Description of Sansevieria Aethiopica

Sansevieria Aethiopica is a perennial rhizomatous herb, without stem, usually forming large groups, it bears thin, fibrous roots. Its leaves are in a rosette, petiole absent with narrowly linear blades. It bears, flowers which are bisexual, regular which can be white, purple or cream.

The leaf fibres are used to make twines and ropes which are very strong. Its rhizomes are warmed and used in treating toothache. The leaf sap is applied to wounds to accelerate healing. Sansevieria and Agave Sisalana are given the same treatment and are used similarly. It is a drought-resistant plant (its very properties allow it to grow without much attention) which can withstand the harsh dry season. The best fibres are harvested during the raining season as in the dry season the fibres become weaker.

When the leaves are harvested, they are placed on a soft surface and scraped with a wooden tool. The scraping is done continuously till the white fibres begin to appear. The fibres are then rolled and twisted together to form strong and long ropes which are used in threading or stringing of beads.

When the fibres are soaked in a strong caustic soda solution, it weakens (the fibres are not twist resistant as they break off), but becomes whiter when washed in detergents. It exhibits no lustre and it is very strong when wet. It is able to absorb moisture when fluffy or beaten into a pulp. It dyes well with most dyes and flames up quickly when dry. It

smells like burning paper when set on fire and bleaches very well becoming whiter than the original colour.

Local Usage

Sansevieria Aethiopica are used in weaving traditional baskets, making ropes for tying various items, twines for stringing beads, also for tying around the wrist and neck of newborn babies, during puberty rites, the sisal yarns are tied around the neck or upper arm of the initiates. In rural areas in tropical Africa Sansevieria Aethiopica is used for making rope, string, mats and sandals.

Plate 4.7: Paper Mulberry, Ghana Yorke, Deer's Tree (Broussonetia Papyrifera)

Source: Field Research (2015)

Broussonetia Papyrifera

Family: *Moraceae*

Synonyms: *Morus Papyrifera*

Locality: Odumase Krobo

Description of Broussonetia Papyrifera

Broussonetia is a dioecious deciduous medium sized tree which grows up to 35 metres tall. Its bark is smooth, dark grey with its inner bark consisting of tough interlacing fibres that can be extracted in broad layers.

Its leaves alternate, simple, slightly rubbed and hairy. The inner bark is about 2mm thick, it is dense and homogeneous. The fibre cells have thick walls and their ends are usually pointed or blunt. Paper mulberry is a fast growing tree with often abundant sucker formation and it grows annually. In Ghana, canopy gaps and farming activities favour its spread and it has gained a reputation as one of the most serious invasive weeds.

It is promoted in some places for firewood because of its rapid growth. No breeding programmes of paper mulberry are known to exist. Wherever introduction of the plant would be considered, the risk that it will develop into an invasive weed should be taken into account. In many instances, vegetative multiplication of male plants only is a good option to avoid problems.

In some tropical African countries, the exploitation of the plant as a source of raw material for Specialty papers, for example, for decoration and currency notes. Paper mulberry could have done future and economic potential. Paper mulberry is considered as a promising "second generation" biofuel crop species.

Paper mulberry bast fibres are soft, lustrous and very strong. The barks are peeled off the stem and used as ropes to tie farm produce and sometimes used as firewood. The twigs

from paper mulberry are very strong and can be used for tying fences. It swells up in caustic soda solution becoming very stretchy and does not change colour. It bleaches very well, leaving a white surface. When over-bleached it breaks easily upon stretching.

Local Usage

Broussonetia Papyrifera is an invasive weed, but could be a good source of raw material for Specialty papers such as currency note which could have some future potential in Tropical Africa (PROTA 16)

Plate 4.8: Hatso, Congo Jute, Hibiscus Bur (Urena Lobata)

Source: Field Research (2015)

Urena Lobata

Family Name: *Malvaceae*

Locality: *Odumase Krobo*

4.5.6 Description of Urena Lobata

Annual and perennial shrub which spreads its branches until about 2.3 metres tall. Its leaves alternate, are simple in size and shape. It grows very well in the southern part of Ghana. The flowers self-pollinate. The plants are propagated by seeds and need a hot and humid climate with ample sunlight and rainfall with a very deep and fertile soil to grow.

As a fibre crop, Urena Lobata competes mainly with jute, kenaf and Roselle. It is as fine and supple as jute, but not as strong. It has the same colour and lustre as kenaf and Roselle but it is finer and less durable. The locals use the fibres or the bark of the stem to make "gbegedze" (the hunter's bag), mats and for tying loads from the farm or for firewood. The leaves are used to induce labour or facilitate childbirth. It is also said that its leaves are chewed or grounded and drunk against hypertension and asthma. The fibres of Lobata when retted yield fine, soft, flexible and lustrous creamy white or pale yellow colour.

It is very elastic when stretched and not very strong. They swell up in caustic soda solution becoming very weak when it takes a longer period of time in the solution. It is also able to retain water for a long time. It flames up and burns quickly smelling like burning wood. It dyes well in both vat and suede dyes. When bleached, it produces an off-white colour and becomes very weak, with no lustre on the surface.

Local Usage

For most of the local people using these plant fibres or yarns is highly economical since it prevents them from using other items which have to be purchased. Most of the plants are multipurpose, not yielding only fibre for local production such as mats and ropes, but also a range of other products including edible leaves and seeds.

4.6 Major Findings for Objective One

Identification and description of local plants with fibre forming properties found within the Daffiama community in the Nadwoli District of the Upper West Region and Manya Krobo community in the Eastern Region.

Having identified the above plants it can be deduced that the extraction process for all identified plants have similar processes. Such as harvesting, peeling from the stem and beating into pulp to obtain the deserved fibres.

1. *Bigre* has to be harvested only after the leaves of the plant has been harvested for food and its seeds are drying up. For the remaining plants total harvesting is not done rather the portion needed for yarns can be taken off even as the plant is still growing.
2. All the plants identified grow in the wild and as such do not need any special cultivation care.
3. All the fibres identified were very strong but not elastic enough to qualify for a yarn suitable to make macramé knots.
4. On the issue of durability, the fibres identified depend mostly on the way the fibre was used such as if the fibre was exposed to the weather, that is rain and sunshine, it wears off easily thus not making it durable.

5. All fibres were very strong due to the way the locals used them such as tying of animals, as ropes for drawing water from wells, tying of fences and using as pegs for farm produce, making of stretchers for relaxing and carrying bodies.
6. Similarly, all the fibres are plant based they can be cultivated, they grow in the wild and can also be found in the tropics.
7. Apart from the fibre source of all the identified plants they all serve as food and medicine for both human and animals.
8. From the findings it is evident that all the fibres identified can be used for tying and therefore be explored for macramé knotting.
9. Again, it can be deduced from the findings that since all the fibres identified can be used for tying it can therefore be explored for macramé knotting. Having identified and described plants with fibre forming properties the study went on to experiment with the extracted plant fibres turned yarns under the following headings: resistance to chemicals, lustre, strength and to pulling, absorption of moisture, flammability of fibre, elasticity when stretched and finally its affinity to dyes.

4.7 Experimenting with the extracted fibres from the plants for knotting macramé products

4.7.1 Fibre Extraction for Hibiscus Cannabinnus (Kenaf)

Locally known as *Bigre* by the locals of the Daffiama community, it is mostly cultivated for its leaves and serves as food for both humans and animals.

To extract fibres from *Kenaf Hibiscus Cannabinnus* the whole stem of the plant is harvested when dry by uprooting it. The whole Kenaf plant stem is soaked in water to soften the bark (Plate 4.9). This will help to easily remove or extract the fibre. This

procedure was followed by creating a split at the bottom end of the stem and carefully peel off the bark to obtain the fibres.

Plate 4.9: A native of Daffiama creating a split on the *Bigre* stem

Source: Field Research (Daffiama, 2015)

Plate 4.10: A native of Daffiama peeling off the bark of the Bigre stem

Source: Field Research (Daffiama 2015)

In its wet state, two to three plies of the peel off strand were put together and placed on the human thigh and twisted together to get a long yarn which is then used for weaving or given further treatment.

Plate 4.11: A native of Daffiama twisting fibre into yarn

Source: Field Research (Daffiama 2015)

Plate 4.12: Bigre twisted yarn

Source: Field Research (Daffiama 2015)

4.7.2 Fibre Extraction for Agave Sisalana

Agave Sisalana or sisal is mostly cultivated as a flower or found in the wild. It does not have a long stem but its leaves are crowded on a short stem in a dense rosette.

Plate 4.13: A clustre of Agave Sisalana plant

Source: Field Research (2017)

After harvesting, the leaves are allowed to ret or rot because when treated fresh, the juice in the leaves itches the skin. The retted leaves were washed to separate the fibre from the core material which holds it together.

The fibres were spread to dry in the sun for about two to three days. The sun drying is needed to prevent mould and dullness in colour. Five to six ply fibres were put together and twisted to form a yarn.

Plate 4.14: Retted Agave Sisalana Leaf ready for washing

Source: Field Research (2015)

4.7.3 Fibre Extraction for Acacia Kamerunenesis

Acacia Kamerunesis grows in the wild, it is a climber it attaches itself to most timber. This plant it has so many domestic usefulness.

Plate 4.15: Acacia Kamerunesis flexible stem attached to a plant

Source: Field Research (2015)

Plate 4.16: Harvested Acacia Kamerunesis stem

Source: Field Research (2015)

To extract fibre from Acacia Pennata, the flexible stem is cut at two ends from base to the top. The flexible twisted stem formed into rings were put in burning fire or flame to roast slightly for easy peeling. The roasting allows for the bark or the fibre to separate easily from the woody core. With the help of a blunt knife, one side was split and peeled off from the bark of the stem. (Plate 4.17).

Plate 4.17: Roast or Burning of the flexible twisted stem

Source: (Field Research 2015)

A mallet or wooden pestle was used to beat the bark till it became fluffy or spongy. The beating was done tenderly in order not to break the fibres into shorter splits.

Plate 4.18: Beating the bark of roasted stem

Source: (Field Research 2015)

Plate 4.19: Fibre obtained after beating, ready for twisting into yarns

Source: Field Research (2015)

4.7.4 Fibre Extraction for Vernonia Biafrae

Vernonia Biafrae is a woody shrub which grows in most open lands. It sprouts and grows very fast and most locals harvest them for fuelwood.

Plate 4.20: A young Vernonia Biafrae plant

Source: Field Research (2015)

To extract and make strands from this plant, portion of the stem was cut from the base to the final length of cords, then with a sharp knife or cutlass, a split was made on the surface towards the base and the back of the stem was peeled gently towards the top. For the purpose of yarn making the peels were split further into 0.2cm thick for easy twisting. The splitting was much more successful when the stem was still fresh, however, it became difficult to split the moment the stem dried up.

Plate 4.21: Split created at one end of Vernonia Biafrae Stem

Source: Field Research (2015)

Plate 4.22: Peeling towards the top of Vernonia Biafrae stem

Field Research (2015)

4.7.5 Fibre Extraction for Sterculia Tragacatha

Sterculia also known as false baobab is very gummy when cut fresh, so it is best used when the gummy substance is still intact. The plant has many uses to the locals from its leaves to its fruits. The stem was cut into a convenient length of 100cm for easy conveyance to where the fibre extraction was to be done. As stated earlier, though it is gummy the gum cannot be exploited for commercial use. This is due to the difficulty related to mass extraction of the gum.

Plate 4.23: Sterculia Tragacatha plant

Source: Field Research (2015)

Splits were created at the top of the stem and gently peeled off, the fibres were then twisted together. It was realized that, they hold better due to the gummy nature when moist. When the fibre dried up, it was difficult to be used for twisting puposes as it had a webby or loose fibre structure which disintegrated when subjected to vigorous manipulation.

