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NATURAL RESOURCE PRODUCT ANALYSIS – SHEA ROADMAP

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NATURAL RESOURCE PRODUCT SECTOR ANALYSIS – SHEA ROADMAP

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ABBREVIATIONS & ACRONYMS

AgNRM	Agriculture and Natural Resource Management
CBE	Cocoa Butter Equivalent
CREMA	Community Resource Management Area
CRIG	Ghana Cocoa Research Institute
FFA	Free Fatty Acid
FMNR	Farmer Managed Natural Regeneration
GSA	Global Shea Alliance
HCSB	Handcrafted Shea Butter
MT	Metric Ton
NRP	Natural Resource Product
PAH	Polycyclic Hydrocarbon
PMF	Palm Oil Mid-Fraction
SET	Shea nut Equivalent Ton
SFC	Savannah Fruits Company
TAG	Triacylglycerol
USAID	United States Agency for International Development
WCHS	Wechiau Community Hippo Sanctuary

EXECUTIVE SUMMARY

The shea nut grows on 4 million km^2 across sub-Saharan Africa, an area referred to as the “shea belt”. More than 16 million people, primarily women, are involved in the collection and sale of shea across more than 20 different countries.[1] Predominant producers are Burkina Faso, Nigeria, Mali, Ghana, and Benin.

Ghana – the world’s fourth largest shea producer – supplies 94,000 metric tons (MT) of shea annually and is known for its high-quality nuts. Ghana is also a major shea processor with an estimated kernel extraction capacity of 226,000 MT per year. However, more than half of this capacity is met through imports from neighboring countries with limited extraction facilities.

Across northern Ghana, there is an opportunity to increase incomes from shea collection and, to a lesser extent, processing. Shea collectors could grow their revenue through increased volumes in the long term. The price of dry shea kernel has increased from $150 per MT in 2003 to $350 per MT in 2016, and is predicted to reach $450 per MT within five years. Collectors can earn a hefty 44 percent profit margin, which is equivalent to a net income of $162 per MT of kernel. Benefits weaken further down the value chain, as butter processors only make a 4 percent profit margin, or $61 net income per MT produced.

In order for Ghana to grow its shea sector, the supply of nuts needs to expand, but a range of challenges must be addressed in order to increase collection. Poorly functioning nurseries, uncontrolled felling of productive trees, mechanical ploughing, and unregulated use of herbicides are all major threats to existing trees and to the natural regeneration of shea. In addition, nut imports are expected to fall as processing capacity comes online in neighboring countries, which will reduce the quantity available for Ghanaian facilities.

Shea processing also poses certain sustainability challenges. In Ghana, traditional open-fire shea processing consumes approximately 37,000 MT of fuelwood and 62 million liters of water each year.[2] There is a need for innovative and appropriate technologies to increase the efficiency of shea processing. For example, improved, climate-smart cook stoves could reduce the sector’s fuel wood requirement by 75 percent, improving health and safety, and reducing environmental pollution.[3]

This roadmap provides recommendations to the Agricultural and Natural Resource Management project (AgNRM) on how to strengthen the shea value chain in Ghana. Specifically, it builds on existing Community Resource Management Areas (CREMAs), a concept introduced by the Government of Ghana to conserve critical wildlife corridors while increasing economic livelihoods for local communities. CREMAs offer a unique opportunity to strengthen the shea processing value chain through the growing market linkages between collectors, producers, and exporters. This document is based on a literature review; industry surveys; field research; and input from workshops carried out in Tamale and in six CREMAs in the Black Volta and Western Biodiversity Corridors.

In order to modernize and strengthen the shea value chain in Ghana, the roadmap makes recommendations along four main dimensions:

[1] USAID, 2016
[2] Lovett, et al. 2016
[3] Ibid

Exhibit 1: Summary of recommendations

	Recommendations	Link to current or planned activities
1 Increase the quantity of shea supply	• Protect existing shea tree stock • Increase quantities collected • Increase future shea stock	• Continue to support bush fire prevention efforts, encourage sustainable harvest practices, and promote FMNR • Continue to support usufruct rights for collectors and partner with Naasakle/MotherShea • Train on propagation techniques, pest management • Continue to promote pollination through beekeeping • Expand partnership with GSA to accelerate tree planting programs
2 Improve processing procedures	• Improve production efficiency and quality • Reduce water and energy consumption	• Continue to promote use of higher quality equipment and provide training on quality control • Analyze additional processing innovations to identify new products as well as methods to reduce processing cost and energy consumption
3 Increase profitability and margins for collectors and producers	• Set up and support collector groups • Strengthen market linkages • Secure price premium certifications	• Continue to support registration of collector groups, provide TA on export standards • Explore formation of vertical networks, including umbrella associations • Conduct market analysis to identify new buyers • Continue to support links between collector/processor groups and buyers • Continue to facilitate organic and/or Fairtrade certification, improved branding and packaging
4 Develop the enabling environment	• Ensure access to finance • Enhance the policy environment	• Leverage project grant component to stimulate investment in infrastructure and equipment • Continue to promote VSLAs, support business plan development • Collaborate with advocacy groups to promote a conducive policy environment and pass and industry bill

CHAPTER 1: INTRODUCTION

1.1 Background

The Agriculture and Natural Resource Management project (AgNRM) is a United States Agency for International Development (USAID) project developed under the Feed the Future initiative. It serves as the main vehicle to address environmental and natural resource management issues in northern Ghana under a five-year period (May 2016 to April 2021).

In close partnership with the Government of Ghana, AgNRM is building on the concept of Community Resource Management Areas (CREMAs), a model under which rural communities collaborate to share and manage their natural resources more sustainably, with the objective of diversifying income streams, maintaining social cohesion, and minimizing environmental degradation.[4] AgNRM employs a value chain approach to facilitate collaboration between collector and processor groups, buyers, and marketing agents in the shea sector (producing kernel or butter products), as well as for other natural resource products (NRPs).

Developing effective value chains for these products requires a thorough understanding of their prevalence, production, processing, and marketing dynamics, as well as identification of key industry actors and their needs. For this reason, AgNRM commissioned a comprehensive set of studies on existing NRP market systems in Northern Ghana. The studies seek to reveal demand- and supply-side issues related to relevant NRP markets in CREMAS, and to help formulate appropriate interventions tailored to the needs of local communities. During AgNRM's proposal phase, shea, moringa, tamarind, and dawadawa were selected as focal NRPs. This roadmap focuses specifically on the shea value chain, with references to other NRPs when relevant.

1.2 Objectives

The goal of this roadmap is to fill knowledge gaps related to the Ghanaian shea sector and to identify a pathway towards developing a strategy for more sustainable shea production, processing, and butter extraction in the context of CREMAs. Specifically, this roadmap hopes to:

- Analyze key trends in the Ghanaian shea sector;
- Detail relevant regulatory frameworks;
- Describe the shea value chain and its level of competitiveness in Ghana;
- Explore the strengths, weaknesses, opportunities, and threats to the local shea industry;
- Explore gender roles along the shea value chain;
- Analyze energy and water consumption along the value chain;
- Detail the relationship between production challenges, and production quality and quantity;
- Explore pathways for the development of handcrafted shea butter (HCSB) processing in CREMAs;
- Provide recommendations to improve and centralize local butter processing and to grow the export market.

[4] Asare et al. 2013

CHAPTER 2: THE WEST AFRICAN SHEA SECTOR

2.1 Industry overview

Shea butter made from the shea nut is an edible vegetable fat traditionally harvested by women in West Africa's agroforestry parklands.[5] Shea consumption by local populations is believed to date back thousands of years.[6] Evidence points to ancient Egyptians utilizing both the oil and the wood of shea trees – most likely sourced in the current territories of Chad, along with South Sudan and Uganda up the Nile River – suggesting that shea-based farming systems could be over 5,000 years old.[7] This could make shea one of the oldest-traded food plants on the continent.

Shea trees are typically protected by farming communities across the "shea belt", a semi-arid area spanning 3.5 million km^2 and 21 countries.[8] Mature, healthy, and productive trees are selected and maintained, while woodlands or fallow lands are cleared for farming activities. It is common practice to preserve between 15 and 50 shea-producing trees per hectare, while keeping about 10 percent of the natural woody biomass surrounding the trees.[9] After multiple cycles of farm-fallow and crop rotation, natural regeneration is encouraged through the removal deadwood and the protection of new trees.

Shea is primarily used as a cocoa butter substitute in the food sector, and for skin and hair application productions within the cosmetics industry. Approximately 600,000 MT of shea are collected globally each year, constituting a global market of $500 million.[10] North America, Europe, and Japan constitute the largest export markets.[11]

The global shea industry is dominated by nut supplies from the western sub-species of shea trees – *Vitellaria paradoxa* ssp. This western variety is known to have significantly higher stearin levels than the eastern *nilotica* ssp. This report is focused on ssp *paradoxa*, which is predominant in West Africa. The oil content in shea kernels also varies widely from 25 to 60 percent, although it is possible to produce kernels with 45 to 55 percent oil content through good post-harvest processing.[12]

2.2 Regional competitiveness

Competitiveness in the shea sector is determined by four main elements: product quality, available volumes, processing capacity, and prices.

