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Preliminary Examination of the Processes of Production and Value Chain Management of Indigenous Shea Butter Marketed in Nigeria

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ABSTRACT

Shea butter has gained maximum attention in local and international markets for its diverse and widely effective use in pharmaceutical, chemical, cosmetics firms, and domestic culinary (food) functions. Its production and exportation have a protracted positive impact on the economy, increases GDP, improves food security, and creates a source of livelihood. The study attempts to find out the value chain from harvesting ripe fruits to the packaging of processed butter, alongside the constraints of the process using secondary data. It was found that about 13 labor-intensive stages are involved in the transformation of raw Shea kernel to butter in two distinct phases. Semi-mechanized, bridge-press, or fully mechanized processing systems have been deployed for better quality performance, with semi-mechanized being preferred for adding more quality, reducing the fatigue and long man-hours involved. Areas of bedevilment include climate variability induced rainfall patterns and drought, seasonality of fruit development with over-exploitation, reduced plantation and planting, soil degradation, disease and pest infestation, adulteration during the refining of butter after extraction from the kernel. The value chain is threatened by inadequate orientation, improper storage facilities, and vulnerability to extinction due to conservation threat levels, stringent regulatory policies, and taxation, packaging deficiencies, especially for locals. Suffice to say that for an efficient value chain management, deployment of biotechnology for improved and more adaptive variety production, quality control, fair trades policy frameworks. It is recommended that regular training, financial support for redesigning and improving the efficiency of the machines by developing or upgrading new versions to increase output and enhance quality.

KEYWORDS: *Shea kernel, processing, Shea butter, extraction, export, sales, value chain, constraints*

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1. INTRODUCTION

1.1. Background of the study

Two species (*Vitellaria paradox* and *Vitellaria nilotica*) of Shea butter trees are identified and produced in Africa. *Vitellaria paradoxa* does well in northern West African countries, while *V. nilotica* does well in northern Uganda and southern Sudan. A top edible oil produced by the V. paradoxa tree, according to Jibreel et al. (2013), is regarded a significant asset in many regions of Africa. There are several applications for the plant in local communities and industry, including the local eating of mangoes, the creation of herbal cures, the production of charcoal, and the use of the trunk as a source of wood. To produce butter, you may also utilize the kernel. Butter is used to replace cocoa butter in traditional treatments, cosmetic, chocolate, candy, and pastry. Vitamins A, E, and F are found naturally in it, making it a popular ingredient in medications and cosmetics. Shea butter is also commonly used in

the home, for example in cooking, as a skin moisturizer, and even in food goods (Olalade, 2014). As a moisturizing cream, for illumination, for soap marks, as a herbal treatment for fire-lighting, and for water-proofing homes, the dried kernels of the Shea tree (generally known in the West as Shea butter or Beurre de karate) are utilized in vast amounts in traditional cultures. Besides being utilized as fodder for livestock, the leaves may also be used to make alkaline and paint, which Europe and the United States are major markets for this product.

The supply chain is a network of product-related commercial operations that facilitates the movement of items from the point of manufacture to consumption, including pre-and post-production activities. This is mainly concerned with the cost reduction of links and the duration of making the products available in the market to maximize profit. On the other hand, the value chain goes beyond just bringing the product to the market but embraces the incremental value added to the product in the nodes chain either by value addition or value creation (Michael, 2016). The value chain empowers the various networks or stakeholders as they try to recognize creative opportunities to contribute and increase the product value. To ensure the stakeholders contribute effectively, it needs a collaborative effort involving diverse entities working together, sharing processes and technologies to serve the customer. The collaborative efforts of these networks will promote innovative skills among partners, reduces production cost, transfer of knowledge, and above all, increase the overall quality and performance or output. This assures that collaborative effort is necessary if qualitative products are to be produced for the final consumer (FAO, 2010).

2. LITERATURE REVIEW

2.1. Understanding Value Chain Management

Micheal (2016) described value chain management as "a comprehensive redesign of operations from the retail consumer through manufacturing, sales, marketing, shipping and procurement," which he characterized. When the whole supply chain works together, inventory levels are reduced, customer satisfaction is increased, and time to market is shortened. Definition: The whole range of activities required to provide a product or service from conception through different production stages (physically transformations and inputs from diverse producer services), marketing to final customers and end-of-use final waste disposal (Kaplinsky et al., 2010). This means that a product or service must undergo physical transformations before it reaches the end customer. Each activity in a company's value chain reflects the company's history and strategic goals as well as the underlying economics of those operations. The two primary forms of business activity are primary and support activities. Primarily, the actions involved in converting inputs into output, delivering products, and assisting with customers' post-sale needs fall under this category. The second line of activity within the value chain is the support activity. The appropriate people typically handle these within the relevant department. Supply and purchasing of raw materials; technological development; human resource management cell selection; appraisals; rewards; labor relations; last but not least, firm infrastructure that focuses on general business management, planning; financial accounting, and legal issues are all functions performed by this support staff (Michael, 2016).