Plate 4. 24: Peeling off the bark of Sterculia Tragacatha plant

Source: Field Research (2015)

Plate 4.25: Fibre obtained after beating the bark of Sterculia Tragacatha plant

Source: Field Research (2015)

4.7.6 Fibre Extraction for Urena Lobata

Urena Lobata is a fibre crop which is like Kenaf or jute. The fibres are supple but not too strong so the locals use it for weaving bags and mats. In similar manner of cutting stems for fibre extraction. The stem were cut in 100cm lengths for a few days to ret in order or the fibres to separate easily from the stem.

Plate 4.26: A young Urena Lobata plant

Source: Field Research (2017)

When allowed to ret, the bark yields soft and flexible fibres, but when peeled off fresh the fibres became stiff when dry. After two to three days retting was completed and the fibres were washed to separate them from the woody core and air dried before twisting together to form yarns which were used for weaving.

4.7.7 Fibre Extraction for Broussonetia Papyrifera

Broussonetia commonly known as paper mulberry is a fast-growing plant which can be found on any abandoned land.

Plate 4. 27: A clustre of Broussonetia Papyrifera plant

Source: Field Research (2017)

Economically the plant is being exploited for paper making. Its bark peels off in wide sheets. The stems were conveniently cut into pieces of 100cm long, and long vertical splits were made at one end of the stem then carefully peeled off the bark in the manner of peeling plantain or cassava from its bark (See Plate 4.28). The sheets were then splitted into thin sheets of 0.2cm thick and twisted together to form yarns or ropes which were used for weaving (See Plate 4.28).

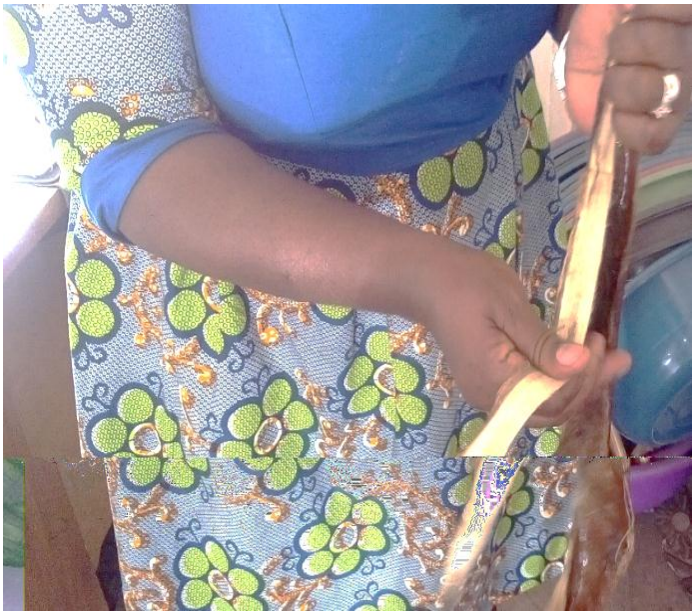

Plate 4.28: Long peel of the Broussonetia Papyrifera plants' bark

Source: Field Research (2015)

Plate 4.29: Thin strips of the Broussonetia Papyrifera plant's bark

Source: Field Research (2015)

4.7.8 Fibre Extraction for Sansevieria Aethiopica

Due to the stereotypical sharp tongue and sassy nature of mothers-in-law, sansevieria with its narrow blades, colour and tiny thorns on the sides, is commonly called mother in-laws tongue and is a rhizomatous herb. Its leaves are in a rosette with narrow blades. It bears flowers which are bisexual.

Plate 4.30: A flowering Sansevieria Aethiopica plant

Source: Field Research (2015)

The plant can be cultivated as flowers or they grow in the wild with little or no water. The harvesting of the leaves for fibre extraction was done during the raining season, since it was easy to get the fresh and supple leaves as they yielded strong fibres. Two different ways were used for the extraction. The first was that matured leaves were allowed to ret by pouring water on them and allowing them to rot for a week. This

method yielded weak fibres of short strands. The second method was done immediately after harvesting the leaves, they were placed on a soft surface and with a wooden knife-like tool scrapping was done till the fibres began to appear from green surface. The sap of the leaves itch so care was taken when scrapping was done. The fibres were then washed to separate them from the core and dried in the shade before twisting together to form yarns. (See Plate 4.31 and 4.32)

Plate 4.31: Various twisted plant fibres

Source: Field Research (2015)

Plate 4.32: Various twisted plant fibres

Source: Field Research (2015)

4.8 Tools and Materials Needed for Test

1. Plastic bowls
2. Plastic spoons
3. Measuring spoons and cups
4. Water
5. VAT / Suede Dyes
6. Caustic soda
7. Candles
8. Matches / lighter
9. Plastic surgical gloves
10. Sodium hydrosulphite
11. Bleach
12. Measuring tape

4.9 Tests Conducted on the Various Plant Fibres Extracted

The PH of water used for all the tests conducted was 7PH straight from the tap. Water that had to stay for a while to room temperature was 6.9PH.

4.9.1 Hibiscus Cannabinus (kenaf)

A. Kenaf Reaction with Caustic Soda solution

One (1) litre of water was poured into plastic bowl as shown in plate 4.33. Two (2) tablespoons full of caustic soda was added. Caustic soda was used because it was finally going to be added to the vat dye bath for dyeing before final usage.

Plate 4.33: One (1) litre of water in a plastic bowl

Source: Field Research (2016)

Plate 4.34: Two tablespoons full of caustic soda being added to the measured water

Source: Field Research (2016)

After the caustic soda had dissolved, the solution was allowed to stand for 3 minutes after which a twisted strip of kenaf fibre about 0.5cm in width was put in the solution and allowed to stay for 40 minutes. During the 40 minutes, the fibre was observed for reactions every 10 minutes and the test result recorded (Table. 4.3)

Plate 4.35: Effect of Caustic Soda on Kenaf

Source: Field Research (2016)

B. Kenaf Reaction to Bleach

One litre of water was poured into a plastic bowl and a tablespoon of white crystal bleach was added. After the bleach had dissolved the solution was allowed to stand for 20 minutes then a piece of twisted kenaf, 0.15cm thick, was dropped into the solution to find out how the yarn would react to bleaching. It was observed every 5 minutes to see changes, after 20 minutes it was taken out and the results have been recorded in Table 4.3.

C. Lustre of Kenaf

This test was done by observing surface lustre before wetting the fibre. After the fibre was dried the surface was observed to find out if there was any gloss on the strands then when put into water the second observation was done to find out if there was any change in surface nature. The results are recorded in Table 4.3.

D. Strength of Kenaf

This test was done by tying two twisted fibres between two ends of objects to find out the number of minutes it will take for the fibres to break when stretched. Within 4-5 minutes the fibre when subjected to rubbing started breaking at the tension point. Another piece of twisted fibre was soaked in water for 3 minutes and also tied in between two ends and subjected to the same rubbing. It was observed that the wet kenaf did not break. The results of the test are recorded in Table 4.3.

E. Elasticity of Kenaf

Before this test was conducted the length of a piece of dry kenaf yarn was measured and cut, stretched a bit to find out if it would stretch, then measured again to find out if it had gained any length. During the test when the fibre was put into the caustic soda some observation was made as to expansion in width or swelling of fibre. The fibre was later taken out and wrapped round the index finger after 10 minutes the fibre was released and measured then a comparison was done as to the two length. The results are shown in Table 4.3.

F. Absorption of Kenaf (Water)

The bark after being beaten into a fine spongy pulp was air dried for 3 days then weighed and the weight recorded. The sponge was later soaked in water for 5 minutes taken out of the water and weighed again. A comparison of the different weights was done after recording the changes in all three sample. See Table 4.3 for results.

G. Flammability of Kenaf

The twisted fibres of kenaf into yarns do not look smooth on the surface; it has some short fibres that stick out thus making it look hairy. A piece of yarn about 0.15cm long was passed over a lighted candle to find out how fast the fibre would get burnt or flame up. The findings are recorded in Table 4.3.

H. Kenaf's Affinity to Dyes

- **Vat Dye**

  One litre of water was poured into a plastic container and ½ tablespoon full of caustic soda added to the water till it dissolved. One quarter tablespoon full of vat dye was added to the solution after it had dissolved. One tablespoon full of sodium hydrosulphite was added to complete the bath. Three strands of yarns 10 cm each were dropped into the bath for 20 minutes, after which they were taken out for oxidation to take place and later aired in the shade.

Plate 4.36: Dyeing of Kenaf in Vat Dye

Source: Field Research (2016)

- **Suede dye**

  One (1) litre of water was put on fire to boil, one tablespoon full of suede dye and two tablespoons full of common salt was added to boiling water. After 5 minutes three stands of twisted kenaf (yarns) 10 cm each was dropped into the bath and allowed to boil for 20 minutes after which they were taken out and dried in the shade. Result of dyeing vat and suede was taken and recorded in Table 4.3.

4.9.2 Agave Sisalana

A. Agave Sisalana Reaction with Caustic Soda Solution

Harvesting of the sisal leaves are done when the leaves are supple and fresh 2-3 sheaths were beaten up into a spongy mass washed and dried in the shade for 3 days. Two tablespoons of caustic soda were added to 1 litre of water allowed to stay between 30-40 minutes during which every 10 minutes results in changes were recorded. (See table 4.3 for results).

Plate 4.37: Sisal fibre in Caustic Soda solution

Source: Field Research (2016)

B. Lustre of Agave Sisalana fibre

To test for the surface lustre of Agave Sisalana (sisal) adequate observation was done on the surface nature of the dry fibres to find out if the fibre had gloss after which the fibres were finally put into water after 5 minutes of immersion the fibres were taken out and the surface nature rechecked. Results are recorded in Table 4.3.

C. Strength of Agave Sisalana

To test for the strength of Agave Sisalana, four to five fibres were put together to form a yarn. They were tied in between two ends and pulled to find out the rate at which the yarns would break. After 20 minutes the tension was also put into water for 3 minutes and subjected to the same pulling process to find out how easily or fast the yarns would break. The findings are recorded in Table 4.3.

D. Elasticity of Agave Sisalana

After putting together four fibres and twisting the fibres into yarns. A piece of dry yarn measuring 0.10cm was wrapped round the index finger for 10 minutes then when released from the finger it was measured again. The difference in the measurement shows its elasticity. The results are recorded in Table 4.3.

E. Water Absorption of Agave Sisalana

The leaves after harvesting was beaten into a spongy mass and allowed to dry in the shade. In its dry state it was weighed then it was soaked in water for 10 minutes after which the sponge was removed and weighed again. The water was squeezed out and the sponge allowed to dry a little, after which it was weighed again. A comparison all three weights shows how much sisal is able to take water. See Table 4.3 for results.

F. Flammability of Agave Sisalana

A piece of twisted sisal yarn is held over a lighted candle to find out how fast or slow the stray strands of the yarn would burn. Results are recorded in Table 4.3.

G. Affinity of Agave Sisalana to Dyes (Vat Dye)

A bath of vat dyes was made by pouring 1 litre of water into a plastic bowl then ½ tablespoon full of sodium hydrosulphite was added. The mixture was allowed a mixing time of 3 minutes. Then the twisted yarn was dropped in for 30 minutes. After the stipulated time the yarn was removed and allowed to oxidize in the shade. Results are recorded in Table 4.3.