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[5] Parklands are generally understood as landscapes in which mature trees occur, scattered in cultivated or recently fallowed fields. For more information, see Stigter, 2011.
[6] See for instance Gallagher et al., 2016; Höhn & Neumann, 2012; Neumann et al., 1998; and Park, 1983.
[7] Lovett, 2015a
[8] These include Benin, Burkina Faso, Cameroon, Central African Republic, Côte d'Ivoire, Democratic Republic of the Congo, Ethiopia, Gambia, Ghana, Guinea-Bissau, Guinea-Conakry, Mali, Niger, Nigeria, Sierra Leone, Senegal, South Sudan, Sudan, Chad, and Uganda. For more info, see Naughton et al., 2015.
[9] Dianda et al., 2009
[10] USAID, 2010
[11] Ibid
[12] Lovett, 2015b

2.2.1 Product quality

Ghanaian shea enjoys a reputation for high-quality due to high stearin levels and low levels of Free Fatty Acids (FFA).[13] These characteristics stem from the boiling and sun-drying method of dry kernel processing that is traditionally practiced in Ghana, as opposed to the smoking method typical of other countries, such as Mali. The smoking method results in low extraction yields as well as contamination with polycyclic hydrocarbons (PAHs), which are internationally regulated as carcinogens.[14] The timing of rainy seasons in northern Ghana also offers the opportunity to collect, boil, and sundry nuts during more favorable weather conditions as compared to Burkina Faso, where drying occurs during the peak rainy period.[15]

2.2.2 Available volumes

Based on the suitability model developed by Naughton et al. (2015),[16] Table 1 shows the predicted to actual volumes from the eight main shea exporting nations for a bumper export crop.

Table 1: Estimated regional shea nut equivalent tons (SETs) exported for a 'good crop'

Countries	Suitability model sheanut/tpa	Estimated actual % of model	Estimated actual harvested (SETs)	Estimated industrial exports (SETs)	Actual % total high stearin SN
Nigeria	568,827	30%	170,648	90,000	18%
Mali	248,007	40%	99,203	80,000	16%
Burkina Faso	229,611	70%	160,727	125,000	25%
Ghana	134,303	70%	94,012	75,000	15%
Cote d'Ivoire	126,722	25%	31,681	20,000	4%
Benin	125,977	70%	88,184	70,000	14%
Guinea Conakry	76,377	25%	19,094	10,000	2%
Togo	60,024	70%	42,016	30,000	6%
Total	1,569,847	50%	705,565	500,000	

Observations and discussions with shea stakeholders indicate that Côte d'Ivoire has a far smaller shea crop than previously believed due to significant parkland clearances for food production. In comparison,

[13] Quainoo et al., 2012
[14] Lamien et al., 2014
[15] More details on production methods are available on producer's websites, e.g. http://www.sekafghana.com/productionmethods.html
[16] Naughton et al, 2015

the shea crop in Mali, Nigeria, and Guinea is considered to be underexploited based on their levels of collection and untapped export potential. Ghana, Benin, and Burkina Faso's shea production are all heavily exploited, leaving few accessible shea fruits in the parklands after the annual harvest.[17]

Furthermore, there is a growing concern that Ghana's production may be heading in the same direction as Côte d'Ivoire's. Ghana is rapidly losing shea tree populations due to land conversion to farmland for the production of food crops and due to a lack of sufficient fallow periods to facilitate natural regeneration. Unfortunately, the pathway to a sustainable planting and growth regimen that could support the sustainable future exploitation of shea has been difficult to establish.

2.2.3 Processing capacity

Ghana has by far the highest capacity for industrial extraction and fractionation in comparison with its West African neighbors, and is also home to the largest number of trained workers. However, this situation is changing, as increasing volumes of shea are now processed in Burkina Faso, Togo, and Benin, and there are plans to renovate or build new plants in Côte d'Ivoire, Nigeria, and Mali.[18] Moving forward, the most successful country in the shea industry will be the one that can sustainably and competitively increase production to levels that meet processing capacity sustainably, while simultaneously developing strong market linkages.

For this reason, Ghana is currently establishing new shea nurseries with hopes of augmenting its production capacity.[19] These include the Ghana Cocoa Research Institute's (CRIG) nursery in Bole, the University for Development Studies' nursery in Nyankpala, Form International Ghana's nursery in Akumadan in the Ashanti Region, and the Tree Global Inc.'s nursery near Tafo in the Eastern Region. About 500,000 seedlings are due to be planted in the coming years through various initiatives supported by USAID. The Shea Network Ghana is also discussing shea planting and regeneration programs.

2.2.4 Prices

Table 2 shows the evolution of farm gate prices for Ghanaian shea. Fueled by significant growth in demand, prices have increased from $150 per MT of dry kernel in 2003 to $350 in 2016. Available data predicts shea kernel prices to continue increasing up to $450 over the next five years.[20]

Across West Africa, a strong harvest can be expected to generate annual farm gate sales of over $150 million from shea kernel sales alone.[21] However, these sales levels will not be sustained unless there is further investment in shea parkland production and prioritization of shea trees over food crops. Moreover, the seasonality of the shea crop (one good year generally followed by two years with lower yields) could further restrain production levels.

It is also important to consider the relative prices of palm and shea-based substitutes to cocoa butter, or cocoa butter equivalents (CBE). Shea byproducts such as stearin are often used alone or in combination with palm byproducts (such as palm oil mid-fraction, or PMF), as CBEs, and their use as mutual substitutes for the others means their relative prices have a significant impact on demand. Although shea stearin and PMF combinations currently offer a lower price than cocoa butter, shea itself remains more expensive than palm.[22] Therefore, significant supply chain efficiencies will need to be achieved in order

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[17] Stakeholder interviews conducted during the production this report
[18] Alonge & Olaniyan, 2007
[19] See for instance https://www.ghanaweb.com/GhanaHomePage/NewsArchive/Sheanut-project-launched-in-Tamale-310618
[20] Savannah Fruits Company market surveys, 2009 – 2015
[21] USAID, 2010
[22] Simmons, 2011.

for refined, handcrafted shea butter to compete with palm in the edible sector, while the only present market for "whole" handcrafted shea butter is the cosmetic sector. [23]

Table 2: Regional shea kernel annual revenue by harvest

Harvest year	Shea kernel annual average price per MT (US$5 rounded, April-March year)	Estimated regional 'harvest for export' volume (SETs, April-March year)	Estimated regional farm gate revenue (US$)
2009	$250	150,000	$37,500,000
2010	$275	100,000	$27,500,000
2011	$340	260,000	$88,400,000
2012	$295	180,000	$53,100,000
2013	$300	500,000	$150,000,000
2014	$350	180,000	$63,000,000
2015	$355	450,000	$160,000,000

(Source: Savannah Fruits Company market surveys, 2009 – 2015)

2.3 Regulations and standards

Government regulation can impact the quality, quantity, and pricing of shea. As a general rule, however, regulation of the West African shea sector has been weak and ineffective, with growth being driven mainly by the private sector, foreign donors, and NGOs.[24]

Aside from traditional regulations around parkland management and harvesting, the longest-standing active government regulation has been in Benin, where a national policy is in place to spell out who can buy shea nuts, when, and for how much.[25] Notably, only local traders can purchase from the beginning of the season (May/June through the beginning of September), after which point large processing firms can then purchase from these traders. There are also reports that Benin will place a tax of $15 per ton of unprocessed shea kernel exports in order to encourage local processing, raising fears of lower farm-gate prices.[26]

Apart from this, one of the most successful government interventions to date was carried out by the International Trade Centre, which supported the formation of national development strategies in shea-producing countries. Through a multi-stakeholder consultation completed in April 2014, a new strategy was developed for Burkina Faso, and quickly passed through parliament before being adopted in June 2015.[27] In Ghana, a floor-pricing attempt was introduced in 2011 (GH¢32 per bag of 80 kg), but did not succeed.

[23] Talbot & Slager, 2008.
[24] Stakeholder analysis conducted during the production of this report.
[25] RONGEAD, 2014.
[26] Ibid.
[27] See for instance http://news.aouaga.com/h/69380.html

Other attempts to introduce standards for unrefined shea butter and kernel quality were made as part of the ProKarité Common Fund for Commodities project.[28] Regrettably, inappropriate standards for butter processing only added additional export hurdles, imposing unwelcome penalties by national standard boards. This occurred when the international buyers had pre-agreed on quality and indicated that most shea butter should be refined to some degree before mass-market use. FLOCERT Fairtrade® also tried to set minimum farm gate prices for shea butter, but after accusations of making decisions without sufficient consideration of feasible and sustainable standards, FLOCERT Fairtrade® hurriedly developed a new set of shea kernel standards that were deemed inappropriate by the African Organization for Standardization due to a lack of stakeholder involvement.

