Journal of Biology, Agriculture and Healthcare
ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)
Vol.3, No.5, 2013

Developing the Shea Value Chain for Wealth Creation in Nigeria

Olife, Ifeyinwa Chidiogo[1]*; Onwualu, Azikiwe Peter[1] and Jolaoso, Moyosore Adedapo[1]
[1]Raw Materials Research and Development Council, Abuja
* E-mail: ifeeolife@yahoo.com

Abstract
Shea tree, which grows widely and naturally in West and Central Africa, is valued because of the Shea butter extracted from the Shea nut. It grows only in the wild, and can take up to 50 years to mature. Based on distribution, two species of the tree have been identified namely; *Vitellaria paradoxa* and *Vitellaria nilotica*. *Vitellaria paradoxa* grows mainly in the West African region while *Vitellaria nilotica* grows mainly in Northern Uganda and Southern Sudan. In Nigeria, Shea tree grows in Niger, Kwara, Kebbi, Kaduna, Kogi, Benue, Ogun and Oyo States. Shea butter, a slightly yellowish or ivory-coloured fat, is widely used in cosmetics as a moisturizer, salve or lotion. In Africa, Shea butter is used as cooking oil, as wax, for hairdressing, for candle-making, and also as an ingredient in medicinal ointments. Shea butter is also used in the chocolate industry as a substitute for cocoa butter. Shea butter extract is a complex fat that contains, besides many nonsaponifiable components, the following fatty acids: oleic acid (40-60%), stearic acid (20-50%), linoleic acid (3-11%), palmitic acid (2-9%), linolenic acid (<1%) and arachidic acid (<1%). Demand for Shea products has grown in the European Union (EU) and the United States of America (USA) necessitating Nigeria and other West African Countries to go into the export of Shea products. The rise in demand is due to the fact that cosmetics and personal care companies have increased the use of Shea butter in their products. The market prefers the following kernel qualities: FFA<6%, fat content 45 – 55%, water content < 7%, and impurities < 1%. The preferred demand for butter quality for the cosmetic industry varies depending on the end use. However, preferences include non-solvent extraction, low FFA, 'clean' white to yellow colour (not grey), low level of impurities, low water content, low odour, low melting point and high unsaponifiable fraction. It has been indicated that the main problem encountered in marketing of Shea products is FFA and aflatoxin content in the nut while in storage. For the butter, the main problem is both the FFA and impurities. This paper identifies lack of value addition as the major constraint in expanding Shea nut processing and marketing in Nigeria. The concept of value addition is a vital component for addressing global market competition, post-harvest losses and food security. Value addition promotes market acceptability and gives the products high economic value which consequently brings higher income to the producer.
Keywords: Shea nut, Shea butter, Value addition, Processing, Marketing.

1. Introduction

Nigeria is blessed with abundant natural resources including a number of cash crops. These include cassava, cashew, Shea, cotton, cocoa, oil palm, rubber, etc (Onwualu, 2012a, 2012b). It has been shown that when the value chains for these crops are developed, it can lead to employment generation and wealth creation (Olife, et al., 2011a and 2013). Of all these crops, the Shea tree although has many industrial applications, its production, processing and handling are still not developed.

Shea tree (*Vittellaria*) with sub species *paradoxa* and *nilotica* is indigenous to the Guinea and Sudan Savanna zone from Senegal to Sudan, and to western Ethiopia and Uganda, in a belt 500–700 km wide. Shea is found in the interior, separated from the Gulf of Guinea by forest. It is only in Ghana and Nigeria that it occurs within 50km from the coast (Nikiema & Umali, 2007). It is a perennial and deciduous tree which grows naturally throughout Guinea Savannah region. Mature tree height vary considerably with some attaining heights of over 14m and girth of over 1.75m (Yidana, 1994). The tree has profuse branches with a round or hemisphere crown. The bark of the stem is deeply fissured, thick, waxy, corky and fire resistant.

Shea trees in Nigeria grow naturally in the wild and thrive almost exclusively in the North. In general, trees do not usually yield fruit until they are 20 years old, and do not reach full maturity until they are 45 years old. However, once productive, they will continue to bear fruits up until their 200th year (Fleury, 2000). An average of 25 - 55 kg of berries can be expected each year from one tree, although one tree in three will be productive each year (Godwin and & Spensley, 1971). The kernels are made up of 42 to 48% oil. However, the long period taken to reach maturity has

discouraged its planting in an organized plantation. Shea tree is an important economic crop because of the heavy demand for its butter in the international market mainly as a substitute for cocoa butter in the production of chocolate. There is also increasing demand for Shea butter in pharmaceutical and cosmetics industries. Shea butter is a useful cocoa butter substitute because it has a similar melting point (32–45°C) and high amounts of distearin (30%) and some stearo-palmitine (6.5%) which makes it blend with cocoa butter without altering flow properties. The high proportion of unsaponifiable matter, consisting of 60–70% triterpene alcohols, gives Shea butter creams good penetrative properties that are particularly useful in cosmetics (Nikiema & Umali, 2007).