Plate 4.38: Agave Sisalana fibre in a Vat Dye

Source: Field Research (2016)

Plate 4.39: Oxidised Agave Sisalana fibre

Source: Field Research (2016)

H. Suede dyes

A dye bath of one (1) litre of water, a tablespoon full suede dye and 2 tablespoons full of salt kept on fire. A yarn of about 0.10cm long was dropped into the boiling bath and left for 20 minutes before it was taken out and the results recorded in Table 4.3.

4.9.3 Acacia Pennata

A. Acacia Pennata Reaction to Caustic Soda

One (1) litre of water was poured into a plastic container and 2 tablespoons full of caustic soda added. The resultant solution was allowed to stand for 3 minutes. A strip of acacia pinnate measuring 0.5mm in width was dropped into it and observed for changes or reactions every 10 minutes. After 40 minutes it was taken out and the results recorded in Table 4.3.

B. Acacia Pennata Reaction to Bleach

One (1) litre of water was poured into plastic bowl and one (1) tablespoon of bleach was added. After dissolving a strip of acacia pennata measuring 0.10cm was dropped into the solution. After every 10 minutes the results of observation were recorded, then finally after 30 minutes of immersion the final results recorded in Table 4.3.

C. Lustre of Acacia Pennata Fibre

A piece of acacia pennata was observed to find out if it had lustre on the surface before it was put into water to find out if it would have lustre. Finally, the strip of fibre was wrapped round the finger to find out if would wringle and the results recorded in Table 4.3.

D. Strength of Acacia Pennata Fibre

Four fibres were put together and twisted into a thick yarn about 0.05cm in width. This yarn was held and stretched in between two ends and subjected to some level of tension to find out how fast or slow the yarn would break. This was done to dry yarn. Another piece was soaked in water for 10 minutes and also subjected to the same process above to also find out how fast or slow the yarn would break the results are recorded in Table.4.3.

E. Elasticity of Acacia Pennata Fibre

A strip of fibre was cut and measured, it was later wrapped around the index finger and after 10 minutes it was released from the finger and the difference in measurement showed how elastic or otherwise the fibre is. The results were recorded in Table 4.3.

F. Water Absorption of Acacia Pennata

In order to find out how well acacia pennata absorbs water the fibre was beaten into a fine spongy mass and allowed to dry. It was then weighed before it was soaked in water for 20 minutes. After it was taken out of the water, it was weighed to determine how efficient Acacia absorbs water. The results are recorded in Table 4.3.

G. Flammability of Acacia Pennata

A piece of Acacia Pennata yarn was passed over a lighted candle flame to see how fast or slow the fibre will catch fire. After the hairy strands of fibres which were stuck on the yarns had burnt off the results were recorded in Table 4.3.

H. Affinity of Acacia Pennata to Dyes (Vat)

A dye bath of one (1) litre of water, ½ tablespoon of caustic soda, one quarter tablespoon of vat dye and ½ tablespoon of sodium hydrosulphite mixed together was used to dye the yarn for 30 minutes after which it was taken out and allowed to oxidise. The results were recorded in table 4.3.

Plate 4.40: Dyeing of Acacia Pennata in Vat Dye

Source: Field Research (2016)

I. Suede dye

One (1) litre of boiling water, a tablespoon of suede dye and two (2) tablespoons full of salt kept on fire constituted the bath. A piece of yarn was dropped into the bath and left to boil for twenty (20) minutes before it was taken out. The results can be found in Table 4.3.

4.9.4 Tests on Vernonia Biafrae

A. Vernonia Biafrae Reaction to Caustic Soda solution

After drying a mass of vernonia biafrae fibres, 1 litre of water was put in a plastic container and 2 tablespoons full of caustic soda was added after dissolving. The diluted solution was allowed to sit for 3 minutes then a strip of vernonia biafrae about 0.15cm in width was dropped into it and allowed to stay for 30-40 minutes. After every 10 minutes changes in the fibre was observed and recorded (See Table 4.3.

B. Vernonia Biafrae Reaction to Bleach

One tablespoon of dry bleach was added to one (1) litre of water in a plastic bowl. After it had dissolved a strip of veronica Biafrae was dropped into the solution. After every 10 minutes changes in the fibre was observed and after 30 minutes the final results were recorded in Table 4.3.

C. Lustre of Vernonia Biafrae Fibre

In its dry state the surface nature of vernonia brafrae was observed and recorded before it was soaked in water for 10 minutes, then it was taken out and the surface nature recorded. Finally, the strip was wrapped around the index finger and released to find out if the fibre would wrinkle. The results are recorded in Table 4.3.

D. Strength of Vernonia Biafrae Fibre

Testing the fibre strength was done by tying a piece of vernonia Biafrae yarn in between two ends and subjecting it to pressure. The speed at which the yarn breaks determines how strong or weak it is. Then later another piece of the same measurement was subsequently soaked in water, brought out and subjected to the same process above. The results are recorded in Table 4.3.

E. Elasticity of Vernonia Biafrae Fibre

The fibre were twisted into yarns and after measuring and cutting a piece of dry yarn of 0.10cm in width, the yarn was wrapped round the index finger for 10 minutes, after it was released from the finger it was measured again to find out if there was a change in length. The results are recorded in Table 4.3.

F. Water of Absorption of Vernonia Biafrae Fibre

The fibre were beaten into a sponge and dried after which it was weighed. It was soaked in water for 5 minutes after which the soaked fibre was weighed again to find out how much water the fibre had soaked. The results are recorded in Table 4.3.

G. Flammability of Vernonia Biafrae Fibre

A piece of yarn was twisted from the vernonia biafrae plant and was run over the flame of a light candle to find out how fast and slow the fibre would catch fire. The results are recorded in Table 4.3.

H. Affinity of Vernonia Biafrae Fibre to Dyes (Vat)

One (1) litre of water was put in a plastic container, ½ tablespoon of caustic soda was dissolved into the water and ¼ vat dye was added to the caustic soda then ½ tablespoon full of sodium hydrosulphite was finally added. The bath was allowed to sit for three (3) minutes before a piece of vernonia yarn was dropped into it. After 30 minutes the yarn was taken out and the results recorded in Table 4.3.

Plate 4.41: Dyeing of Vernonia Biafrae fibre in Vat Dye

Source: Field Research (2015)

I. Suede dyes

A bath made up of one (1) litre boiling water with one (1) tablespoon suede dye and two (2) tablespoons full of sodium chloride added to the boiling water still on fire. The piece of vernonia yarn was dropped into it and left for twenty (20) minutes before it was taken out. The results recorded in Table 4.3.

4.9.5 Sterculia Tregacantha Fibre

A. Sterculia Tregacantha Reaction to Caustic Soda Solution

A strip of sterculia tragacantha was peeled from the stem. One (1) litre of water was put in a plastic container and two (2) tablespoons full of caustic soda was added to the water. After the soda had dissolved the piece of fibre measuring 0.05cm in width was dropped into the concentrated water. Observation of fibre reaction was done every 10 minutes until 40 minutes when the test was completed and the results are recorded in Table 4.3.

B. Sterculia Tregacantha Fibre Reaction to Bleach

A concentrated solution of one (1) tablespoon full of bleach in one (1) litre of water was prepared in a plastic container and a strip of sterculia Tregacantha fibre was put into this solution for 30 minutes and after every 10 minutes fibre reaction was observed and recorded. Results are recorded in Table 4.3.

C. Lustre of Sterculia Tregacantha Fibre

Surface lustre of the fire was observed and then it was put into water for ten (10) minutes afterwards it was taken out and the surface nature was observed and noted. Finally, another piece of sterculia tregacantha was rubbed in between the two hands and released, the surface nature was then checked and recorded (See table 4.3)

D. Strength of Sterculia Tregacantha Fibre

The test done for the strength was by cutting a strip of fibre and tying it between two ends then the fibre was subjected to stretching to find out how fast the fibre would break. Finally, the same piece was soaked in water for 10 minutes, taken out and the same

process as the first (the dry fibre), was done to the wet one. The results are recorded in Table 4.3.

E. Elasticity of Sterculia Tregacantha Fibre

A strip of fibre in its moist state was measured and then rolled around the index finger upon release after ten (10) minutes, it was measured again. The difference in measurement shows how elastic it is. Secondly a piece of dry fibre was measured and then subjected to pulling after which a second measurement was taken and the difference in length is recorded in Table 4.3.

F. Water Absorption of Sterculia Tregacantha Fibre

The fibre was beaten up into a spongy mass and weighed, later on the sponge was soaked in water for ten (10) minutes, taken out and weighed again, the difference in the weights showed how much sterculia could retain water. The results are recorded in Table 4.3

G. Flammability of Sterculia Tregacantha Fibre

This test was done to two fibres twisted together to form a yarn. This yarn about 0.10 cm long was passed over a naked candle flame to see how fast or otherwise the yarns would react when exposed to fire. The results of the test is recorded in Table 4.3.

H. Affinity of Sterculia Tregacantha Fibre to Vat Dyes

A bath consisting of one (1) litre water ½ tablespoon full of caustic soda and ¼ tablespoon full of vat dyes then finally ½ tablespoon full of sodium hydrosulphite was made in a plastic bowl was made and allowed to sit for five (5) minutes. Finally, a piece

of sterculia yarn was put into the bath for twenty (20) minutes before it was removed and allowed to oxidise. The results are recorded in Table 4.3.

Plate 4.42: Dyeing of Sterculia Tregacantha fibre in VAT Dye

Source: Field Research (2015)

I. Suede dye

One litre of water was boiled and one (1) teaspoon full of suede dye was put into it and finally two (2) tablespoons full of sodium chloride was added to it to serve as a fixative. With this bath still on fire, a piece of Sterculia Tragacantha yarn was put into the bath and allowed to boil for 20 minutes after which it was taken out for observation. Results are recorded in Table 4.3.

4.9.6 Urena Lobata Fibre

A. Urena Lobata Fibre Reaction to Caustic Soda Solution

After peeling the fibre from the bark of Lobata it was beaten up to separate the fibre from the wood and core. The fibres were allowed to dry and twisted to form yarns. A solution made up of one (1) litre of water and two (2) tablespoons full of caustic soda was added

and dropped into the diluted solution for 30 minutes. Observation of the yarns was done every ten (10) minutes and the results recorded in Table 4.3.

B. Urena Lobata Fibre Reaction to Bleach

One tablespoon of dry bleach was added to one (1) litre of water in a plastic container. After dissolving a strip of Urena Lobata yarn was put into the solution and changes or reactions observed every ten (10) minutes and after thirty (30) minutes the results recorded finally in Table 4.3.

C. Lustre of Urena Lobata Fibre

A few pieces of dry Urena Lobata fibre were put together and the surface observed to check if it had lustre, then it was put into water for ten (10) minutes, taken out and was wrapped around a stick and was later released to find out if the fibre would wrinkle. The outcome is recorded in Table 4.3.

D. Strength of Lustre Urena Lobata Fibre

Two to three fibres of Urena Lobata was twisted together to form a yarn. This yarn about 0.15cm long was tied between two ends and subjected to pressure to find out whether the yarn would break easily or not. Another piece of yarn was soaked in water for three (3) minutes, taken out and also tied to the same two ends and subjected to pressure to find out the speed at which the yarn would break.

E. Elasticity of Urena Lobata Fibre

The first measurement of a piece of yarn was taken of Urena Lobata this yarn was wrapped round a pen 3.5cm thick for ten (10) minutes after it was released from the pen,

it was measured again to find out if there was any change in measurement. The results are recorded in Table 4.3.

F. Water Absorption of Urena Lobata Fibre

The fibres were beaten into a spongy mass and dried after which it was weighed. The dry fibre was soaked in water for five (5) minutes after which the soaked fibre was weighed again to find out how much water the fibres had absorbed. The result is recorded in Table 4.3.