2.2. Principles and Requirements for Effective Production Process

According to Addaquay (2014), a successful manufacturing process requires the fulfillment of several prerequisites. You can't start a manufacturing process until you have a company, not a factory. Forcing participation from people who may not be competent or motivated at the industrial level will reduce the production's ability to remain competitive. Second, everyone involved in the process must be sufficiently enthused. For example, the system of government may decide who belongs to the system and what their job is within it, which might serve as inspiration for this kind of behavior. Sharing strategic and operational information on a regular basis may help drive everyone to perform at their best. Consumers' evaluations of quality and value are utilized to establish financial incentives or punishments. An additional need is that enterprises should be able to use information about the chain's internal dynamics and its external environment to make choices that can be put into action and measured. This is important because the activities of the external environment in which they operate can influence the firm's structure, operations, and ultimate competitiveness. The fourth requirement necessary for an effective production process is the process that must adhere to a particular set of principles. The fifth and final requirement is that firms should understand and know how to manage the process and not focus on the labels production Managers should know which individuals, links, or sections that can comprise the process and the factors that bind or glues the process together for effectiveness and efficiency (Samou & Lamieu 2013).

The dried kernels of the Shea tree are the primary source of the tree's oil or fat. Small businesses use

this as a raw material. Shea butter is the most widely utilized fat in manufacturing food, cream, and soap in the northern region of West Africa. Around 150,000 tons of kernel are shipped out of Africa each year, almost the same as what is utilized here, with up to 10% of that quantity going to cosmetics (Samou & Lamien, 2011). If implemented properly, this project might have a tremendous impact on the African economy and the overall supply of vegetable fats. The current market value of African shea exports is believed to be approximately $30 million (USD) and the price per ton of dry kernel is currently around $200 per ton free on board (USAID, 2005 in Obibuzor et al., 2014). If the Shea fruit is ripe, it is traditionally and medicinally consumed fresh like a mango, much like any other fruit. Bark, cortex, roots, and leaves may be utilized to manufacture herbal treatments, and charcoal can be made from a tree trunk, which can also be used as a construction material. The nut's butter is also removed from the nut. As a substitute to cocoa butter, the butter is also utilized in traditional local remedies and cosmetics, chocolates, candies, and pastries. Cosmetics and medications also include it. This is owing to the high concentration of anti-oxidant vitamins that are present therein (Jibreel *et al.*, 2013).

2.3. Transformation of Shea Fruit to Shea Butter

Generally, there are three recognized ways of making Shea butter, and the categories are traditional or manual, semi-mechanized, and fully mechanized or industrial systems. In West Africa, the Shea fruit undergoes the same traditional procedure and is predominantly made by women (Olalade *et al.,* 2014).

2.3.1. Traditional/Manual Method:

According to Addaquay (2014), the traditional method (Figure 1) predominates, and about 60% of all crude butter is produced by the rural-based women who employ the manual way of extraction. One kilogram of Shea butter takes up to 20-30 hours for one person to produce, and about 8- 10kg of firewood is needed to produce only 1kg of butter. The essential traditional equipment includes mortar, pestle, cooking pots, frying pans, grinder, and firewood. The significant stages, according to Mensah (2010), are as follows

1. Gathering the ripe fruits or nuts
2. De-pulping, boiling, and de-shelling
3. Breaking of kernel
4. Roasting
5. Pounding and grinding
6. Beating
7. Boiling

Collections of Fruits or Nuts: Shea nut picking is usually done by women and children within families. Research has it that some men are now also in the collection due to the finance it generates (Garette *et al.,* 2013). The collection is a daily activity for women in the area from 530hrs up to about when the sun's heat compels them to retire. The Shea tree sheds its fruits in the middle of May and continues to about August and September. The collection is done by moving from tree to tree to pick the fruits and even shaking the tree for others to fall off. Due to the presence of wild animals, they do not go far beyond certain boundaries, and the collection is done by foot and head pans. The owner's wives only pick Shea trees found on cultivated lands. Prohibition is given to trees on cultivated plots, but the issue of illegal picking is at times reported (Garette *et al*., 2013).