Finally, there is currently a program led by the Global Shea Alliance (GSA) to develop more appropriate shea quality standards.[29] The objective of this initiative is to revise national standards, which are currently ignored by most traders.[30]

2.4 SWOT analysis

Table 3 provides a SWOT analysis of the shea industry in Ghana. The analysis has been developed through consultation with stakeholders and considers shea-specific trends as well as larger social, political, and environmental developments.

Table 3: SWOT analysis of the West African shea sector

Strengths	**Weaknesses**
• Existing traditionally-managed production base • Demand in both local and international markets • Improving collection and processing standards offer options for premiums • Continued infrastructure improvements along the value chain • Regional and international collaborative research and facilitation network • GSA of major international and sub-regional stakeholders	• Statistics & market intelligence unreliable • Unorganized supply chain, particularly upstream • High cost of increasing industry transparency • Variability of production and risk of falling yields • Long gestation period makes it difficult to increase supply in the short term • Dependence on diminishing kernel imports to fill processing facilities • No planting of indigenous tree species, lack of improved shea varieties
Opportunities	**Threats**
• New technologies available to improve water and energy efficiency • Growing niche markets with premiums through certification, especially organic • Increasing local demand for use in edible and cosmetic products • Growing international use in other non-chocolate edible sectors (e.g. bakery) • Increasing interest from investors to streamline production and aggregation	• Mechanized farming and loss of fallow • Increasing share of land used for food crops • Diminishing fuel wood availability and low regeneration of parklands • Shea tree clearance for exotic perennials • Volatility in production volumes due to climate change • Susceptibility to pests and diseases after loss of genetic diversity

[28] World Agroforestry Center, 2004
[29] Details available on the Global Shea Alliance website at http://www.globalshea.com/quality/standards
[30] USAID, 2016

• Developing demand for non-cocoa fats from the chocolate industry	• Unsuccessful regulatory attempts in many countries, including Ghana • Regional health (e.g. pandemics) and insecurity (e.g. terrorism) concerns • Strict EU and US health regulations around stearic-rich fats • Risk of changing consumer perception of shea with regards to health or environmental sustainability

(Source: Stakeholder consultations and desk research carried out to produce this report)

2.5 Current state of the Ghanaian shea sector

The Ghanaian shea sector has experienced rapid development since shea trade regulations were lifted in the mid-1990s and cocoa demand began to increase in the early 2000s. Considered a politically and economically safe nation, Ghana has received multi-million-dollar investments into several shea extraction plants, including the first two fractionation units in Africa.

As Tables 4 and 5 indicate below, 94,000 MT of kernel are currently produced in Ghana every year, as compared to the country's processing capacity of 226,000 MT.[31] Functioning under capacity, many factories struggle with competitiveness and access to international markets with only a few factories equipped to process solvent extraction and wet fractionation.

Due to Ghana's relatively low shea production volumes, local factories have had to rely on shea nut imports from neighboring countries in order to meet capacity. Given that shea processing plants are also being renovated or built in these exporting countries – along with the prediction that the domestic supply of shea will continue to fall – there are serious concerns for the viability of shea factories in Ghana.

Yet options do exist to increase shea production in Ghana, such as planting more trees, promoting farmer-managed natural regeneration (FMNR), using propagation techniques to reduce gestation periods, or facilitating more pollination.[32] Given the unavailability of idle lands for new shea plantations, future interventions should focus on FMNR and increasing tree stock. Encouraging shea pollination from bees constitutes another strategic area of interest, as highlighted by recent studies in Ghana, Mali, and Burkina Faso.[33]

[31] These figures are based on expected capacity by the end of 2017
[32] Stout et al., 2016
[33] Lassen et al., 2016

Table 4: Ghanaian shea nut end market volumes

End market for Ghanaian shea crop	Estimated shea nut equivalent tons (SETs) Thousand p.a.
In-country industrial processed for export	50
Kernel exported abroad for industrial processing	25
Processed for local consumption	12
Hand-crafted shea butter for export	7
Total	94

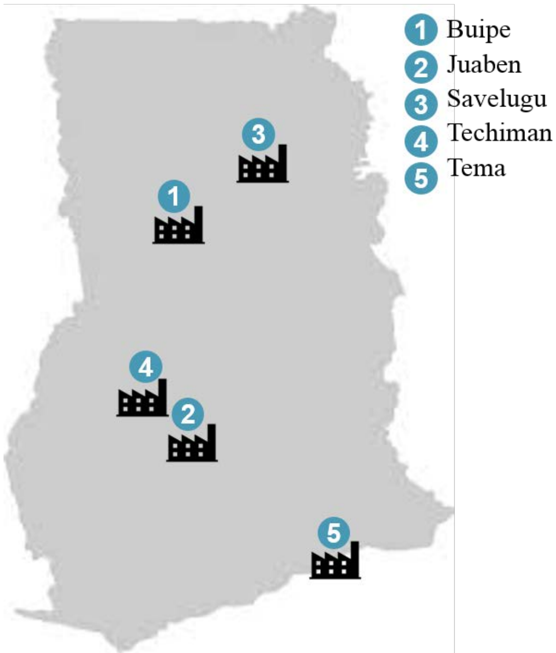
(Source: Stakeholder consultation process, 2016)

Table 5: Shea kernel crushing capacity in Ghana

Operator	Estimated capacity 2017 harvest season, kernel thousand MT p.a.	Location	Status
PBC	60	Buipe	• Currently inactive, solvent extractor on site. Undergoing renovation and expansion
GNLs	50	Techiman	• Crushing underutilized, solvent extractor on site and wet fractionator next door
GSFIL	40	Tema	• Currently inactive, solvent extractor and wet fractionator on site
3Fs	30	Tema	• Capacity fully utilized, solvent extractor on site
JOML	12	Juaben	• Currently inactive in shea but active in palm oil, mechanical crushing only
Sheabu	12	Savelugu	• Currently inactive, mechanical crushing only
TPC	3	Buipe	• Currently inactive, mechanized water-kneading and centrifugation technology
HCSB and local consumption	19	n.a.	• This an estimated local consumption together with processed handcrafted butter

(Source: Stakeholder consultation process, 2016)

Exhibit 2: Location of shea producing facilities in Ghana



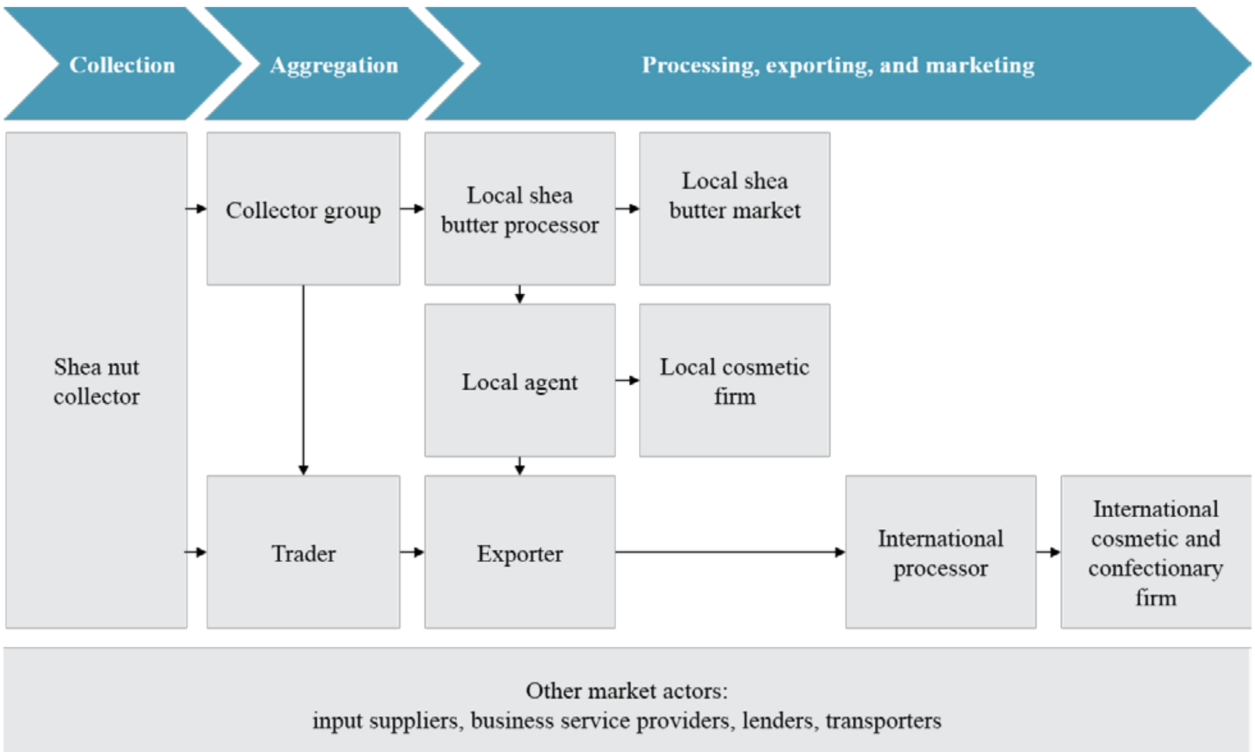
(Source: Stakeholder consultation process, 2016)

CHAPTER 3: THE SHEA VALUE CHAIN

3.1 Production steps

Exhibit 3 describes the shea value chain from its collection to the end market, with the final product presented as edible and/or cosmetic products. The processes outlined are typical of the West African shea trade with the shea fruit collected in the parklands, processed locally into kernel and unrefined butter, and then refined locally or abroad.