G. Flammability of Urena Lobata Fibre

After the fibres were twisted into yarns some short fibres which did not adhere to the long ones were passed over a naked candle flame to find out how fast or slow the fibres would catch fire. The results recorded in Table 4.3.

H. Affinity of Urena Lobata Fibre to Dyes

A dye bath of one (1) litre of water in a plastic container ½ tablespoon full of caustic soda dissolved, ¼ tablespoon vat dye dissolve into the water then finally ½ tablespoon of sodium hydrosulphite was finally added. The bath was allowed to sit for three (3) minutes before a piece of urena lobata yarn was put into the bath. After thirty (30) minutes of being in the bath, the yarn was finally taken out and the results recorded in Table 4.3.

4.9.7 Broussonetia Papyrifera Fibre

A. Broussonetia Papyrifera fibre Reaction to Caustic Soda Solution

After peeling the bark of Broussonetia Papyrifera from the stem. The bark was shredded to get it in fibre form. A concentrated solution of two (2) tablespoons of caustic soda in one (1) litre of water was prepared and a piece of fibre measuring about 0.15cm long was dropped into the caustic soda solution. The fibre was observed intermittently for ten (10) minutes to find out its reaction in the solution for thirty (30) minutes after which the results were recorded (See Table 4.3).

B. Broussonetia Papyrifera Fibre Reaction to Bleach

One (1) tablespoon of bleach was put into one (1) litre of water and allowed to sit for three (3) minute then a piece of fibre 10cm long was put in to the solution for thirty (30) minutes, after every ten (10) minute the fibre was observed and checked for every change. The final results are recorded in Table 4.3.

C. Lustre of Broussonetia Papyrifera Fibre

Observation of the dry fibre surface was done and it was finally dropped into water for ten (10) minutes. After it was taken out, the surface was observed again to find out any changes in its surface. Finally, another piece of fibre was rubbed in the hand to find out the change in appearance of the fibre. The final result is recorded in Table 4.3.

D. Strength of Broussonetia Papyrifera Fibre

After the bark of the plant was peeled it was observed that paper mulberry peels in large sheet so it is advisable not to pound into sponge. The sheet was split into small bits of 0.01cm and tied in between two ends and subjected to pressure to find out if the yarn

would beak easily. It was observed that the more the fibre was stretched the stronger it got. A piece was then soaked in water for five (5) minutes and subjected to the same process. The result is recorded in table 4.3.

E. Elasticity of Broussonetia Papyrifera Fibre

A strip of fibre was cut and measured in its wet state, the strip was wound round a pen and it stayed in that position for ten (10) minutes then it was released from the pen and measured again to find out its final measurement. Then another piece was dried and subjected to the same process after which the results are recorded in Table 4.3.

F. Water Absorption of Broussonetia Papyrifera Fibre

The fibre had to be beaten into a spongy mass and weighed after which the sponge was soaked in water for five (5) minutes, taken out and weighed again to find out how much water the fibre had absorbed. The result was recorded in Table 4.3.

G. Flammability of Broussonetia Papyrifera Fibre

About four pieces of yarns were twisted together into a thick cord and run over a lighted candle flame to find out how fast or slow the fibre will catch fire. The results are recorded in Table 4.3

Plate 4.43: Flammability of Broussonetia Papyrifera Fibre

Source: Field Research (2015)

H. Affinity of Broussonetia Papyrifera Fibre to Dyes (Vat)

A dye bath of one (1) litre of water was made by adding ½ tablespoon of caustic soda, ¼ tablespoon of vat dye and finally ½ tablespoon full of sodium hydrosulphite was finally added. The bath was allowed to sit for three (3) minutes before a piece of paper mulberry was dropped into it, after thirty (30) minutes of dyeing the yarn was taken out and the results were recorded in Table 4.3.

I. Suede dyes

A bath made up of one (1) litre of boling water with one spoon full of suede dyes and two tablespoons full of sodium chloride added to the bath still on fire. A piece of broussonetia was dropped into it and left for twenty (20) minutes before it was taken out. The result has been recorded in table 4.3.

4.9.8 Sansevieria Aethiopica Fibre (Bu)

A. Sansevieria Aethiopica Reaction to Caustic Soda

The fibrous part of this plant is found in the sheaths or leaves. After the leaves of Sansevieria were harvested it was allowed to ret for two (2) days since the sap or juice from the leaves can be irritating when it comes into contact with the human skin. The leaves were beaten into a pulp, washed and dried. Two (2) tablespoons of caustic soda was added to one (1) litre of water and allowed to sit for three (3) minutes after which a long strand of twisted yarn, about 0.05cm thick, was dropped into the solution and allowed to stay in the solution for thirty (30) – forty (40) minutes. During this period observation in changes were recorded every ten (10) minutes. The final outcome is recorded in Table 4.3.

B. Sansevieria Aethiopica Fibre Reaction to Bleach

One (1) tablespoon of dry bleach was added to one (1) litre of water in a plastic container and allowed to dissolve. After dissolving two strips of Sansrvieria Aethiopica fibre was put into the solution, the reaction of the fibre was observed every ten (10) minutes and after thirty (30) minutes the results were recorded in Table 4.3.

C. Lustre of Sansevieria Aethiopica Fibre

A few pieces of dry Sansevieria fibre were put together and the surface observed to check if it had lustre then it was put into water for ten (10) minutes, taken out and the surface nature was observed and recorded. A strip was wrapped round a stick and released to find out if the fibre would wrinkle or break. The results can be found in Table 4.3.

D. Elasticity of Sansevieria Aethiopica Fibre

A strip of fibre was picked and measured, then wrapped round a pen tube measuring 3.5mm thick for ten (10) minutes after it was release form the pen. It was measured again to find out any changes in measurement. The results are recorded in Table 4.3.

E. Strength of Sansevieria Aethiopica Fibre

Four (4) strands of Sanseviera Aethiopica fibre were twisted to form a yarn or cord. The cord measuring 0.10cm long was tied in between two ends and subjected to pressure to find out if the cord would break easily. Another piece was soaked into water and subjected to the same amount of pressure to find out the speed at which the yarns would break. The results of this test are recorded in Table 4.3.

F. Water Absorption of Sansevieria Aethiopica Fibre

After the fibre were beaten into a sponge and dried it was put on a scale and weighed and recorded. The dry fibres were soaked in water and weighed again to find out how much water the fibre had absorbed. The results is recorded in Table 4.3.

G. Flammability of Sansevieria Aethiopica Fibre

The fibre were twisted into cords and the shorter fibres which did not adhere to the original cord was subjected to burning by passing it over a naked candle flame to find out how fast or slow the fibres would catch fire. Results of this test are recorded in Table 4.3.

H. Affinity of Sansevieria Aethiopica Fibre to Dyes

A dye bath consisting of one (1) litre of water in a plastic container, half tablespoon full of vat dye dissolved into the water and then finally two (2) tablespoons of hydrosulphite

added to make it very potent. The bath was allowed to sit for three (3) minutes before a piece of Sansevieria Aethiopica cord was dropped into it. After thirty (30) minutes of being the bath the yarn was finally taken out and the results recorded in Table 4.3.

I. Suede dyes

A bath made up of one (1) litre of boiling water with one (1) teaspoon full of suede dyes and two (2) tablespoon full of sodium chloride added to the bath which was still on fire. A piece of Sansevieria fibre was dropped into it and left for twenty (20) minutes before it was taken out. The results recorded in Table 4.3.

Table 4.3: Plant fibres and its characteristics

Plant	Location	Description	Uses	Resistance	Lustre	Strength	Elasticity	Absorption	Flammability	Affinity to dyes
Kenaf (*Bigre*)	Daffiama (upper west)		Ropes for tying and weaving Leaves as vegetables and eaten When dried the stems are used as fuel for cooking	When twisted the ply open up with caustic soda solution. Fibre darkens and become slippery and elastic Swells up during the first 30 minutes of soaking, then shrinks smaller than original size when out of the	Not lustrous	Very strong when wet, strong when dry	1. Exhibits elasticity when in caustic soda solution. 2. Non elastic when dry	1. Nil. Twist well whilst moist.	Flames up, but flames die off leaving embers to smoke. Smells like burning wood.	1. After 2hrs of dyeing with vat dyes, not too favourable. 2. Very good with suede dyes even after 15 minutes.
Plant	Location	Description	Uses	Resistance	Lustre	Strength	Elasticity	Absorption	Flammability	Affinity to Dyes
				Solution						
Sisal (Agave Sisalana)	Daffiama (upper west) Krobo (eastern)	Robust, perennial herd, about 3-9m tall. When it flowering its leaves	Twine for beading Ropes for tying and weaving	When soaked in caustic soda it weakens when it over stays and changes colour It becomes whiter than the	Not lustrous	Very strong, when wet, very strong when	Exhibits some elasticity when twisted together.	It's able to absorb moisture when fluffy.	Flames up quickly when dry. Smells like burning paper.	Very good with vat dyes and suede dyes.
Plant	Location	Description	Uses	Resistance	Lustre	Strength	Elasticity	Absorption	Flammability	Affinity to Dyes
Acacia Pennata Kutsa-tatɛɛ	Krobo (Eastern)	Acacia is a flexible climber with a thin rough back with longitudinal bands with downward	1. Used as chew - sticks or chew sponges. For tying firewood and farm produce.	When twisted the ply's open up in caustic soda solution. Swells up both shrinks later than the original.	Non lustrous	Strong when wet.	Not too elastic	It is able to absorb moisture when left in water over a period of time	Burns slowly leaving the smell of burning wood or paper.	Very good with vat and suede dyes

Veronia Biafrae Hu / Ho	Krobo (Eastern)	A small tree shrub or woody herb up to 9m. tall. It has thick stems and sprouts whenever is cut.	It does not rot in water so it is used to draw water from wells. Also used to the tie the neck of goats.	Does not react with caustic soda solution.	Not lustrous.	Strong when wet.	Non - elastic	It is able to retain water for a long time.	Flames up when dry. Smell like burning paper.	Dyes good with suede and vat dyes.
Plant	Location	Description	Uses	Resistance	Lustre	Strength	Elasticity	Absorption	Flammability	Affinity to Dyes
Sterculia Tregacantha (Tokokzo /Tokojo)	Krobo (Eastern)	Deciduous, Monoeciou s, small to medium - size tree up to 25m tall. Not too strong breaks easily. Its bark yields material for tying	1. Uses the stem as pegs for yam plants. 2. Used in making ropes formats. 3. The leaves are used to treat leprous sores. `	Swells up in caustic soda.	Not lustrous.	Not too strong when very dry.	Non - elastic	Twist well whilst moist but when dry breaks easily	Burns slowly when dry leaving the smell of paper.	Has good affinity for dyes.
Plant	Location	Description	Uses	Resistance	Lustre	Strength	Elasticity	Absorption	Flammability	Affinity to Dyes
Sansevieria Aethiopica (Mother in-laws tongue)	Krobo (Eastern)	Robust herb. Its leaves are crowded in Roots fibrous with leaves arranged in an ascending spiral. Spikes at the tip of extended leaves.	Leaves are beaten and used as ropes for beading and tying.	Becomes weak when it over stays in a strong solution of caustic soda. It becomes whiter when washed in bleach.	Not lustrous	Strong when wet	Non - elastic	It is able to retain water for a long time	Flames up when dry, smells like burning paper	Dyes well with all dyes

Broussonetia Papyrifera	Krobo (Eastern)	Grows fast on fallow spaces when not controlled	The seeds are eaten. Highly medicinal for the cure of snake bites (leaves)	When twisted the ply's open up when in caustic soda solution.	Not lustrous	Very strong when wet	Exhibits some elasticity when wet.	Able to retain water for a long time.
Urena Lobata	Krobo (Eastern	Fibre crops which is like jute or kenaf	Weaving mats and bags		Not lustrous	Not too strong	Does not exhibit elasticity	Able to retain water when dry and spongy

4.10 Introducing Macramé Concept to the Daffiama Community and Krobo **Community through Training Workshops**

As part of the third objective of this study, the researcher through a training workshop introduced basic knowledge of macramé to the selected group of participants from the two study areas. The introduction took the form of Demonstration, where the researcher led the participants through the knotting processes.