De-pulping, boiling, and de-shelling: The removal of the delicious fruit reveals the nuts at these phases. In addition to eating the majority of the mesocarp, boiling and drying also removes any leftover mesocarp from the nuts. It's been shown that drying the harvested fruits for extended periods of time produces significant degradation. The nuts are then sundried for hours and days to make them very dry for the next stage, de-shelling. This process is known to cause lots of damage to the kernel as this is done manually. About 80% of the kernel is visibility bruised (Drost, 2012).

Breaking of kernel-after de-shelling: After the shell has been removed, the kernel is sundried again for hours and then broken into pieces to prepare them for the next stage, roasting. The breaking of the kernel is done manually with a mortar and pestle.

Roasting: The nuts are roasted to give a brown color at this stage. The roasting is stopped when they achieve that brownish color and can easily be broken by hand. For the best butter extraction, a temperature of 1200 degrees Fahrenheit is required. It will become black and cannot be sold on the market if it has been burned (Schreckenberg, 2014)

Pounding and grinding: After the kernels are roasted and the brown nature is achieved, the pieces are ground again manually with mortar and pestle to obtain a brown-black paste. After the brown-black stage is achieved, it is ground on a flat stone. This, traditionally, is the most challenging stage but vital for the butter extraction process. Interestingly, the thoroughness of the grinding will determine the quality of butter to be obtained.

Beating: Beating involves the preparation of paste for beating. Warm water is added severally to keep the paste at a perfect high temperature because a cold paste at a very food high temperature because a cold

paste is difficult to beat. At this stage, the butter appears as a creamy mass.

Boiling: After the beating stage, the mass is washed to remove unwanted Shea nuts. Nevertheless, this also removes vitamins and taste, so much washing is not advised. After this, the mass is boiled again for water to evaporate, leaving the butter behind. This is then allowed to cool as it will turn into solid white butter. The quality of butter obtained will depend on the number of kernels used. A 9 kg kernel can give an approximate 3 kg butter as this also depends on the uniformity and temperature of roasting.

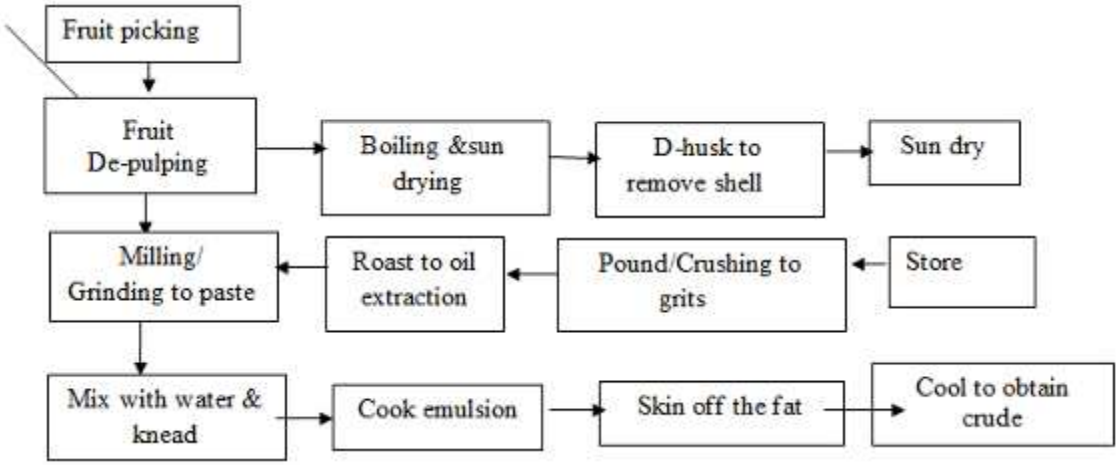

Figure 1: Stages of the traditional manual method (Source: Addaquay, 2014).

2.3.2. Semi-Mechanized Method: The new technologies of nut crusher, roaster, and hydraulic pressers, do not solely work on their own but complement the traditional process. The introduction of these new technologies has improved the extraction rate from about 20% to 40%. The semi-mechanized is ideal for developing countries in the West African region.