The measure of the long- term prospect of Shea products in any nation includes research and development, improvement of Shea productivity and product quality, transfer of technology diversification and improvement of processing technology (Garba, et al., 2011). The Shea tree also has a unique resource for poverty alleviation and employment generation for both rural women and youth.

Shea tree is important for the livelihood of the rural population as it has been for over centuries (Lovett & Haq, 2000). Almost every part of the tree has its use, e.g. the fruit is eaten and the leaves are used as fodder and serve as an ingredient for making alkaline and paint (Lovett & Haq, 2000). The Shea tree also has a great capacity for producing copious amounts of sap that can constitute an important source of raw material for the gum and rubber industry. Shea tree seed husks have a capacity to remove considerable amounts of heavy metal ions from aqueous solutions, for example, from wastewater. These were found to be more effective than the melon seed husks for absorption of Pb^{2+} (Eromosele & Otitolaye, 1994).

The brown solid that is left after extracting the oil and the hard protective shell are used as a waterproofing material on the walls of mud-buildings to protect them from the eroding forces of the wind and rain. Poor quality butter is not only applied to earthen walls but also to doors, windows, and even beehives as a waterproofing agent. In a traditional setting, Shea butter of poor quality is used as an illuminant (or fuel, in lamps or as candles). The residual meal is also used as a waterproofing agent to repair and mend cracks in the exterior walls of mud huts, windows, doors and traditional beehives. The sticky black residue, which remains after the clarification of the butter, is used for filling cracks in hut walls and as a substitute for kerosene when lighting firewood (Wallance-Bruce, 1995). The husks reportedly make a good mulch and fertilizer (FAO, 1988), and are also used as fuel on three stone fires. Latex is heated and mixed with palm oil to make glue (Hall et al., 1996). It is chewed as a gum and made into balls for children to play with (Louppe, 1994).

Shea tree has the potential to contribute to the economic development of Nigeria considering the wide range of industrial applications of the Shea tree especially the nut. The Shea value chain (planting, harvesting, processing and marketing) could provide employment and business opportunities to Nigerians mostly in the Shea tree belt. However, the value chain is underdeveloped. There is therefore the need to understudy the value chain in order to identify the constraints and challenges and proffer solutions. Therefore, the objectives of this study are to provide a critical appraisal of Shea value chain in Nigeria, outlining the challenges, identifying recent interventions and proffering solutions towards increased wealth creation through Shea processing.

2. Shea Butter Processing

The equipment for primary processing include pan for boiling water, drying mat, hammers, pestles, winnowing basket and clay pot. The pulps of the harvested berry are crushed under foot after fermentation. The berry (almond) sticks to the shell wall and to separate them, the nuts are immersed in boiling water and sun dried for a few days. During the drying stage, the berries become detached. Nuts can now be stored for months without deterioration. Shelling is carried out using stone, hammers and pestles while winnowing is achieved by holding basket filled with nut at arm length and gradually employing them. If there is a strong wind, the piece of shell will be blown away, if not, then the operation is repeated many times (Fleury, 2000). The day prior to oil extraction, the shelled almonds are dried again from a moisture content of 40 to 50% to 6 to 7% (Godwin & Spensley, 1971).

There are two methods for oil extraction, traditional process and mechanical procedure. The traditional process involves many time consuming stages. After drying, the kernels are crushed by simultaneous strokes in a mortar. The paste that is gradually formed needs to be kept at a temperature of about 40^0C. Shea butter tends to solidify between 34 and 38^0C. Once the paste becomes a fluid, it is strained and heated in a pan. A kneading process using a polished stone takes place to break up oil cell and ease oil extraction. The paste is then mixed with water to separate the remaining oil. Afterwards, it is rapidly mixed by hand until it starts to cover itself with a white emulsion of fat. Once this is achieved, the paste is left to rest. The oil that floats to the surface is scooped off and poured into a container

filled with lukewarm water for decantation. During decantation, a white film forms over the top of the surface, this is Shea butter. It is separated and heated in a cauldron to evaporate the remaining water and allow heavy impurities to settle at the bottom. The butter is left overnight to rest. Traditionally, it is then divided and wrapped in leaves for market or storage. The butter lasts for many years if kept away from light and heat as it is resistant to oxidative rancidity (Fleury, 2000). The fatty acid composition of Shea butter is shown in Table 1.