4.10.1 Stages in the Demonstration Process

The following steps were followed during the demonstration process

1. The researcher shows samples of work produced in macramé to the participants. The researcher introduced these samples to the participants in order to whip their interest and desire to learn.

Plate 4.44: Students in Daffiama viewing samples of the macramé products on laptop

Source: Field Research (2016)

2. The researcher then puts the participants into groups. Each group was to produce one item. The grouping was done to help make explanations and supervision easier and effective.

Plate 4.45: Participants practicing the basic knots in Groups

Source: Field Research (2016)

3. The researcher now explains to the participants what macramé means, tools and materials and some basic knots. It was established that macramé is the art of knotting and some basic tools needed includes a pair of scissors, tape measure, the hands with which knotting is done and the basic materials being the cord.

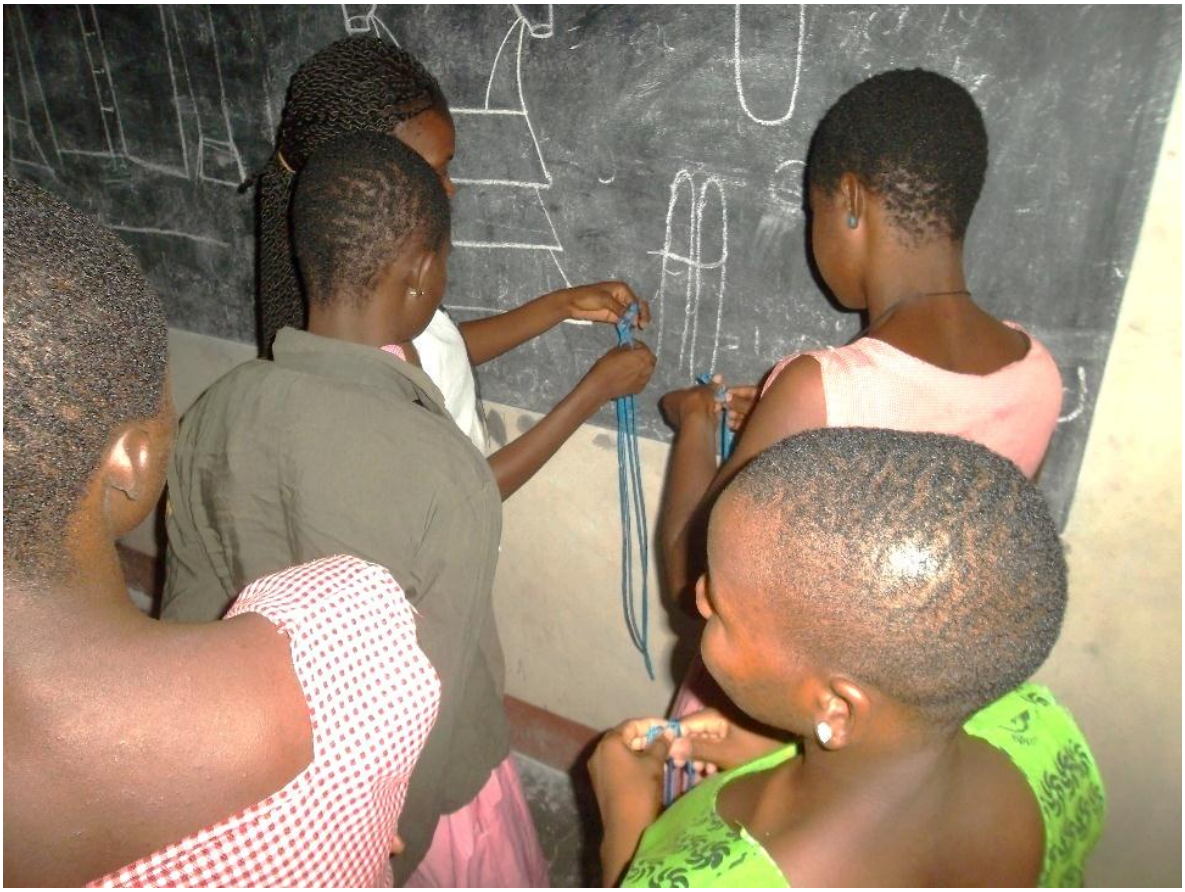

Plate 4.46: Participants being taken through basic knots in Macramé

Source: Field Research (2016)

The researcher found out from students if they had heard of macramé. Their responses are indicated in Table 4.4.

Table 4.4: Respondents' knowledge of the concept of macramé

RESPONSES	FREQUENCY	PERCENTAGES
YES	47	78.4
NO	13	21.6
TOTAL	**60**	**100**

From Table 4.4, it is evident that majority (78.4%) of the respondents are aware or have heard of the word macramé whiles (21.6%) did not know anything about it.

4.10.2 Introduction of the First Knot (Square or Flat Knot)

Steps in producing a Square Knot

1) To make a square knot, four (4) ends of cords or yarns are required to make a unit.
2) Number the knots from left to right, 1-4.
3) Working from the right, loop cord 4 over 3 and 2 then, loop cord 1 behind 2 and 3 and pass the end of the cord 1 through the whole or loop created by cord 4.
4) Hold both ends 1 and 4 and pull them together, so that cord 1 replaces cord 4 and 4 replaces 1 in that order.
5) Repeat step 3 and 4, this time start with cord 1 which now has moved to position one on the right. After which, when pulled together cord 1 and 4 now returns to their original position, this forms a square knot or flat knot.
6) A series of this knot on the same set of cords forms a sinnet of square knots normally called the *Josephine knot*.

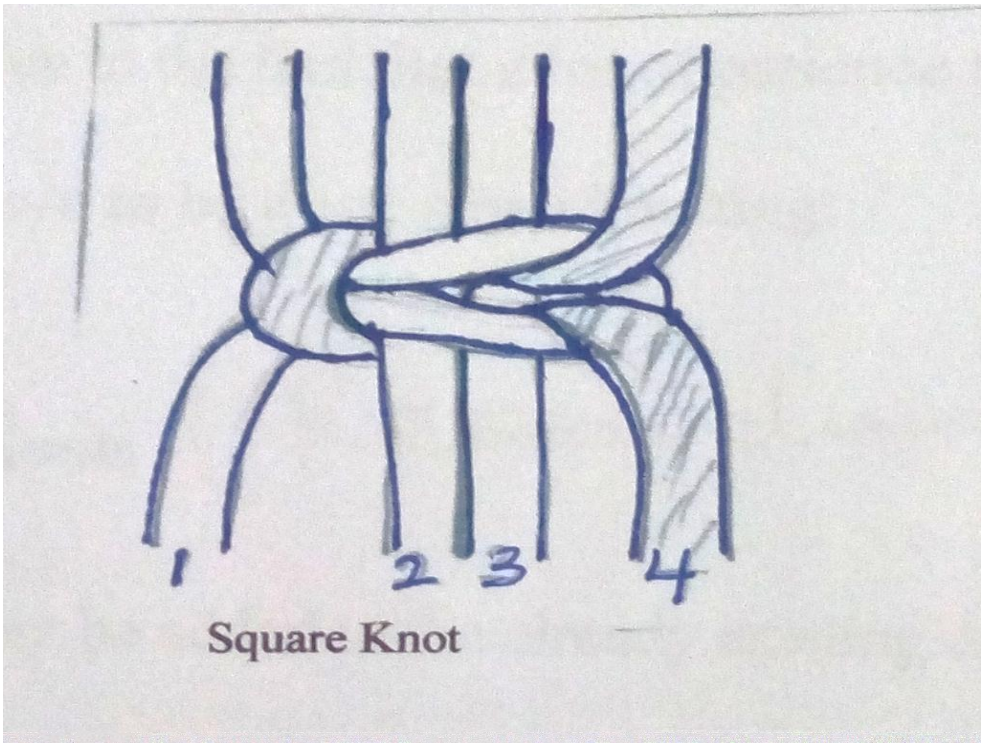

Figure 4. 1: Square Knot

Source: Field Research (2016)

4.10.3 Introduction to Clove Hitch Knot

1) To make a clove hitch, the ends or cords have to be mounted on a holding cord or a support. So a sizeable number has to be used depending on the length of hitch one requires. If four (4) ends are used, the resulting hitch would be eight (8) since each hitch is two.
2) Mount the 4 ends, then take an extra cord and use that as the support to wrap all the ends around.
3) Number the ends 1-4 from left to right. Place the separate one at the extreme end of the 4 and put the cord horizontally over on all the four (4) ends.
4) Take cord 4 from behind the horizontal cord (A5) and wrap it round the cord (A5) two times and pull it to make sure it does not slip.

5) In succession, wrap all the cords in this manner 4,3,2,1 so that the end results would be eight (8) hitches. This forms a clove hitch.

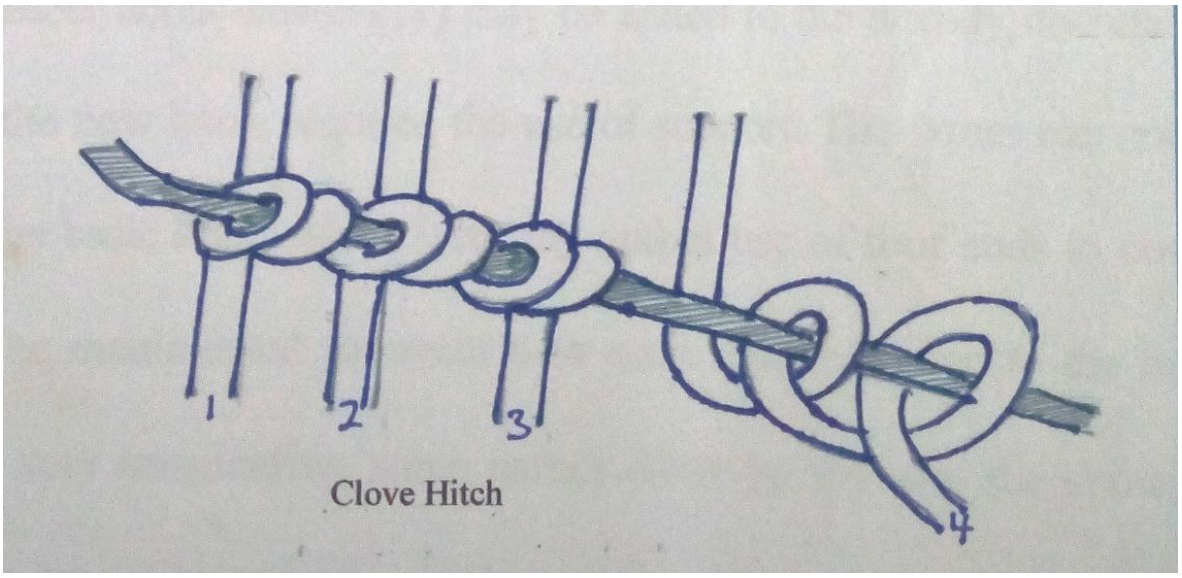

Figure 4.2: Clove Hitch Knot

Source: Field Research (2016)

4.10.4 Introduction to Button Hole Knot

1) Mount four (4) ends of cords and put them into two sets. 1&2, 3&4. In effect you have four working ends.
2) Make a loop with cord 1&2 over 3&4 from the left, placing the working end under the beginning end.
3) Place the right cords 3&4 on top of the loop that was formed with the left cords. Bring the ends of the right cords under the ends of the left cords.
4) The right cords are interwoven over and under each other, going from upper left to lower right. Pull the ends together to lock and tighten them. This knot does well if the cords are firmer. This knot is known as the button hole because it looks like a button and its hole when locked together.