Exhibit 3: The shea value chain



(Source: Stakeholder consultation process, 2016)

3.1.1 Shea fruit collection

In Ghana, shea kernel is sourced locally as well as through imports from neighboring countries (such as Mali and Burkina), as Ghana is not currently able to meet its own processing capacity.

Locally sourced shea is typically harvested by women collectors who pick the fallen fruit from the parkland. They then transport the harvest to their homes where the fresh fruits are accumulated for kernel processing. During this process the shea fruits are boiled in large pots of water, sun-dried, de-husked, and sun-dried again. The kernel is then stored appropriately prior to being processing into butter or sold at local markets.[34]

[34] In the past, the nuts were collected for free, but surveys conducted for this report indicate that some landowners now ask collectors for a share of the total volume collected.

Bulk shea kernel is either processed locally (hand-crafted, as described above); sent to industrial shea processing factories for further processing; or transported to the harbor of Tema for export. Volumes sold on the local market range from bowls and basins, to sack-filled loads. Aggregators (often local agents for major buyers, classified into 100, 1,000, or 10,000+ MT traders) mobilize shea kernel from the village to urban market chains via their warehouses, or sell to other large-scale aggregators down the chain.

Exhibit 4: Traditional shea processing steps

1. Picking and accumulation of fruits
2. De-pulping of fruits
3. Parboiling of fruits
4. Drying of boiled fruit
5. De-husking of dried fruit to extract kernel
6. Drying of kernel
7. Sorting and cleaning of kernel
8. Crushing of kernel
9. Roasting of crushed kernel
10. Drying of crushed kernel
11. Grinding of kernel into powder
12. Kneading of shea powder into paste
13. Boiling of kneaded paste into shea butter oil
14. Filtering shea butter of impurities

3.1.2 Shea butter processing

Traditionally, collected shea fruits were processed into shea butter within the household for family consumption. With manual extraction methods, shea kernel to butter conversion rates normally reach 20 percent.[35] More recently, handcrafted shea butter processors started to purchase conventional shea nuts directly from open markets for processing at their centers. With improved processing methods, studies suggest that 35 to 45 percent extraction by dry weight is attainable and was confirmed in a CREMA pilot. Local shea butter is usually sold in head-panned, calabashes of butter, while exporters typically pack shea butter in plastic-lined, 25-kg cardboard boxes onto 20 MT load containers.

Bulk exports of shea butter are dominated by supplies from mechanical extraction plants using palm-kernel expellers, pre-heated in cookers, top kettles, and press-filtration. After cleaning (which results in an average weight loss of 6 percent), extraction yields are typically between 31 to 33 percent. The more economical plants now have hexane solvent extractors installed, which allows for yields of 45to 48 percent by cleaned kernel weight. Crude "whole" butter is usually exported in flexi- or ISO-tanks for further refining or fractionation abroad.[36]

[35] West African Trade Hub, 2004

[36] Lovett, 2015

3.1.3 Shea butter refinement

Until recently, only traditional refining options existed in Africa, and professionally processed shea butter was typically refined in two major refineries in the Netherlands (Zor and SRC). However, a state-of-the-art refinery was commissioned in Tema in 2016, with a capacity of 200 to 250 MT per day for either imported crude soya oil or for shea butter produced in-country.

Losses constitute a common issue during shea butter refinement. These losses are proportional to the levels of impurities and FFAs (typically between 1.5 to 2 percent per unit (1 percent) of FFA). For example, for 5-percent FFA crude shea butter, one might expect about 7.5 percent volume loss. Similarly, a loss of approximately 15 percent would be expected for 10 percent FFA shea butter.[37]

An immature shea fruit and its kernel

The technologically advanced process of acetone "wet" fractionation helps reduce losses, but were kept secret by international processors with Ghana's first two plants capable of applying this method only being built in 2006. There are now at least four additional wet fractionation plants worldwide (in India, Malaysia, the Netherlands, and Denmark). Other wet fractionation plants are thought to be planned for construction in Burkina Faso and Nigeria.

3.1.4 Shea butter applications

The various byproducts (such as stearin, olein, and karitene) that can be extracted from shea butter have many applications, including utilization as cocoa butter equivalents (CBEs) and improvers for chocolate confections. Currently, the European Commission directives state that a maximum of 5 percent of chocolate weight can consist of CBEs, while this number is often different in South American, Japanese, and Chinese markets.[38] New regulations on non-cocoa butter fats are expected in the United States and in India.[39]

Yields of shea stearin from crude shea butter are typically expected to be between 35 to 38 percent, with impurities removed via centrifugation or dropout into olein during fractionation. Roughly 7 MT of dry farm-gate shea kernel produces 1 MT of shea stearin and 1.5 MT of shea olein. The major costs of extraction, refining, and fractionation are due to the energy needed to produce steam for the motors, as well as for the cooling processes of solvent recycling. The by-products, olein and karitene, are then sold to soap manufacturers along with FFAs.[40] Both the stearin and olein fractions require further refining before edible use. Shea stearin (SS) is then combined with palm mid fractions (PMF) in ratios of about 10 to 30 percent SS to 90 to 70 percent PMF.

An estimated 10 to 15 percent of total shea butter production is used in retail for personal care cosmetic products. This shea butter can come from either handcrafted or industrial sources, and may be crude (unrefined), filtered, or fully refined. For cosmetics, ingredients can consist of a mixture of whole butter, fractionated products such as stearin or olein, hydrogenated oils, or concentrated fractions of the unsaponifiables.[41]

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[37] Lovett et al., 2016
[38] Timms & Berger, 2003
[39] See for instance Food Safety and Standards Authority of India, 2011
[40] Quainoo et al., 2012
[41] Abagale et al., 2016

Most shea butter utilized for cosmetic products within West Africa comes from unrefined, handcrafted sources, often leading to low uniformity and poor quality. Therefore, the majority of shea butter sold in international markets is either physically refined or at least pasteurized and micron-filtered. This allows for the removal of impurities and foreign matters, batch standardization at appropriate ingredient volumes, and consumer acceptability. The new Tema refinery offers an opportunity to improve quality standards for both international and domestic consumption.

3.2 Gender roles

Men and women perform different roles along the shea value chain. Women dominate the upstream collection, kernel processing, and handcrafted butter processing, while men tend to manage bulk kernel aggregation, industrial processing, and export.[42]

Although female family members are often involved, men are traditionally the main decision-makers around how a piece of land should be farmed and which shea trees should be cut or retained. These decisions may also involve a dialogue with custodians of community lands, *Tindaana*, who are also traditionally male.[43]

Thus, shea is collected either from family farmlands or community fallow lands. In the latter case, access to land is derived from traditional regulations, which can vary from one place to the other.[44] While women collectors often have open access to shea trees growing in fallow agricultural fields, some field owners have begun to demand small payments/rent from shea collectors, which could hinder shea collection in some areas.

Collectors accumulate shea fruit over time until they have gathered a certain threshold. Fruits are then boiled in water to remove the flesh from the nut -- It is the responsibility of the women to also gather the necessary fuelwood and water needed for such processing. After this, shea nuts are dried and de-husked to obtain the shea kernels, which are brought to the market for sale to local aggregators, who may be agents for larger firms or independent bulk-traders.[45]

Although men aggregators are more common, women traders are present at this point in the supply chain. Nevertheless, most vehicle operators (trucks, taxis, motor-tricycles, or carts) are typically male. In terms of organizational management, in previous years literate men were often involved as cooperative secretaries and treasurer, but more recently, women have educated their children, including their daughters, and these positions are now being filled with female members of the cooperatives.

3.3 Energy and water consumption

Table 6 provides an indication of the energy and water needs for traditional, handcrafted shea butter processing.