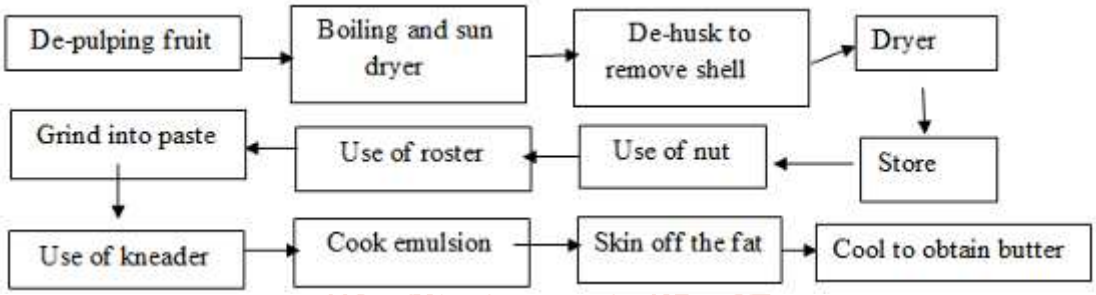

Figure 2: Semi-mechanised method of producing Shea butter (Source: Addaquay 2014)

The chart shows that introducing small-scale machines such as the dryer, roaster, nut crusher, and kneader has reduced traditional processes and helped reduce the drudgery of traditional methods. This has, in many ways, improved quality and enhanced productivity.

2.3.3. Fully mechanized/Industrial Method: When it comes to the quality of butter, Addaquay (2014) said that industrial or completely automated processes get the best results. Unrefined Shea butter is used as a raw material in the industrial unit, which includes an extraction plant and a refinery. Automated and electronic methods may also be used in this procedure. Typically, large-scale manufacturers include refineries inside their extraction facilities. Developed nations like the United States, Japan, India, and the Netherlands, to name a few, use this technique (Mensah 2010).

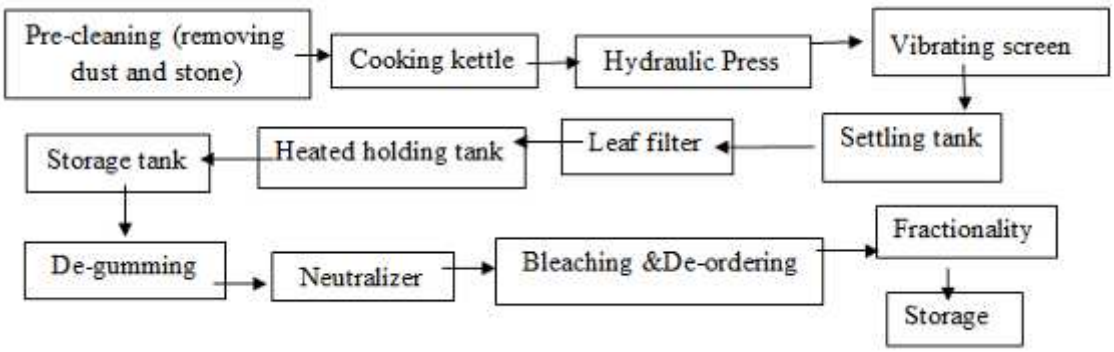

Figure 3: Fully-mechanised method of producing Shea butter (Source: Addaquay 2014)

2.4. Adding Quality to the Shea Butter

"Bawa" has three primary concerns about the traceability and consistency of butter's quality and quantity. Fat, moisture, and FFA content in the kernel are all indicators of excellent quality-price on the worldwide market. Although there is no evidence to support this, the European Union's new restriction on the amount of non-cocoa fat in chocolate raises the specter of a significant increase in the demand for vegetable fat or stream (Osibo, 2013). To comply with these rules, all cocoa butter substitutes (CBS) or improvements (CBIs) must be manufactured with a stream derived from a small number of tropical plant species; nevertheless, the market's preference for whatever species, i.e., "fat," draws the best market price depends on supply and quality (Bawa, 2016). It should be noted that because of a wide range of genetic irregularities, it is possible to get butter from various sources with varied melting temperatures, resulting in a large variety of fatty acid and unsaponifiable profiles in both Shea kernels and butter.