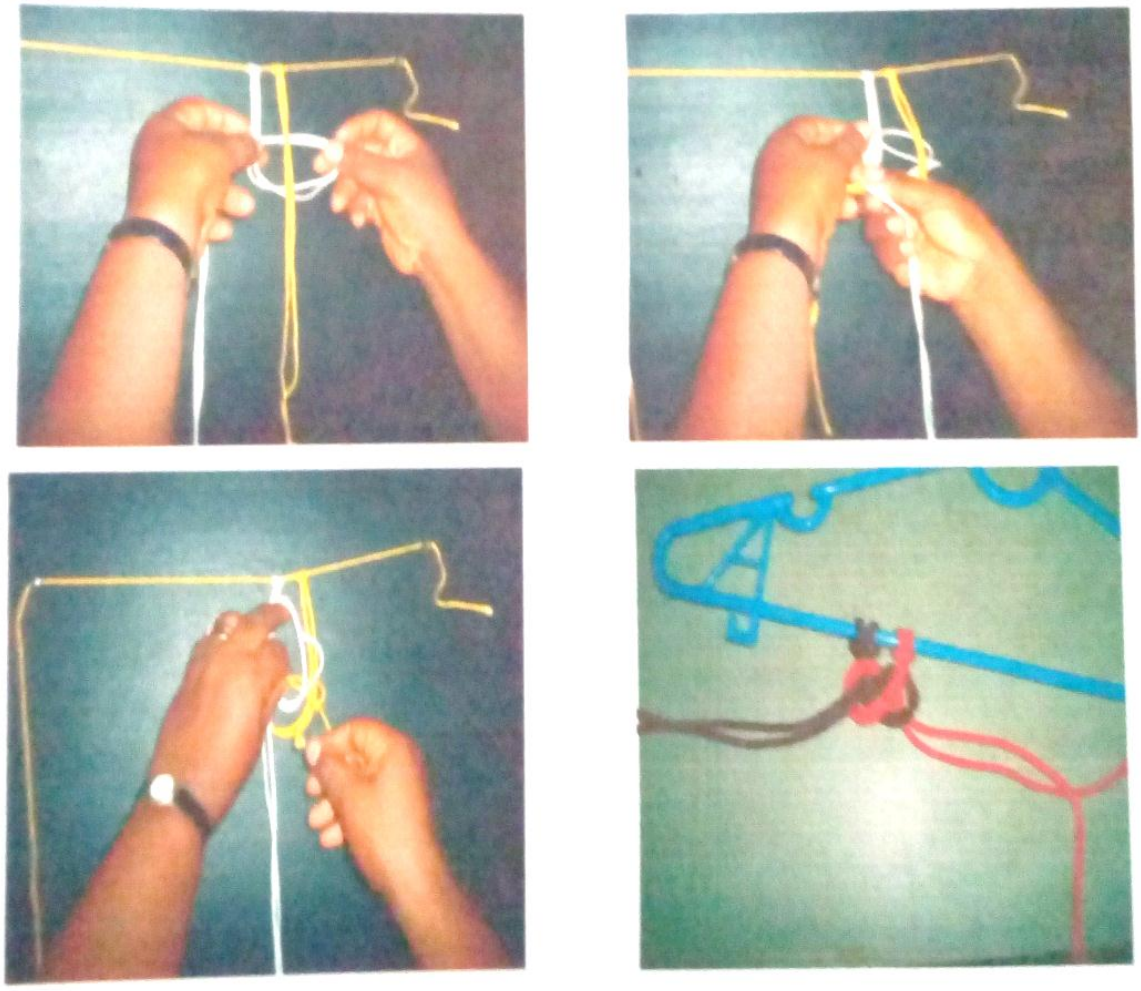

Plate 4.47: Button Hole Knot

Source: Field Research (2016)

4.10.5 Introduction to Twist Knot

1. To make a twist knot, four (4) ends of cords are needed.

2. The twist only produces ropes so it is very suitable for making necklaces.

3. Number the cords 1-4 from left to right.

4. Twist cord 1 behind cord 2 and 3 then place 1 between the 2 and 3 again.

5. Now take cord 4, twist it behind cord 3 and 2 again. This time the 1 stands alone.

6. Continue in that succession till it is done and secure the ends.

Plate 4.48: Twist Knot

Source: Field Research (2016)

Figure 4.3: Twist Knot

Source: Field Research (2016)

4.10.6 Results achieved after basic knot training

There were three groups in all. Each group produced a purse each using the different types of knots that were introduced; making a total of three purses. One with all square knots, one with clove hitch and the other with buttonhole.

Plate 4.49: Square Knot Purse

Source: Field Research (2016)

Plate 4.50: Square Knot Purse

Source: Field Research (2016)

Plate 4.51: Button Hole Purse

Source: Field Research (2016)

Plate 4.52: Button Hole Knot Purse

Source: Field Research (2016)

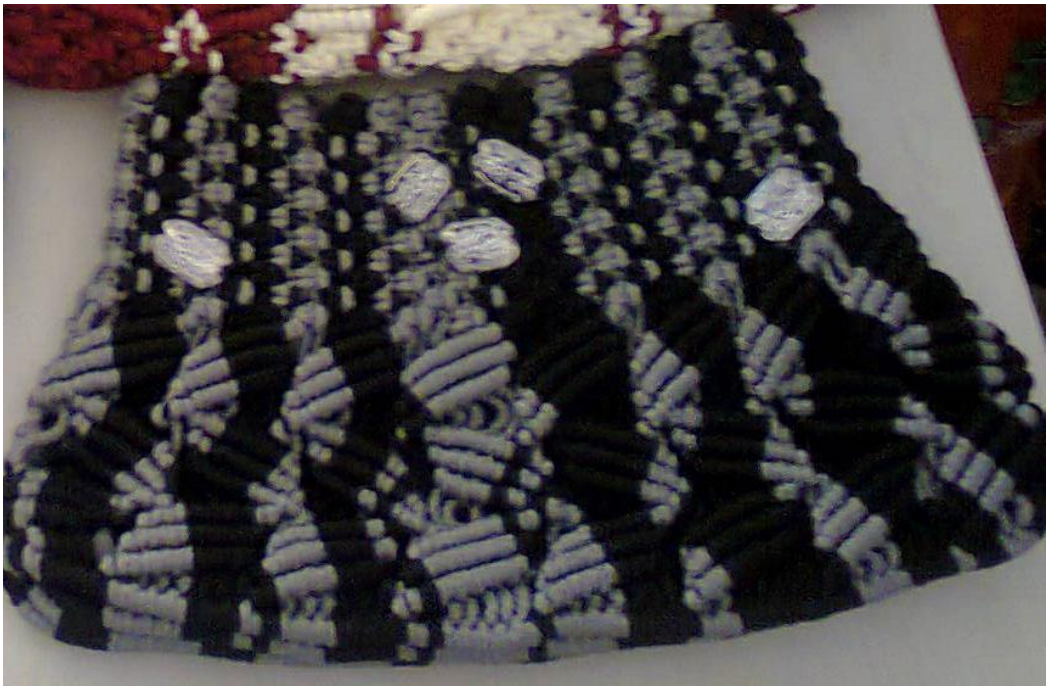

Plate 4.53: Clove Hitch Purse

Source: Field Research (2016)

Plate 4.54: Clove Hitch Purse

Source: Field Research (2016)

The introduction of the knots was successful. After the training, majority of the participants could confidently do the basic knots and were also enthused about introducing their newly acquired techniques to others. They were happy that they have learned something new and wished the researcher was living in the community or rather in their institution to teach a lot more people.

Similarly, the researcher took the participants in the Krobo community through a training programme: The introduction was in the form of demonstration, where the researcher led the participants through the knotting process.

4.11 Introduction of the Basic Knots at Krobo Women's Group

4.11.1 Stages in the Demonstration Process

Researcher first of all shows samples of macramé products which would entice and encourage them to facilitate the learning process.

Plate 4.55: Sampled macramé item being shown to participants

Source: Field Research (2016)

Plate 4.56: Sampled macramé item being shown to the participants

Source: Field Research (2016)

Since participants were a sizeable group, all of them were put together and the basic knots were introduced to them. The researcher explained the concept of macramé to the participants. They were then given sets of rayon cords to produce a series of square knots which would be later used for the production of jewellery.

Plate 4.57: Researcher explaining the concept of macramé to participants

Source: Field Research (2016)

Participants trying the basic knot after the researcher took them through the knotting processes. The same procedures explained in the introduction of the various knots were followed and used.

Plate 4.58: Participants trying the basic macramé knots

Source: Field Research (2016)

After the participants had experimented with the basic knots, the researcher assessed the knots that were done. This was to ensure that the participants were doing the right thing. Corrections of the knots that were wrongly done were unknotted and the necessary corrections done.

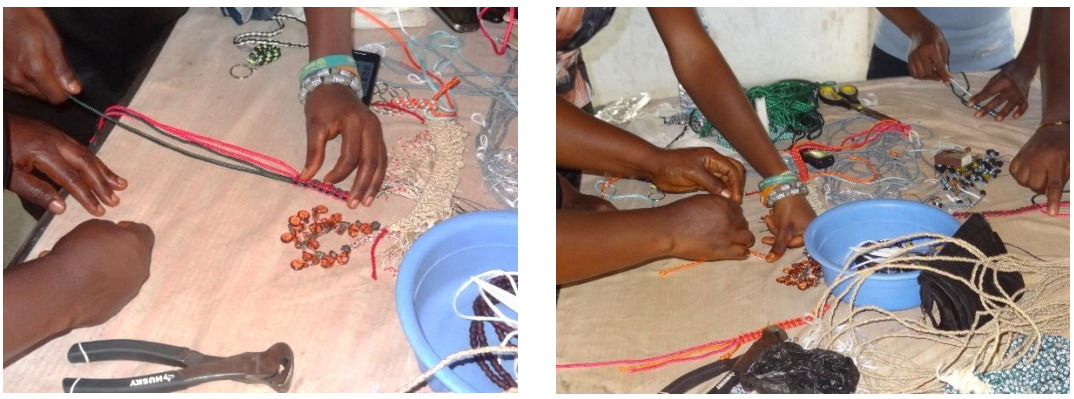

Plate 4.59: Researcher Vetting the Basic Knots

Source: Field Research (2016)

The participants, having done all the necessary corrections, were asked to produce a beaded necklace with the macramé cords.

Plate 4.60: Participants Producing Beaded Necklace

Source: Field Research (2016)

Plate 4.61: Finished beaded necklace

Field Research (2016)

Plate 4.62: Display of the finished necklace

Source: Field Research (2016)

Participants after the training were excited about the new knowledge and technique acquired, however, they showed interest in learning how to use the technique in producing other items beside the jewellery. All the participants could confidently do all the basic knots introduced.

Plate 4.63: Collection of natural plant fibre accessories made by participants.