A less time consuming method of preparing Shea butter has been developed by the Royal Tropical Institute in the Netherlands. The process has only four stages. The kernels are pounded to a fine powder, which is then heated to a temperature of 100^0C. It is kept hot in a hot air oven for one hour before being pressed in a hydraulic hand press. The fat, which is obtained, is cleared of all other residues by boiling with okro, lemon, juice and water (UNIFEM, 1987). It should be noted that using a Shea nut press not only alleviates time consuming process but also improves the fat output. For example, using a Shea press, fat output will be between 40 to 45%, while fat output using the traditional method will be about 25% (Niess, 1983).

Manufacturers in the chocolate and other food industries prefer to buy the Shea nuts as opposed to the butter so that they can have as much control as possible over the processing and quality of the final product. Nuts are also preferred because they can be stored for up to five years in the right conditions, while the butter is more expensive to store and deteriorates more rapidly. As Shea butter ages, the original clinical potency and healing power are also lost. It is therefore, recommended that Shea butter is used within 18 months from the date of extraction from the seed.

Shea butter comes in different grades: Grades A, B, C, D, and F. Grades are determined by the presence or absence of various nutrients. These nutrients are Vitamin A (250 IU or greater), Cinnamic Value (0.75 or greater), Sterols (2 gm/kg or greater), Bioactive matter (6% or greater) and sometimes, Triterpenes, Latex and Vitamin E. Grade A is the highest and best quality for cosmetics industry, while Grade D is the lowest grade missing most of the valuable nutrients (ASBI, 2009). The highest grades are awarded to those butters with the largest fraction of bioactive matter (5% and above), a good safety screen, and rancidity value below 10. Therefore, only the best preparation of unrefined Shea butter can earn the Grade A status, but refined Shea butter are typically Grade C, sometimes D, but never Grade A and rarely Grade B. Grade F is reserved for Shea butter not fit for human use because it is contaminated by microorganisms or heavy metals (ASBI, 2009).

3. Shea Nut Global Production and Export

Shea tree occurs naturally in a 5000km long zone stretching from Sudan to Guinea, with a width of 500km and can be found in 18 countries which include: Senegal, Guinea, Mali, Cote d'Ivoire, Ghana, Togo, Benin, Burkina Faso, Nigeria, Niger, Chad, Cameroon, Central African Republic, Uganda, Congo, Kenya and Sudan. Shea nut is one of the most important sources of vegetable oil in rural areas of the savanna zone of West Africa. The bulk of the Shea nuts produced are for home consumption and local trading. Nigeria is the leading producer of Shea nut: 355,000 tonnes produced in 1999, 58% of the African production, but 10,000 tonnes lower than in 1996 and 414,000 tonnes in 2005. Mali and Burkina Faso are other leading producers; at the end of 2005 they produced 85,000 tonnes and 70,000 tonnes respectively, followed by Ghana (65,000 tonnes), Côte d'Ivoire (36,000 tonnes), Benin (15,000 tonnes) and Togo (8,000 tonnes). Up-to-date statistics on Shea nut production are not available for most countries. Reports on Burkina Faso show a remarkable increase in production to 222,000 tonnes in 2005. Similar trends probably take place in other West African countries (Nikiema & Umali, 2007).

West African countries are top producers of Shea nuts. Nigeria is the largest producer of Shea nuts but contributes relatively only little to world exports. Table 2 shows top Shea nut producing and exporting countries for 2007/2008 (USAID/WATH, 2010). Major Shea nut importers in recent years are Belgium, Denmark, Japan, the Netherlands, Sweden, the United Kingdom, France, and North America (Elias and Carney, 2007). In these countries, it is processed into a wide range of food products including chocolate and it is also used in the cosmetic industry (Schreckenberg, 2004).

Exports of Shea nuts have increased dramatically in recent years, from 50,000 tonnes in 1994 to 150,000 in 2004 and 350,000 in 2008. Until recently, about 90% of exported Shea product was raw nuts. However, the figure has dropped to 65% as processing operations in West Africa have increased. It is estimated that about 30,000 to 35,000 tonnes of butter are processed in Africa for export to Europe and Asia for further refinement into value added Shea butter to be used in food and cosmetics (USAID/WATH, 2010).

Shea nuts are exported in one of two ways; either by the nut themselves after the roasting or the nuts are processed into Shea butter within the country of origin and then exported (Boffa, 2000). The FAO estimated that about 650,000

tonnes of Shea nuts are produced annually from the main producing countries of Ghana, Benin, Burkina Faso, Togo, Cote d'Ivoire, Mali and Nigeria. The Shea fruit picking is basically an occupation for rural women and children. This wild and slow growing savannah tree provides food (nutritious fruit as well as food oil) and revenues from the sale of the nuts/butter. The market prospect of Shea butter is high both locally and internationally.