[42] Pouliot, 2012.
[43] Ibid
[44] Elias, 2015
[45] Pouliot, 2012

Table 6: Energy and water use for shea processing in Ghana

Resource use per kg of end product			
Product	**Processing stage**	**Fuel wood** (kg per kg kernel)	**Water** (kg per kernel kg)
Kernel only[46]	Boiling fresh nuts water/kernel kg (kg)	0.00	0.99
	Boiling fresh nuts fuel wood/kernel kg (kg)	0.65	0.00
Traditional butter[47]	Washing water pre-processing per kg kernel (kg)	0.00	0.81
	Roasting fuel wood per kg kernel (kg)	0.27	0.00
	Water used for kneading per kg kernel	0.00	2.46
	Heating kneading water fuel wood (kg)	0.20	0.00
	Boiling emulsion fuel wood (kg)	0.35	0.00
	Total kg per kg of kernel	1.47	4.26
	Empirically determined extraction rate	34.60%	34.60%
	Total kg per kg of butter	4.25	12.31
Resource use for whole of Ghana's yearly production			
Kernel only	Estimated 50,000 MT exported	32,500	MT of fuel wood
		49,500,000	liters of water
Traditional butter	Estimated 1,000 MT exported	4,249	MT of fuel wood
		12,312,139	liters of water
	Total	36,749	MT of fuel wood
		61,812,139	liters of water

(Source: Lovett et al., 2016)

46 Kernel post-harvest processing data: n=24 women, in 9 communities, processed an average of 76.2 kg of fresh fruit each (total 1,829 kg)
47 Butter extraction data: n=15 women, in 5 communities, processed an average of 49.3 kg of dry kernel to butter each (total 740 kg)

Woman using an improved mud cook stove at the Wechiau shea processing centre

In total, approximately 37,000 MT of fuel wood and 62 million liters of water are consumed annually for shea processing in Ghana. The fuel wood demand is met by felling trees, including shea. Typically, the roasting stage uses “light” fuel wood such as sticks and stalks to produce flames for fast roasting, as relatively small volumes of water are needed at this stage. Later, bigger pots requiring larger fires call for large pieces of wood in order to break the kneaded emulsion and boil off the water in the paste.[48] This latter stage could benefit significantly from improved industrial stoves, as demonstrated by AgNRM’s collaboration with *InStove* and *Envirofit*.[49]

Results presented in Table 7 indicate that, with an *InStove* cook stove, about five bags of 85 kg shea kernel could be processed into butter in a single day. Assuming an average yield of 33 kg of butter per bag, an average of 165 kg of butter could be processed per day per stove. Considering an average of 22 working days in a month, about 3,630 kg of butter could be processed each month (110 bags of 85 kgs).

Table 7: Results of shea processing using InStove in Dorimon[50]

Activities	Weight (kg)
Weight of 1 bag of shea kernel used for the demonstration	85 kg
Weight of Kneaded shea paste from 85 kg bag of kernel	73 kg
Weight of Shea butter after cooking	38 kg
Time Required to cook the butter	1 hour 47 minutes
Average weight of fuel wood used	0.4 kg

These results also suggest that no more than six improved cook stoves would be necessary for shea butter processing in a centralized unit like the Wechiau Shea Processing Centre, which has a capacity of 21 MT of butter a month. By reducing the required number of stoves from 24 to 6, the introduction of improved stoves could help reduce fuel wood consumption by no less than 75 percent.

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[48] ICCO, 2014
[49] See for instance http://www.ghananewsagency.org/economics/dorimon-residents-applaud-agnrm-for-improving-livelihoods-117525
[50] This excludes shea fruit parboiling

Given the high volumes of water used during shea butter processing along with the volume of residue that it produces, there is also an opportunity to invest in recycling technologies and in using the dried residue (the shea cake) for either energy generation or usages, such as organic mulch or fertilizer (after composting and mixing with soil). During field trials in Uganda, using a soil and shea mix as fertilizer was found to significantly improve survival rates of *Eucalyptus*. After a year, treated samplings were 50 percent taller than untreated ones.[51] Further research into water purification methods – including the possibility of using moringa seed cake – is recommended.

Shea residue can also be dried and used to form briquettes or pellets, which can be used directly as fuel or can be fed into a boiler or gasification system for steam production. The steam produced using this method could then be used to power steam engines for mechanical processes such as crushing, milling, or kneading shea nuts, or for the production of additional electricity. Steam could also be used during shea nut processing to reduce water use. Funding a proof of concept study would be a step in the right direction.

3.4 Financial analysis

Table 8 presents an economic analysis of traditional shea butter processing in Ghana. Assuming collectors do not pay for the shea fruits that they pick, an average collector is expected to make a net income of $162 per MT of shea kernel, corresponding to a profit margin of 44 percent. The results also indicate that a ton of butter only generates a net income of $61, corresponding to a mere 4 percent profit margin. To the extent that women make the highest return from shea kernel, it is of great importance to focus shea interventions on increasing the quantity of shea that women can collect. Volumes collected per person appear to be a key limiting factor for kernel processing, as collected crops are supplied in small batches from a single harvest per year. Meanwhile market and kernel availability appear to be the main barriers for butter processing, although production can occur all year around.

Table 8: Economics of shea collection and hand butter extraction

Kernel economics		
Revenues	Per ton, US$, Summer 2016 data.	$367.77
Fixed costs	Per ton of dry kernel, US$. Includes water and fuel wood.	$35.39
Labor costs	Per ton of dry kernel, US$. Includes all direct costs of women's labor time (collection, boiling, drying, etc.) at Ghana 2016 minimum wage. Excludes opportunity costs.	$169.98
Total costs		$205.37
Net income	Revenues – Total costs	$162.40
Profit margin	Net income / Total revenues	44.16%

[51] COVOL, 2000, unpublished

Shea butter economics		
Revenues	Per ton of butter, US$.	$1,500.00
Fixed costs	Per ton of dry kernel, US$. Includes water and fuel wood.	$279.94
Raw material costs	Per ton of butter at 36% extraction by weight, US$.	$1,021.60
Labor costs	Per ton of butter, US$.	$137.25
Total costs		$1,438.79
Net Income	Revenues – Total costs	$61.21
Profit margin	Net income / Total revenues	4.08%

(Source: AgNRM Shea Roadmap Survey, 2016. Figures provided by industry leaders during interviews)

Revenues and profitability at the collector level could be further improved through higher shea tree densities on parkland (50 trees per ha), resulting in higher yields (10 kg dry kernel per tree).[52] In addition, planting improved shea varieties and appropriate fuel wood species, coupled with apiculture or increased bee populations (which also can allow for the sale of honey, wax, and propolis in addition to increased pollination), could generate higher shea yields per ha on lands where the women have secured tenure. Timesaving innovations, such as bicycles with trailers, nut-harvesters, water-rollers, three-stone fire-smocks, drying-racks or tunnel-driers, PV-powered bore-holes, or de-husking equipment, could potentially allow women to collect and process more bags and boost profits.[53]

With regards to shea butter processing, sensitivity analyses have shown that if processors can buy directly from collectors (thus reducing raw material prices by 10 percent while improving extraction efficiency by up to 75 percent, a 37.5 percent yield by weight), a cost reduction of $200 per MT of shea butter could be achieved. In this scenario, collectors would likely get better prices compared to what local buying agents offer, which could yield improvements to incomes by up to fivefold.[54]

This brings the following considerations:

- Is there an opportunity for processors and collectors to collaborate? Or for collectors to use processing center resources?
- Could equitable pricing be shared with consolidators to improve their competitiveness in the global marketplace, for example against industrial organically certified competitors?

Other innovative solutions for butter processors could include the use of mechanical kneaders, water sourcing and recycling, improved cook stoves, as well as replanting shea and fuel wood species on farms. There is also a potential to incorporate appropriately scaled gasifiers to allow energy from waste systems to be used for roasting or boiling the butter-emulsion, or for the heat to be used for recycling water, or for producing steam for mechanical energy.

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[52] Lovett et al., 2016
[53] Ibid
[54] Lovett, 2004

3.5 Infrastructure

Machinery and other equipment are needed along the value chain. Inadequate infrastructure can impact kernel quality and extraction efficiency negatively. The following infrastructure requirements are needed along the shea value chain.