The absence of proper quality control, particularly in rural areas, is a second problem with Shea butter and kernels processing. With the high demand for Shea butter with low levels of free fatty acids, peroxide value, and fungal contamination, recent research sponsored by United States Agency for International Development (USAID) has showed that drying the kernel and accumulating fresh Shea nuts are the most critical post-harvest processing steps in terms of determining the quality of the kernel. If the quality is inadequate, further extraction operations may be able to retain it, but the Western market will almost certainly need further refinement before use. A third reason for the low quality of butter is that it is not produced according to industry standards for extraction, storage, and packaging. The international accepted standards for unrefined Shea butter as developed by the George (2012) and approved by UEMOA (Union Economic monetary QUEST Africa)

Table 1: UEMOA Standard for Unrefined Shea Butter

Parameter	1st Grade	2nd Grade	3 rd Grade
Free fatty acid (%)	0 – 1	1 – 13	3.1 – 8
Peroxide Value (m Eg)	0 – 10	11 – 15	15.1 – 50
Moisture Content (%)	0 – 0.05	0.06 – 02	0.3 – 2
Insoluble Impunities (%)	0 – 0.05	0.1 – 02	0.3 – 2

Source**:** Lovett (2014)

Cosmetics often include First-grade unrefined shea butter. and pharmaceutical sectors and for direct ingestion by the general population. In the culinary sector, the second-grade Shea butter is used for confectionery, chocolate, edible oil, or margarine base. The third grade might be used in the soap-marketing industry or refined for personal use. To ensure that the butter meets these criteria, it must be tested at one of the approved labs (Lovette, 2014).

The Nigerian Approach to High-Quality Shea Butter: Due to its enormous fertile land area, Nigeria is the world's largest producer of Shea fruit. One-fifth (of Nigeria's 36 states) are actively engaged in producing Shea butter and kernels. These include the states of Niger and Nasarawa, Kwara and Kogi's federal states, and the states of Adamawa and Benue (Obibuzor et al., 2014). According to this expert, a considerable percentage of the Shea fruit produced in Nigeria is lost to decay in the bush owing to inadequate gathering methods. Due to the technique used to gather and prepare Shea fruit, the value of Shea kernels and butter in Nigeria is deficient. The nuts and butter derived from Shea fruits may be treated with local antioxidant or antiperspirants to extend their shelf life and reduce odor before being turned into final goods (Olalade et al., 2014). Other issues included dirty utensils, unpleasant work environments (often in the shade), poor quality control, and inadequate butter storage facilities.

2.5. Nigerian Shea Butter Production Limitations

Several constraints affect the production efficiency of Shea butter in Nigeria. Areas of bedevilment include climate variability induced rainfall patterns and drought, seasonality of fruit development with over-exploitation, reduced plantation and planting, soil degradation, disease and pest infestation, adulteration during the refining of butter after extraction from the kernel. The value chain is threatened by inadequate orientation, improper storage facilities, and vulnerability to extinction due to conservation threat levels, stringent regulatory policies, and taxation, packaging deficiencies, especially for locals. Some of the constraints identified by Eneh (2010) in the Nigerian Shea butter industry include;

A. Improper storage facilities heading to high levels of aflatoxin in the butter
B. Inadequate export-oriented Shea butter manufacturing company and their productive capacity
C. Unrecorded export trade, especially butter (informal sector)

D. Restricted access to credit
E. Poor standardization of products (quality, labeling, packaging)
F. Lack of vital skills, equipment, and basic amenities

2.6. Shea Industry Government Policies

The government launched the Standards and Trade Development Facility (STDF), a program to expand exports of Sesame and Shea nuts in Nigeria. These two products were chosen because of their great potential for growth and the foreign exchange earnings they can earn for the nation on the international market. Another program that aided was the Federal Ministry of Commerce and Industry (FMGI), Nigeria Export Promotion Council (NEPC), National Agency for Food and Drugs Administration and Control (NAFDAC), and all other food security-related organizations. Through the government, the National Export Promotion Council has the following program as opined (Osibo, 2013).

A. Sponsorship of many shea butter processors via the West African Trade Hub (WATH) in Accra, Ghana, a USAID-supported network. The service of a foreign-based consultant (Whitaker Group) was engaged to source for the market for Nigeria Shea on the USA market.
B. A training program was launched in conjunction with WATH to train processors in Abuja.
C. Engagement of Global Shea Alliance (GSA) to train women on proper Shea nuts processing into butter.