Source: Field Research (2016)

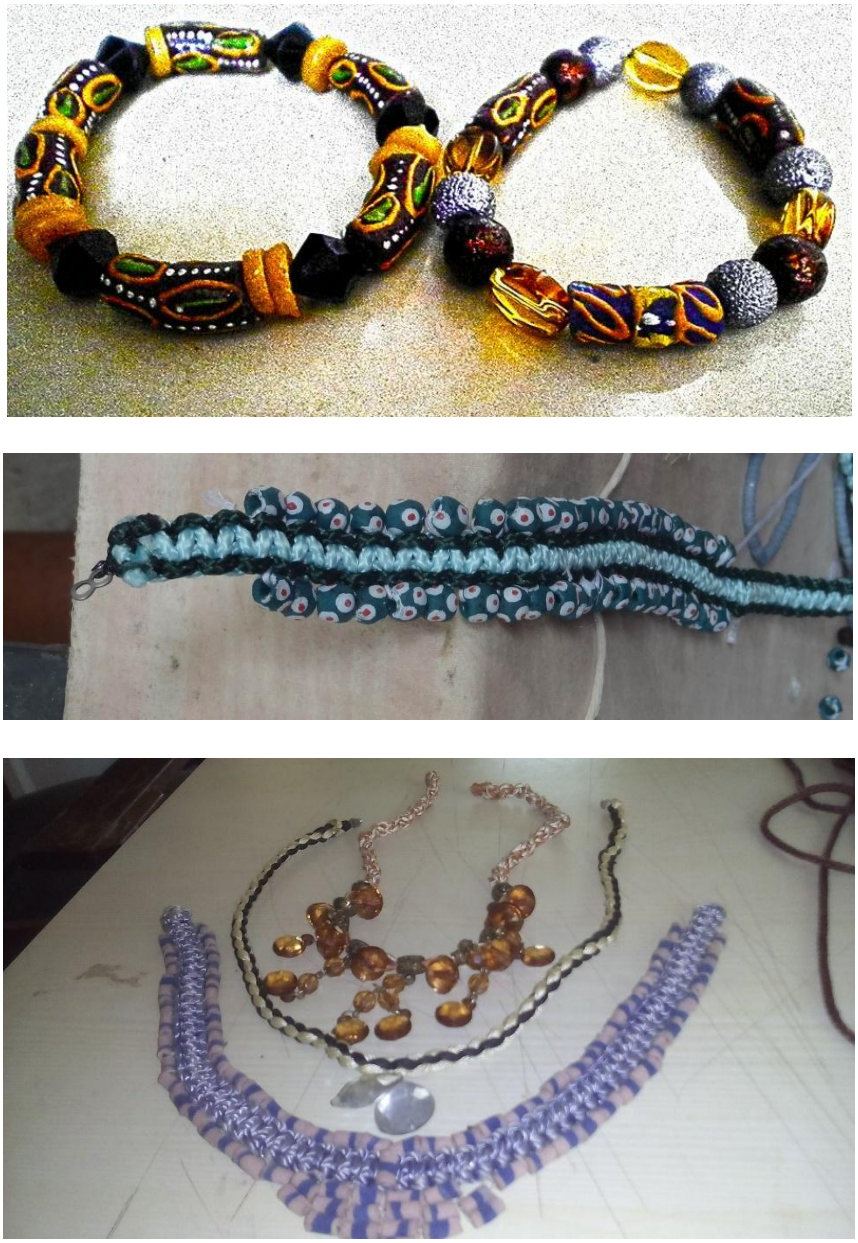

Plate 4.64: Collection of synthetic fibre accessories made by participants.

Source: Field Research (2016)

4.11.2 Appreciation

Finally, accessories were produced by the participants using the plant fibres made. Initially the accessories made came with some difficulties. Some of the cords made for

beading became very stiff and thus could not be used for a long necklaces, they were only suitable for chokers.

Secondly, after wearing some of the chokers the sweat from the human body or around the neck softened the products thus giving it a new out-look. Some of the products were also very supple and easy to use. The participants found the usage of sisal very easy and innovative, since sisal has its own use in the bead industry.

Costing and pricing of products made from the natural plants became a challenge to the participants due to some disadvantages that the products had, but with the synthetic cords it was very easy to price them.

4.12 Purposes, Impacts, Significance and Uses of the plants

I. Spiritual Purposes

Name of Plant: Hibiscus Cannabinus (Kenaf)

Locality: Daffiama, Nadowli District.

How it is used: *Bigre* as it is locally called is used by the locals for widowhood rites. The fibre from the plant is tied around the waist of the widow. Also, the fibre is tied around the left hands or legs of bereaved members of the family.

The significance of the use of the plant: - The fibre tied round the waist of a widow is said to ward off the spirit of the dead husband from her. Also, it identifies the chief mourners of the bereaved family from the rest of the members. It is also used to tie up the straw mat on which a dead person is put or laid in state. This is only done to cut down cost due to the abundance of the fibre within the locality.

How it impacts their lives economically: **-** Obviously the use of the fibre cuts down on the cost of using other materials since the fibre is in abundance and easily cultivated. Due to its availability, the farmers cultivate the plant in large plantations thereby selling out, the stalks of the plants when it is very much matured, for money from the clients. In most West African countries, the plants are used as boundary markers.

II. Medicinal Purposes

Name of the plant: Hibiscus Cannabinus (Kenaf)

Locality: Daffiama

How it is used: The leaves are used to treat stomach disorders. In local medicine in Kenya, pounded roots are administered to spider bites.

The significance of the use of the plant: The leaf of the plant is eaten as a vegetable. It is cut into bits and added to soups as a delicacy of the locals. It is sour, but has some sweetness after eating. Since it is eaten as a vegetable, it is very healthy for the leaves to be ground and water added to it, then the mixture is sieved and the juice drank to cure stomach ache.

How it helps to improve their lives economically: The usage of the leaves as an antidote for stomach upsets saves the locals from spending extra money on orthodox medicine, thus helping them save money.

III. Food purposes

Hibiscus Cannabinus is eaten by the locals as a green leafy vegetable. They are diced and put in soups and stews as a source of vitamin C and K. The seeds of the plants when ground is used for oil extraction and the chaff is fed to the animals.

Group of people who use it: Daffiama, the parts of northern Nigeria and Sudan.

Kenaf grows by seed propagation, when the plant matures, sometimes the seeds disperse from its pods and thus wherever they are scattered, and they germinate and grow. When they grow, they become easily accessible for the locals thus giving them a cheap source of food for both humans and animals. Farmers can sell the extra for income.

IV. Textiles

Kenaf produces a bast fibre similar to jute, but with a greater tensile strength, somewhat coarser and more brittle. Fibres extracted are used in making non - textile goods such as weaving baskets, pens for fowls, ropes for tying, bags, mats to mention a few. These ventures are a source of livelihood for the people of Daffiama. Items made from Kenaf are mostly sold on the local market and exported through NGOs into the European markets. In Africa, production is limited and practically all Kenaf fibre is produced domestically, industrial production is reported from Nigeria and Sudan.

V. Fuel

Kenaf took us 3-4 weeks from emergence to the first harvesting. When the plants are mature, they are pulled up by its roots and sold in bundles. The recommended time for harvesting Kenaf as a fibre crop for an optimum balance in fibre yield and quality is

when about 50% of the plants are flowering. After the fibre have been peeled off the stalks or stems are used as wood for fuel for domestic purposes. In so doing, money is saved for burning fuel.

Kenaf is a high-yielding plant fibre for the market. At present its main constraint is its sensitivity to nematodes. Kenaf fibre is a biodegradable and environment-friendly raw material suitable for many applications, such as woven and non-woven fabrics, Geotextiles and semi-rigid and laminated sheets for packaging and paneling. Kenan stems are excellent substitute for soft wood as raw material for the pulp and paper industry (PROTA 16).

4.12.1 Social Impact

Name of the plant: Agave Sisalana (popularly known as Sisal)

Group of people who use it: The people of Daffiama in the Nadowli District of the Upper West and Odumase in the Manya Krobo District of the Eastern Region.

Sisal fibres are used in weaving traditional baskets, making ropes for tying various items, twines for stringing beads, also for tying around the wrist and neck of newborn babies. During puberty rites, the sisal yarns are tied around the neck or upper arm of the initiates.

I. Significance of the use of the plant or the impact

The use of sisal fibres within the two communities in retrospect, which grows in the wild cuts down on cost for other alternative twines. In rural areas in tropical Africa sisal fibre is used for making rope, string, mats and sandals.

II. Medicinal Purposes

Name of plant: Agave Sisalana

People who use it are mostly the locals from the two communities for study. In Eastern Africa a root decoction is drunk as a diaphoretic and a leaf decoction as a diuretic, while sap from the leaves is taken to treat constipation and stomach ache and also applied to minor cuts on the body. In Morocco, sap from the leaves is used as a wash for skin disease, syphilis, pulmonary tuberculosis and jaundice.

In Ghana, it is used as a laxative. When the fresh juice from the sisal leaf comes into contact with the skin it itches, but when heat is applied it does not have any diverse effect. There is scope for increased utilization of sisal, in view of the resurgence of demand for natural fibres for their biodegradability and unique appearance and texture. Non-traditional uses of sisal and sisal-like fibre, especially for the production of pulp, offer promising new possibilities for producers. However, labour shortages due to low wage paid in sisal plantations may hamper development of mechanical harvesting methods would enhance their prospects as fibre crops, especially if it could be combined with fibre extraction. Better utilization of the by-products would help to make their cultivation more profitable (PROTA 16).

In the foregoing paragraphs, the plants have been put together under the various themes.

III. Medicinal Purposes

Name of the plant: Acacia Pennata, Broussonetia Papyrifera, Steraculia Tragacatha and Vernonia Biafrae

All these plants find their locations in the Manya Krobo District of the Eastern Region in Ghana. The leaves and bark of these plants are boiled and drunk for treatment of malaria, post-partum pains. Some of them are provided and the poultice used on wounds. In

Cameroon, the leaf juice of Vernonia is used as eye drops for the treatment of cataract. In Tanzania the root decoction is taken against back pain, hernia and dizziness. In Namibia, the root decoctions are drunk against postnatal and stomach pains. The use of these plants for medicinal purposes gives a first aid treatment for most ailments, Thus the indulgence after using these concoctions are able to save money which is meant for orthodox medicine.

4.12.2 For Social and Economic Purposes

Acacia Pennata, Vernonia Biafrae, Sterculia Tragacantha, Fermiana Bateri, Broussonetia Papyrifera are plants whose bark are mostly used because of their fibrous nature.

The indigenous people found the barks of the above-mentioned plants as very handy. Their barks are quickly peeled off for tying farm produce, for making traps for catching game, and used as ropes for drawing water from wells. In the case of Acacia Pennata, the flexible stem is very spongy therefore, the plant is slightly roasted to make peeling easier and beating into a pulp easier. Other uses of these plants are that the barks, when peeled for their ropes, are used in weaving mats for drying farm produce such as cocoa beans, maize, pepper, palm fruits to mention a few. The ropes made from these plants were sometimes used to make bags for hunting purposes.

For most of the local people using these plant fibres or yarns is highly economical since it prevents them from using other items which have to be purchased.

Most of the plants are multipurpose, not yielding only fibre for local production such as mats and ropes, but also a range of other products including edible leaves and seeds. Oil extraction from the seeds of Sterculia Tragacatha though not edible has technically been demonstrated to be feasible to be used for cosmetic purposes and biofuel. Broussonetia Papyrifera is an invasive weed, but could be a good source of raw material for Specialty

papers such as currency note which could have some future potential in Tropical Africa (PROTA 16).

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Overview

The summary of the relevant points and findings revealed by the study, the informed conclusions and beneficial recommendations are important elements that should convey the relevant material derived from the study to promote discussion on effective fibre plant extraction for teaching and learning of macramé.