- **Transport:** Tricycles, trucks, and taxis needed for transporting shea products.
- **Storage**: Storage at home or at processing centers is common among small-scale aggregators and butter processors, while exporters operate warehouses in urban hubs such as Tamale, Bolga, Wa, and Tema.
- **Drying**: Raised platforms at processing centers and near warehouses are used for drying nuts and crushed-nuts.
- **Roasting**: Groundnut roasters are used to roast crushed nuts. With current open fire roasting situation, a redesigned model is recommended with a 'fixed' baffle that would help ensure that crushed particles get freed from the sides of the roaster in order to prevent charring.
- **Engines**: Multiple engines are needed for crushing, grinding mills, and kneaders. There is potential to use steam engines if a boiler or gasifier can be safely incorporated into the process.
- **Packaging:** Appropriate plastic liners and cardboard boxes (recyclable in Europe at a refinery).
- **Weighing**: Rugged digital platform scales are recommended for both butter and nut weighing.[55]
- **Moisture measurement**: Aqua Boy cocoa moisture meter is recommended for checking moisture content of shea nuts.[56]

3.6 Quality assurance

Quality is of high importance for global shea product buyers. The international market is concerned about four major factors that could impact the value of shea butter.

1. High levels of FFA reduce product quality because of the hydrolysis of triacylglycerols (TAG), which must be removed during the refining process to achieve standardization of the product and increase shelf life. There is a 1.5 percent loss in butter volume for every 1 percent of FFA removed.
2. Carcinogenic Poly-cyclic Aromatic Hydrocarbons (PAHs) must be removed during the refining process prior to any edible use in the United States or EU markets.
3. High levels of volatile peroxides must be removed through refining steps as oxidation products further catalyze degradation of a stored product, hence reducing shelf life.
4. Any water, contaminants, or other impurities that could impact shelf life and standard formulations could result in loss of butter volumes during refining.

Woman stirring shea oil in northern Ghana

[55] See for instance https://www.amazon.com/Salter-Brecknell-GP100-Electronic-Portable-Capacity/dp/B000VW3Y3C; http://www.digitalscales-uk.co.uk/jship-332lb150-kg-platform-scale-26-p.asp
[56] See for instance http://www.aqua-boy.co.uk/kam111-203.html

High levels of FFAs occur when fresh shea fruits remain for too long before post-harvest processing. When germination occurs, metabolic enzymes (lipases) hydrolyze shea TAGs into mono- and di-glyceride FFAs. Increased FFA levels also occur following poor storage and infestation by fungi or molds, as these microorganisms will metabolize the vegetable oils and fats.[57]

Smoking of the nuts, a process used in Mali, causes the kernels to be covered by a coating of aromatic hydrocarbons compounds released from the burning fuel wood. Finally, when fresh shea nuts are boiled for too long, i.e., more than 60 minutes, it has been hypothesized that enzymes, forming protective anti-oxidant complexes, are denatured and peroxides then increase in the butter following oxidation.[58]

[57] Quainoo et al., 2012
[58] Ibid

CHAPTER 4: SHEA COLLECTION, AGGREGATION, AND PROCESSING IN THE CREMAS

4.1 Background

The Community Resource Management Areas (CREMAs) in northern Ghana offer a unique opportunity to strengthen the value chain for handcrafted shea processing given the presence of cooperatives and community environmental awareness. AgNRM focuses on a selected number of CREMAs along the Black Volta and Western Biodiversity Corridors, building on the existing model of the Wechiau Community Hippo Conservation CREMA and the successful linkages already established between organically certified shea collectors and the Savannah Fruits Company (SFC). AgNRM hopes to promote activities with potential to improve livelihoods for CREMA communities, especially women.

While shea is widespread and abundant in farmed parklands along these corridors, most collectors have low processing know-how. They often mix immature, rotten, and germinated shea fruits with good quality ones during kernel processing. Others neglect good post-harvest handling procedures and do not properly dry and store kernels, which can lead to contamination. Because of conflicting farming activities, it is also common for farmers to delay processing too long, resulting in the production of poor quality kernels. Some collectors also store their kernels in the shell, inhibiting aeration and adversely affecting quality. Raising awareness about best practices for post-harvest handling would certainly enhance quality and reduce the amount of fuel wood and water required to process shea nuts.

The Government of Ghana's CREMA mechanism

The CREMA model seeks to conserve critical wildlife corridors while increasing compatible economic livelihoods for communities. A CREMA is characterized by:

1. A protected area with clear social/physical boundaries and land rights
2. Grassroots mobilization uniting residents and communities in social and economic planning
3. A governance structure that includes traditional authorities, ordinary citizens, and the Government of Ghana enforcement authority
4. Sustainable balance between conservation and economic use of resources
5. Conflict resolution based on allocation of resources through community decision-making

4.2 The HCSB market

Between 5,000 and 10,000 MT of handcrafted shea butter (HCSB) is being exported from West Africa each year. Demand largely comes the international cosmetics and edibles industries, especially in the Middle East, the United States, Europe, and Japan. HCSB is praised for its low FFA, low latex, high unsaponifiable content, and for its long shelf life. With a good label and packaging, shea products tend to be easily commercialized. On the other hand, there remain perceptions that HCSB is often associated with health and safety issues, low producer profits, and poor traceability.[59]

[59] Senyo & Lovett, 2017

Women kneading shea butter in northern Ghana

HCSB offers an opportunity for income generation throughout the entire year in rural communities. Its processing is transparent and attractive to impact investors, while there are also opportunities to leverage new technologies to improve processing efficiency.

Fair trade certification creates another opportunity to attract a price premium. There are also examples of HCSB production being beneficial in driving sustainable land-use practices and providing funds for the conservation of biodiversity, e.g., the hippo-friendly shea butter production in the Wechiau CREMA.

4.3 Recommendations for shea management in the CREMAs

4.3.1 Recommended procedures for shea kernel collection and processing

Quality control is key to attain the right color, texture, moisture, and purity after processing. A set of research-based recommendations has been developed and is now promoted by the GSA and followed by AgNRM.[60] These recommendations include:

- Shea fruits should be collecting less than one week after dropping;
- Time between harvest/accumulation of shea fruits and boiling should be immediate, or at most under one week after collection;
- Boiling time should be at least 15 minutes, but no more than 40 minutes;
- Nuts should be immersed in boiling water (not heated with the water combined and then brought to a boil);
- Collectors should use drying-racks or tunnel-driers to improve drying efficiency;
- Kernels should be free from impurities and should appear light to dark brown, or sometimes slightly purple in color;
- Kernels with black or moldy patches should be discarded;
- Moisture content should remain under 8 percent;[61]
- Kernels should be free of foreign materials, such as sands or sticks.

4.3.2 Recommended procedures for shea nut aggregation

Shea aggregation is fundamental for attaining economically viable quantities for haulage, processing, and marketing. With the timing of harvest and the labor required for collection and post-harvest processing, a collector usually collect between 1 and 3 bags of dry shea kernel per year.

After collection, a full container load (FCL) of shea butter can be hold about 21 MT of shea butter (846 x 25 kg boxes = 21,150 kg). A 35 percent extraction rate would then require approximately 60 MT of dry kernel and 720 to 725 bags per FCL butter (about 12 bags per MT). For CREMA establishments like the

[60] These are available on the Global Shea Alliance website at Details available on the Global Shea Alliance website at http://www.globalshea.com/quality/standards
[61] Louppe, 1994

Wechiau Shea processing unit to operate at full capacity, about 720 MT of shea kernel per year would be needed.

For the commercial aggregator, the level of aggregation depends on the size of the truck. The minimum truck size for bush collections is the Bedford truck, with a seven-ton carrying capacity equivalent to the weight allowance for large trucks in Ghana. Warehousing capacity and speed of turnover for further processing or shipment is also critical to determine supply chain volumes.

Aggregators or exporters then normally deliver export volumes (about 40 MT truckloads) to warehouses in Tema or similar factories. From empirical data, fresh de-pulped shea nut is composed of 41percent water, 21 percent oil, 20 percent husk and 18 percent residue. Therefore, following post-harvest processing, drying, and de-husking, approximately 40 percent dry kernel will be produced from fresh clean shea nuts. Once fully dried and prepared for extraction, shea kernel can usually be assumed to have approximately 50 percent fat content.

4.3.3 Recommended procedures for shea butter production

The following recommendations constitute key quality control points for the production of shea butter:

- Nuts should be cleaned of all impurities prior to butter extraction;
- Nuts should be crushed in small pieces by hand or with a mechanical crusher, and should then be immediately dry-roasted, either in larger pots with frequent stirring, or in ground nut roasters;
- Crushed and roasted nuts should be cooled and then milled using plate grinders, ensuring all oil vesicles are broken. While cast iron plates are common in Ghana, stainless steel or ceramic grinding plates are recommended to prevent iron particles to end in butter paste;
- The resulting paste from milling should then be kneaded with by hand or using mechanical equipment. This stage serves to form an aerated emulsion of shea butter, which can then be washed with water for separation from the residue;
- The aerated emulsion must be boiled dry and decanted prior to cooling and packing. Additional washing stages are not recommended, as this has been found to remove important water-soluble anti-oxidants such as catechins;
- Semi-cooled liquid oil is ready for packing when it becomes cloudy and starts to coagulate. The oil should be poured into plastic-lined cardboard boxes, weighed to 25 kg, preferably using digital platform scales. It should then be gently stirred, ensuring good mixing and smooth final consistency;
- The product should then be then stacked in a cool warehouse allowing it to fully solidify before being loaded on containers. If the butter is soft when loaded in high volumes, the boxes may collapse.