CONCLUSION

The study concluded that thirteen stages were identified and used in the Shea fruit process. This process is cumbersome, and little quality is achieved. Nevertheless, introducing these machines, such as the dryer, crusher, kneader, and roaster, has reduced the stages involved and has improved productivity and enhanced quality though more needed to be done to achieve 100% quality. The machine has also reduced the extreme fatigue associated with the manual method. The introduction of the machines or the semi-mechanized method has proven to improve the output and quality of the butter. The semi-mechanized is widely preferred over the traditional system. It was also revealed that the first four stages of the production processes were vital in achieving quality. Also, it was concluded that Shea kernel sells well in the international market alongside the butter. Packing and labeling provide a certain amount of value. While perfect quality has not been realized, some degrees of quality have been obtained with the semi-automated manufacturing method. Illiteracy, high fuel costs, frequent machine breakdowns, and accompanying costly maintenance costs and getting financing were all significant obstacles. Government assistance was critical in the early phases when Shea butter was regarded as a source of foreign cash and a way out of abject poverty for rural people. The government's efforts resulted in creating the semi-mechanized system, which resulted in the invention of dryers, roasters, kneaders, and crushers to increase production and quality. Government policies were set up to welcome NGOs into the industry. These NGOs have assisted and continue to assist the local industries in training and re-training employees.

RECOMMENDATIONS

The following recommendations are made based on the findings

1. More education is needed on the value and usefulness of Shea butter to rural communities and the economy.
2. Staff training should be conducted regularly to help reduce the industry's illiteracy rate.
3. The first three to four stages should be taken seriously, as they are critical to the final product's quality.
4. Shea butter operations should be operated as a business entity (One fundamental principle of an effective production process). Also, the Shea butter centers should add some professional touch to their business and adhere to the ethics of business operations.
5. Financial institutions should be encouraged to make loans available for potential Shea producers or centers.

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APPENDIX A

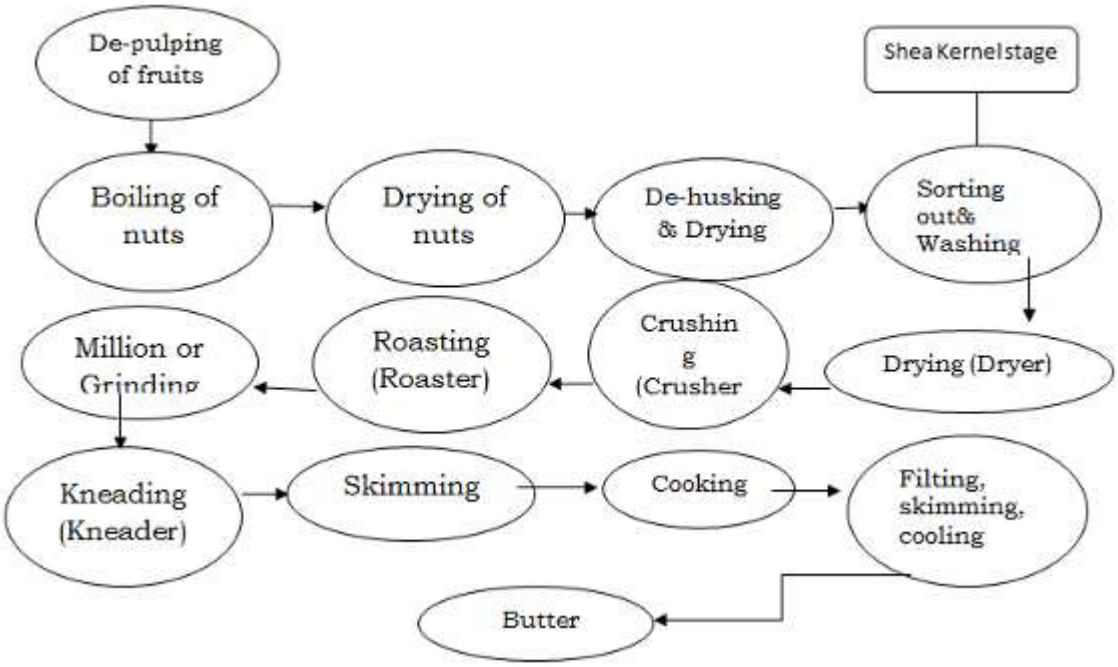

Figure 4: The processing stages of the Shea kernel and butter at MELCIFY

APPENDIX B

Plate 1: Some internationally traded packaged and branded Shea butter products

Plate 2: Unrefined and unpackaged butter

Plate 3: Locally finished product

Plate 4: Traditional kneading of Shea butter

Plate 5: Manuel boiling process of Shea butter by African women

Plate 5: Homogenising and kneading of Shea butter

APPENDIX C

Plate 1: Shea kernel and fruit anatomy

Plate 2: Shea kernel and fruits

Plate 3: Shea **butter** tree

Plate 4: Shea butter leaves and matured fruits

Plate 5: Some mechanised equipment for processing Shea butter