5.2 Summary

Ghana forest cover which stood at 8.2 million hectares at the turn of the century now stands at a paltry 1.8 million hectares. This is shocking but that is the stark truth. It is indeed a worrying situation and something drastic needs to be done and pretty fast. Forestry experts have proffered a litany of factors ranging from the establishment of human settlements, uncontrolled logging, and annual wildfires, downward drift of the Sahara Desert to illegal chainsaw and mining operations. The forest is not in exhaustible resource so it is needless to state that our food security, timber industry and general national economic growth will suffer from the deficit. The identified plants used in the experiments throughout the research demonstrated the feasibility of the materials as a good source of raw material for macramé knotting. The purpose of this project has been to explore the natural reserves, identify plants from which fibres can be extracted and applied to the production of macramé. This task was accomplished by means of assisted visits to various locations to identify, photograph and collect samples of the plants for the experiments; interviews with some indigenous weavers and observation of traditional processing techniques and uses of the fibres; and experiments to explore the fibre

yielding properties, possibilities in extracting fibre from the identified plants under basic art studio conditions, and their suitability for macramé knots. The aim was to seek ways to expand the raw material base to sustain and provide yarn variety; making indigenous knowledge available to teachers and students; and creating awareness for the potential in such art projects, and employable skills that could be gained by students, teachers and the general public.

The extensive nature of plant fibre, however, demands in-depth research and chemical analysis in order to understand the properties of the identified and extracted fibres and their reaction with particular mordants. Nonetheless, the results of this investigation hold a promise for expanding the raw material base of the macramé techniques among students and women in Ghana.

5.3 Conclusions

Twenty plants with fibre yielding properties were identified within the two communities namely, the Daffiama community in the Nadwoli District of the Upper West Region and Manya Krobo community in the Eastern region of Ghana. Some of them were purposely cultivated for food and others grew in the wild with no proper care. Out of these, eight were selected due to their high fibre yielding properties. Another added advantage, was the fact that the plants did not need any special treatment for cultivation. It was very obvious that the locals could easily identify these plants due to their use for daily activities such as ropes for drawing water from wells, tying of goods just to mention a few. Kenaf cited in the Upper West is an annual herb with an erect stem, slender and cylindrical. It is a vegetable plant therefore the food part has to be exhausted before the stems can be harvested for the fibres, which are peeled off the wooden core and twisted. Sisal cited in both regions is a robust perennial herb crowded in a dense rosette and its

leaves arranged in an ascending spiral when the leaves are harvested they are beaten to obtain the fibres, which are long, fine and spongy. Accacia was also cited in the Eastern region. This is a flexible climber with a thin rough back; it had to be roasted before the bark could be separated from the woody core. The fibres are very spongy when beaten, as it was used as a local sponge. Vernonia also found in the Eastern region is a tree shrub with thick stems. Its fibres do not rot in water and therefore are very strong. Sterculia found in the above regionis a deciduous small size tree not too strong but yields fibres for tying it is gummy when fresh but its fibres when extracted over a short period dries up quickly, when left without moisture. Sansevieria Aethopica has the same characteristics as sisal. They are all leaf fibres. Broussonetia is a fast growing plant which sprouts on any fallow land all over the country its fibres are very elastic and long so very suitable for yarn and paper making. Lastly Urenia Lobata also has the same characteristics as Kenaf and behaves in similar manner as Kenaf.

To examine and experiment with the fibres extracted from the selected local plants, the fibres underwent vigorous twisting or braiding to ascertain its pliability for yarns, cords or ropes. These investigations were also done to ascertain their suitability for knotting macramé products since macramé knotting undergoes twists and bends. Simple physical properties test such as plant fibres strength, elasticity, durability, lustre and affinity to dyes were conducted. It was observed that their results from the test varied within the different species of plants selected, but most of them were found to be suitable for knotting. Some of the fibres were also very difficult to twist in their dry state.

Finally the macramé concept was introduced to the locals by first using the synthetic fibres which was readily available and easy to work with, the end products of the exercise proofed successful and awesome. After mastering the basic knots, the locals were introduced to the natural fibres processed into yarns to produce few items. However, few of the processed yarns became very stiff after use over a period of **14 days**. Thus making them unsuitable for accessory making rather conducive for basketry. It was noted that these few plants which behaved that way needed moisture, sizing up and further treatment. Plants like Sterculia tragantha, Vernonia Biafrae and Accacia Pennata are typical examples of plants that behaved in such manner.

5.4 Recommendations

Macramé technique offers knotting combinations using different material fibres for interesting art works. In view of the above, Ghana`s forest region offers many material fibre opportunities that can be exploited as evident in this thesis to make maximum use of its abundant possibilities. The researcher therefore recommend these practical measures for consideration:

1. For plant fibre sustainability, it is recommended that these plants be grown instead of allowing them to grow in the wild or in other cases, just felling the trees to harvest the barks before usage. For effective cultivation, the indigenes must liaise with the forestry commission to help them undertake this all-important assignment for the future. To encourage fibre processing, producers of plant fibre must have the ready market for their yarn to sustain growth.
2. Out of the eight plant fibres identified, Kenaf, Paper Mulberry and Vernonia are the only plants that did not have to be beaten into pulp before twisting into yarns. Rather the peels were splitted further into thin strips before twisting. For that

reason these yarns were rather not suitable for accessory making because the ply made became very thick and stiff when dry. It is therefore recommended that these three plant yarns be channelled into the basketry industry for weaving. Since the remaining five plant yarns passed the experimental and fundamental test, it is recommended that more scientific test be done on these fibres to find out more on their durability and their reaction on the various skin type of humans.

3. In order to encourage more artisans to venture into the use of natural fibre yarns for macramé in the industry, it is recommended that the men especially the youth get involve in their production due to the laborious nature of their processes. This will address one of the major concerns of the bead makers who yearn for its use.
4. Apart from the usage of plant yarns and cords by macramé craft weavers, the yarn fibres can offer innovative possibilities to other craftsmen related to the use of fibre cords and therefore are encouraged to patronise it.

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APPENDICES

APPENDIX 1: LETTER OF INTRODUCTION

DEPARTMENT OF GENERAL ART STUDIES
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Ref: GAS/S/3

Date: 13th May, 2015

The Head
St. Theresa's Vocational
Daffiama
Upper West Region

Dear Sir/Madam,

ART EDUCATION RESEARCH WORK – MILLICANT M.O. MATE (PhD)

Ms. Millicent M. O. Mate is a second year Phd African Art & Culture student in the above Department of KNUST.

Her student ID Number is 20286319.
She is conducting a research on "Processing and Utilization of Plant fibres for Macrame in Art.

I would be very greatful if you could provide her with the necessary assistance to collect data for this study.

Thank you very much for your help.

Sincerely yours,

Dr. Joe Adu-Agyem
HEAD OF DEPARTMENT

APPENDIX 2: INTERVIEW GUIDE

1. Do you make use of any local plants in your practice?
2. Give me examples of plants very popular in your locality?
3. How are the names of these plants derived?
4. How are the plants used?
5. Is there any way to identify the fibre forming properties of these plants?
6. Which part of the plant are used?
7. How durable are the fibres obtained?
8. Are there any complications in the use of these plants?
9. How does the plants identified relate to your traditions and customs? Ie religion, puberty rites
10. Does the use of these local plant create job opportunities for members of your community?

APPENDIX 3: QUESTIONNAIRE FOR VOCATIONAL STUDENTS

DEPARTMENT OF GENERAL ART STUDIES

FACULTY OF ART

COLLEGE OF ART AND BUILT ENVIRONMENT

Email: odikro50@gmail.com

Questionnaire for vocational students

This study is part of my doctoral studies in African Art and Culture. The questionnaire seeks to explore the possibilities of using plant fibres for yarn production to be used in macramé weaving. This is a way of cutting down on cost of importation of synthetic yarns and introducing the concept of macramé to selected communities in Ghana.

The findings of the study will hopefully assist weavers and yarn producers to have first-hand information on the accessibility, availability and affordability of yarns produced from the environment. This will in effect cut down on the importation of synthetic yarns which will further create employment for the youth.

It is vital all your answers are accurate and honest. Your answers to this questionnaire will be as confidential and private. The results of this study presumptions will be published.

Please complete all questions for comments and questions, please feel free to contact me on (+233) 277-429-397 or the email above.

Thank you for being willing to complete this questionnaire. I look forward to publishing and sharing the outcome of this study with the Ghanaian community.

Millicent Mate

Researcher

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

COLLEGE OF ART AND BUILT ENVIRONMENT

FACULTY OF ART

DEPARTMENT OF GENERAL ART STUDIES

QUESTIONNAIRE

OBJECTIVE ONE

1. Do you make use of any local plants in your practice?

[ ]Yes [ ] No

2. Can you provide some of the names of the local plants you use?

……

……

……

2a) How are the names of these local plants derived?

……

……

……

3. Do you know if any of these plants have fibre forming properties?

[ ]Yes [ ] No

3a) Is there a way of identifying whether or not a plant has fibre forming properties (visually or scientifically)?

……

……

……

4. Are these local plants easily available in the community?

[ ]Yes [ ] No

5. How are the plants grown and harvested?

……

6. Apart from the aforementioned plants, do you know of any other plants which have fibre forming properties and can be used?

……

……

……

7. Are there specific ways of describing these plants?

[ ]Yes [ ] No

7a) Explain by examples

……

……

……

8. According to your training, are there modes of classifying these plants?

[ ]Yes [ ] No

8a) If there are modes of classifying these plants, please state them.

……

……

……

9. What makes these plants fibre forming?

……

……

……

10. Which part of the plant is used for making fibres?

……

……

……

11. What are some of the products these local fibres are used for?

……

……

……

12. How durable are the fibres and their end products in general?

[ ] Extremely durable [ ] Durable [ ] Not durable

OBJECTIVE TWO

13. List the step by step procedures involved in extracting the fibres from the plants?

……

……

……

14. Is there a way of testing for specific properties in the plants?

[ ]Yes [ ] No

14a) Explain your answer

……

……

……

15. Are there any complications or discomfort in working with the local yarns?

[ ]Yes [ ] No

OBJECTIVE THREE

16. Have you heard of macramé?

[ ]Yes [ ] No

17. Would you prefer to go through a course that trains you to know the alternative uses of local yarns or stick to what you know?

[ ] Go through the training [ ] Stick to what I know

OBJECTIVE FOUR

18. Have you tried using alternative materials for your products?

[ ]Yes [ ] No

18a) If yes, explain.

……

……

……

19. Which group of people form your target market?

20. Do you use imported materials?

[ ]Yes [ ] No

21. If yes, comparing local materials to imported materials, which one is more economical?

[ ] Local materials [ ] Imported materials

22. Which of these materials would you prefer to work with?

[ ] Local materials [ ] Imported materials

23. How do these plants relate to your traditions and customs in terms of the following?

23a) In relation to your tradition, are there specific religious importances of these plants?

……

……

23b) Are you taught the names, uses and properties of these local plants as part of your informal education?

[ ]Yes [ ] No

23c) Are there beliefs that go along with the names, uses and properties of these plants?

……

……

23d) List some of the beliefs that are attributed to those local plants.

……

……

23e) Are there specific rules and regulations governing the cultivation, harvesting and usage of these plants in your society?

……

……

23f) Are there plants used in any of the following rites of passage and ceremonies of status according to your tradition?

[ ] Naming ceremony [ ] Puberty rites [ ] Marriage ceremony [ ] Funeral rites

[ ] Chieftaincy

If yes, how?

……

……

23g) Are there local plants associated with your community?

[ ]Yes [ ] No

24. Does the use of these local plants create job opportunities for members of your community?

[ ]Yes [ ] No

25. As a source of material for production in your practice, do these fibres provide a source of income to the community as a whole?

[ ]Yes [ ] No

25a) Explain your answer

……

……

……