4.3.4 Recommended procedures for shea butter aggregation

Like shea nut aggregation, it is imperative to aggregate shea butter to attain economically viable quantities for haulage, refining, and marketing. Exporters collect orders of butter, consolidate them into container loads, transport them to Tema, and ship to Europe for further refining or filtering, repacking, and sale to ingredient distributors or bands. With regards to shea kernel quality, oil content at 50 percent, moisture at less than 5 percent and low FFA (typically 2–3 percent) extraction rates are typically 34 to 36 percent, rates as high as 42 percent have been possible for premium (tunnel-dried) shea nuts with FFA of less than 0.5 percent.

4.4 Financing schemes

There are a number of HCSB processing and export agencies offering pre-financing models. These often take the form of memorandums of understanding detailing quantity, quality, pricing, bonuses, group registration forms, and organization models. Trade-financing agreements are developed such that 40 to 60 percent of the value of the order is advanced to the shea butter supplier by an impact investor, e.g. Root Capital, Alterfin, Opportunity International, etc. Within the pre-financing arrangement, the shea butter supplier delivers to the client, who then pays the impact investor for the order. The balance is then paid to supplier minus pro-rata interest rates (usually 9 to 11 percent per annum on EUR and US$ orders).

Woman roasting the crushed shea kernel

In the case of the Wechiau Hippo Sanctuary, organic shea butter processing and shea kernel purchase financing may be pre-agreed with either a client or impact investor based on the predicted seasonal purchase. Bags of shea kernels are then bought for cash from the women and stored at the Wechiau warehouse for further processing. Organic premiums are calculated for the entire season and given to shea collectors once purchases are completed. Women engaged in the processing are paid for their labor based on a pre-agreed rate per weight of shea butter produced.

It should be noted that the Wechiau model is relatively different from conventional groups, as the processing center is rented by Savannah Fruits Company and women in the CREMA are employed to work and paid for their labor. This means that the costs of electricity, equipment, water and fuel wood are covered by SFC. SFC then sells to international clients, including ingredient distributors and cosmetic brands, and negotiates pricing with them as per current market conditions.

4.5 Branding opportunities

There are several opportunities to enhance the HCSB market value through branding. One of these would be to highlight the link between production and conservation efforts. For instance, shea butter from women's cooperatives could be branded as handcrafted, cooperative-crafted, and/or hand-made, thereby allowing market separation from industrially processed butter. This is particularly relevant for certified organic and Fairtrade butter, where industrial production is in direct competition with the women's production model. In this case, a third-party, verifiable consumer facing brand, seal, or logo would be required. Senyo & Lovett (2017) indicates that shea collectors, processors, exporters, and brands and retailers are keen to action this idea.[62]

With the expansion of CREMAs across northern Ghana and the inclusion of a wider range of products, a more generic consumer-facing brand could be another interesting opportunity. Public-private investment in the CREMAs to establish processing centers has the potential to improve the economic wellbeing of shea collector/processor groups. Where possible, the CREMAs could become shareholders to these investments. As is currently happening in Wechiau, women's groups can be linked to these centers for the direct sourcing of shea kernel and employment.

[62] Senyo & Lovett, 2017

Finally, another opportunity would be to rebrand northern indigenous tree food ingredients – shea butter, dawadawa, tamarind, baobab, etc. – by highlighting on social media their use in popular restaurants,[63] bring together Afro-modern food concepts and respected elite chefs.[64]

4.6 Certification schemes

Certification has become a key entry requirement into global markets, allowing collector groups, processors, and retailers to access lucrative niche markets. Certification standards are often strict and require important investments beyond the reach of individual smallholders, hence group certification is usually preferred.

Although some Ghanaian consumers may be aware of certification, demand is mostly restricted to export products. Organic and fair trade are the common certification schemes for shea. In practice, premiums for organic products are usually paid directly to collector/processor groups or to households for compliance. On the other hand, fair trade premiums are usually project-specific and paid at the community level.

The Wechiau CREMA is already implementing some of these standards and collector groups are benefiting. For instance, in the 2016/2017 season, certified organic nut collectors enjoyed 20 percent additional income from their shea kernel compared to their counterparts. Over the same period, Fair for Life certified nuts also attracted a 7 percent premium. These cases present an opportunity to improve livelihoods in other AgNRM CREMAs through organic and Fairtrade certification of shea and other NRPs.

4.7 SWOT analysis of Ghana's HCSB industry

Table 9 presents a SWOT analysis of Ghana's handcrafted shea industry.

Table 9: SWOT analysis of Ghana's HCSB industry

Strengths	Weaknesses
• Strong tradition of shea production in the region • Existing linkages between local producers and buyers (e.g. SFC) • Interest from group collectors to organize as cooperatives • Wechiau Community Hippo Conservation CREMA as a successful model to follow • Existing demand for handcrafted products from the international cosmetics and edibles markets in the US, Europe, and Asia • Higher-quality properties than industrial processors (e.g. low FFA) • Transparent processing system creating business case for impact investors • Clear and well-develop processing recommendations, endorsed by the GSA	• Low processing know-how among local communities • Poor post-harvest handling and storage practices undermining product quality • Conflicting farming activities • High input requirements from already constrained energy and water resources • High capital requirements for purchase of processing equipment and high-efficiency technologies • Weak infrastructure in rural production areas such as CREMAs • Low volumes per processor due to small ratio of collectors per processors • Unpredictability of production volumes and future available supply • Limited local tradition of planting improved indigenous tree varieties

[63] See for instance http://www.timeout.com/accra/bars-and-pubs/republic-bar-grill
[64] See for instance http://ghanarising.blogspot.com/2012/06/pa-johns-accras-best-kept-culinary.html

• Pre-financing models available from HSCB processing and export agencies • Multiple institutions active in shea research and development • Support from regional and international collaborative network (e.g. GSA)	• Lack of appropriate standards authority and export regulations • Limited access to reliable statistics and market intelligence • Language barriers with French-speaking neighbors limited cross-border trading
Opportunities	**Threats**
• Alignment with the sustainability and income-generation goals of the CREMAs • Increasing national demand as imported ingredients are expensive • Interest from buyers in bypassing middlemen and sourcing directly from producers • Lucrative niche markets available for organic and fair-trade products • Growing environmental awareness among local communities • Business case for financial services providers as collector/processor groups formalize • Good commercialization of eco-friendly products and brands in export markets • Popularity of climate smart agriculture practices among policymakers and donors • Water recycling and energy saving technologies available locally • Increase use of indigenous tree food ingredients in modern African cuisine	• Perceptions that HCSB is associated with health, safety, and sustainability issues • Food crop farming and urbanization undermining shea tree stock • Uncertain production levels due to climate variability • High susceptibility to pests and disease • Reestablishment of politically charged regulations for shea purchases, exports, and resource management • Regional insecurity and pandemics concerns • Limited gender development potential due to legacy of decision making belonging to men • Sustained drop in international demand and value • Foreign exchange volatility

(Source: Stakeholder consultations and desk research carried out to produce this report)

CHAPTER 5: CONCLUSIONS

5.1 Summary of key insights and industry recommendations

Several lessons emerged during this report. Perhaps the most important is the need to boost shea nut production in order to meet Ghana's industrial processing capacity. While the country has the highest capacity for industrial shea butter extraction and fractionation in West Africa at 226,000 MT, more than half of the shea nuts processed in Ghana are imported from its neighbors, i.e. Burkina Faso, Mali, and Cote D'Ivoire. Since several of these countries are building new factories to improve their own processing capacity, future shea nut supply is uncertain and could impact efficiency and profitability across the entire Ghanaian shea industry.

Since shea trees have a gestation periods of 15-20 years, and only reach full fruit bearing capacity after 25 years, kernel supply is unlikely to increase substantially in the short term.[65] It is thus essential to maintain the existing tree population and boost the quantities collected from available trees. Therefore, the environmental conservation objectives central to the concept of the CREMAs will need to be pursued with utmost attention. However, inadequate nurseries, uncontrolled felling of productive trees, the use of mechanical ploughing, and the unregulated use of herbicides all constitute major threats to the existing shea trees and their natural regeneration.

Another challenge to competitiveness is the amount of energy and water required for dried kernel and butter processing. In Ghana alone, this amounts to approximately 37,000 MT of fuel wood and 62 million liters of water consumed each year. Improved processes and technologies will be required to develop a more sustainable shea value chain in the country.

At the same time, there appears to be unmet demand for handcrafted shea butter than meets organic and fair-trade certification requirements. Since industrial processors are often unable to access these markets, there is an opportunity for collector groups to attract price premiums for their butter if they can meet required production standards. Collectors could save an additional 25 percent of processing time if they work in groups as opposed to individually, with the advantage of also improving their bargaining power with buyers. Finally, there are also opportunities for new marketing and branding strategies that highlight the sustainable aspect of shea and other NRPs produced in the CREMAs.

Finally, key recommendations from the roadmap coalesced around 4 key areas of focus for the industry to be able to modernize, which are as follows:

1. Increase the quality and quantity of shea supply by protecting lands from erosion and bush fires; scaling up shea propagation; planting, and pollination efforts; protecting usufruct rights for collectors; and training farmers and landowners on sustainable harvesting methods.

2. Introduce higher-quality equipment for both kernel and butter processing in order to yield gains in efficiency and product quality. New technologies would also help to reduce water and energy consumption;

3. Tap into the high demand for handcrafted shea butter, organic and/or fair-trade certification to attract price premiums and increase incomes (Producing butter without these certifications makes less economic sense, as processors then have to compete with more efficient industrial facilities). The formation of new cooperatives would also help to generate economies of scale and greater bargaining power for small-scale processors.

[65] Boffa, 2015

4. Linked collector and processor groups with private sector investors and exporting firms, and in certain cases register themselves as aggregators. Subsidize and/or facilitate financing schemes along the value chain to ensure that the recommendations put forward in this roadmap become a reality.

5.2 Implications for AgNRM

This roadmap outlines current shea supply and demand issues, explores quality and niche market considerations, and highlights gaps and opportunities to increase product competitiveness. AgNRM is currently supporting the development of a more sustainable shea value chain within the scope of Outcome 1, with the objective of increasing incomes among northern Ghana's poor households. Thus, this roadmap can be used to guide the investment of project resources to improve local butter processing, develop market linkages, and grow the export market.

Exhibit 5: Summary of recommendations

	Recommendations	Link to current or planned activities
1 **Increase the quantity of shea supply**	• Protect existing shea tree stock • Increase quantities collected • Increase future shea stock	• Continue to support bush fire prevention efforts, encourage sustainable harvest practices, and promote FMNR • Continue to support usufruct rights for collectors and partner with Naasakle/MotherShea • Train on propagation techniques, pest management • Continue to promote pollination through beekeeping • Expand partnership with GSA to accelerate tree planting programs
2 **Improve processing procedures**	• Improve production efficiency and quality • Reduce water and energy consumption	• Continue to promote use of higher quality equipment and provide training on quality control • Analyze additional processing innovations to identify new products as well as methods to reduce processing cost and energy consumption
3 **Increase profitability and margins for collectors and producers**	• Set up and support collector groups • Strengthen market linkages • Secure price premium certifications	• Continue to support registration of collector groups, provide TA on export standards • Explore formation of vertical networks, including umbrella associations • Conduct market analysis to identify new buyers • Continue to support links between collector/processor groups and buyers • Continue to facilitate organic and/or Fairtrade certification, improved branding and packaging
4 **Develop the enabling environment**	• Ensure access to finance • Enhance the policy environment	• Leverage project grant component to stimulate investment in infrastructure and equipment • Continue to promote VSLAs, support business plan development • Collaborate with advocacy groups to promote a conducive policy environment and pass and industry bill

5.2.1 Increasing the quantity of shea supply

Protecting existing shea tree stock

The tree inventory survey currently being conducted by AgNRM suggests that the number of mature trees in the CREMAs ranges between 2.2 and 4.7 million, on top of an additional one to two million young regenerating trees.[66] This alludes to the potential to boost the amount of shea collected in the future. Yet it is essential to also maintain the existing tree stock for this objective to be achieved. Therefore, AgNRM should continue supporting bush fire prevention efforts (sensitization campaigns and establishment of fire belts); encouraging sustainable harvest practices that discourage the use of pesticides and herbicides; deterring the felling of shea trees for fuel wood production; and promoting farmer managed natural regeneration (FMNR) – allowing crops to grow, in line with Outcome 2 and Outcome 4 plans.

Increasing quantities collected

The validation workshops organized at the Black Volta and Western Biodiversity Corridors suggest that collectors can increase the quantities of fruits they collect should there be demand from the markets (up to six bags a year per collection in the BVC and eight bags in the WBC). In support of this, AgNRM is working on usufruct rights for collectors to be able to access parklands and collect increased quantities of shea, as targeted through Outcome 3. AgNRM has also recently established a new partnership with Naasakle/MotherShea to incorporate efficiency gains into the fruit picking process.

Increasing future shea stock

Despite the long gestation period of shea trees (15-20 years), there are still valuable investments that will contribute to the project goals of AgNRM.[67] These include reducing the gestation period of shea trees, and AgNRM has planned training for collector groups around propagation techniques, such as grafting, to reduce gestation to under 6 years (for seedlings). Training will also explore techniques to treat diseased or unproductive trees, which are estimated to constitute close from half of the existing tree stock. Another areas for investment related to increasing the quantity of available shea fruits is pollination through beekeeping, and AgNRM has introduced beehives in the CREMAS in support of this. Finally, while impact might take time to materialize, AgNRM could further expand its partnership with GSA to accelerate planned shea tree planting programs.

5.3.2 Improving processing procedures

Improving production efficiency and quality

This report has highlighted ways to improve kernel and butter production through the introduction of higher-quality equipment, such as newly designed de-husking equipment; more efficient oven driers and grinding mills; better kneading technologies; and training on other quality controls, e.g. using moisture meters.[68] The new partnership with Naasakle/MotherShea also demonstrates the opportunity for more economical use of raw material (processing shea fruit into juices and shells into biofuel).

Reducing water and energy consumption

AgNRM could also look into other innovations that reduce processing costs, such as efficient parboiling cook stoves that reduce fuel consumption, energy savings roasters, water recycling mechanisms,

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[66] These figures come from ongoing tree counting field surveys carried out. See internal report "Analyzing the Visibility of NRPs in CREMAs, 2017"
[67] Boffa, 2015
[68] See for instance http://engineering.tamu.edu/news/2015/10/26/forty-eight-hour-design-competition-leads-to-pigeon-pea-deshelling-innovation

alternative energy use such as biogas from shea waste. These activities could be pursed in partnership with Outcome 4 plans.

5.3.3 Increasing profitability and margins for collectors and producers

Setting up and supporting collector groups

AgNRM has supported 150 shea groups to aggregate larger volumes in order to meet demand from industrial butter processors and large kernel buyers. The project should continue its Outcome 1 objectives to formalize collector groups into registered groups, providing them with the know-how and resources necessary to meet international exporting standards. Once registered, groups would then be able to become aggregators and interact directly with processing companies. AgNRM could further explore the formation of a vertical network of groups from the community level all the way to the district and regional levels.

Securing price premium certifications

AgNRM should continue to support organic and/or fair-trade certification for collector/producer groups in the CREMAS, which will allow them to access niche markets with substantial price premiums. This requires introducing a traceability system and training producers in meeting the processing and aggregating procedures developed by GSA, among other things. The main advantage of certification for butter producers is the ability to differentiate themselves from industrial processors and substantially increase their margins. Specifically, there are opportunities to improve branding and packaging for HCSB produced in the CREMAs so as to reach more lucrative markets.

Strengthening market linkages

Linking up collector/processor groups to buyers will be essential for AgNRM to reach its income generation targets under Outcome 1. AgNRM seeks to generate new market opportunities by enabling business-to-business negotiations between collector groups and shea kernel buyers and between butter processors and cosmetic firms. AgNRM also offers a co-financing grant program to stimulate private sector investment in the CREMAs. Investments are particularly important to achieve the improvements necessary to make the shea value chain more competitive, such as new warehouses, drying platforms, equipment, clean energy cook stoves, improved roasters, and motor tricycles. AgNRM should explore other measures to spur investor interest, for instance by ensuring the enforcement of quality procedures that meet international standards or by improving access to data and market information. This could be carried out in partnership with ICT-solution providers such as Esoko, with the goal of providing timely market information and enhancing transparency and traceability along the supply chain. AgNRM could also investigate new linkages with the gasification sector to explore opportunities related to steam energy, bio char, and distilled water, perhaps in consultation with ReGenesis, and with the carbon market sector to measure carbon sequestration and access carbon credits.

5.3.4 Developing an enabling environment

Ensuring access to finance

The above proposed changes to the shea value chain will require substantial investment that may be out of reach for most collector/processor groups. To address these investments at the community level, supporting collector/processor groups to operate as VSLAs could help these newly formed cooperatives to access AgNRM's matching grants program and/or develop business plans of sufficient quality to secure support from external financial institutions. The project could also explore buyer-led efforts around pre-financing arrangements for collector/processor groups, which would help to smooth their cash liquidity and support the purchase new equipment and the adoption of new technologies.

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