4. The Shea Nut – Nigerian Perspective

The Shea butter processing in Nigeria is mostly done traditionally by women in the rural area. The procedure is quite tedious and time consuming, from collection of the Shea fruits to the production of the final product. A variety of methods are used traditionally to remove the husks. These include trampling, pounding using a mortar and pestle, and cracking between two stones. In removing the oil from the kernels, it is estimated that the production of 1kg of Shea butter takes one person 20-30 hours with 8.5-10.0kg of wood fuel (Niess, 1988). The Green pulp exterior is removed by several methods. One method is to bury the fruit in the ground so that the pulp ferments and falls off. This takes 12 days or more. The nuts are parboiled or sun dried and then smoked for 3 to 4 days. The dried nuts can then be stored for long periods without significant losses. Decortication is done by crushing the outer shell to remove kernels. Shea nuts are mainly exported as smoked kernels**.** The kernels will be further dried before any additional processing is carried out. The traditional oil extraction technique of Shea butter is time consuming, physically exhausting and requires large quantities of fuel wood and water. These could be improved using technology.

In traditional wet processing, the kernels are roasted in a pot over a fire to approximately 100° C and then pounded in a mortar to produce a course paste. This is then ground between two stones to produce a smooth paste. The paste and water are mixed in a pot where the butter rises to the top. The butter can then be removed and washed repeatedly with warm water until clean. The remaining water is removed by heating. Impurities settle out and the butter can be left to cool and solidify. With the traditional technique, the fat obtained is between 25 and 40 % of the dry kernel weight.

The introduction of equipment can improve the traditional methods of production by reducing the effort and time involved and by increasing the yield. Instead of pounding by hand a mill can be used, oil can be extracted using a mechanical or hydraulic press. Manually turned roasters can be used rather than a traditional pot.

5. The Shea Nut Value Chain

Value Chains reside at the core of high-impact and sustainable initiatives focused on improving productivity, competitiveness, entrepreneurship, and Small and Medium Enterprises (SMEs) growth. As Shea nut is processed into final products, value is added at every stage as it moves through the value chain. Value chain links the steps a product takes from the farmer to the consumer and includes input suppliers, production, processing, marketing and finance.

Rural women are at the bottom of the Shea value chain with end points in multi-national food companies and the local domestic market (Fig. 1). Shea nuts are picked and processed mainly by the rural women. The nuts are also sold in the local market where they are bought by a range of actors including local butter processors, local nut traders and nut exporters. There are no Shea butter extraction facilities and Shea butter oil refineries in Nigeria. All processing are done by the rural people using traditional methods. The value chain for Shea is largely underdeveloped, characterized by low technology input.

The Nigerian Shea industry has the potentials to contribute significantly to the economic and industrial development of the nation, especially with the wide range of industrial application of Shea butter. Efforts should be geared towards the development of the Shea value chain in Nigeria. Benefits of developing the Shea value chain in Nigeria include the following: high potentials for job and wealth creation; women empowerment and poverty reduction in the Shea producing communities; solid raw material base for local and international Shea-based food, pharmaceutical and cosmetics industries; equipping the local Shea nut producers and processors with the right skills and technology to be able to compete global market; structural organization of local producers and processors into formal groups (co-operatives) to harness revenue for national development; reduce the trend of indiscriminate cutting and burning of Shea tress; and domestication and establishment of Shea plantation (Ahmed, 2011).

6. Interventions towards Improving the Shea Value Chain in Nigeria

Interventions in the Shea value chain in Nigeria have been few. There is need to increase women's involvement in butter-making by encouraging cooperative organization, providing training and equipment and facilitating links with international buyers. Increase returns to those at the end of the value chain (the pickers) should be promoted by

providing training on nut processing, organizing pickers and linking them with exporters. At the producer level, research on the maintenance and management of Shea trees should also receive attention. Table 3 shows the necessary interventions at the different levels of the value chain.

In recognition of the need to maximize the economic potentials of the vast Shea resource in Nigeria, the federal government included Shea tree as one of the mandate crop of economic importance to the Nigerian Institute for Oil palm Research (NIFOR). This led to the establishment of NIFOR Shea nut tree research sub-station. The sole responsibility of the substation was to research into the economy, ecology and biology of the Shea tree with the aim of improving its yield. Several researches are ongoing at the sub-stations towards the domestication of the tree and improving the yield per hectare.

The Raw Materials Research and Development Council (RMRDC) has become Nigeria's focal point for the development and utilization of the nation's vast industrial raw materials. One of the Council's mandates is the development of technology and machinery for raw materials processing. The Council is focused on promoting the development and optimal utilization of Nigeria's natural resources for industrial growth and has been involved in Shea butter development and processing.

In 2002, RMRDC initiated a project to upgrade the traditional method of Shea butter processing. The objectives of the project were: to upgrade the process techniques employed by the local processors in order to enhance production in terms of quantity and quality; develop, design and fabricate machineries for the upgraded Shea butter production plant; and transfer the upgraded technology to small and medium scale entrepreneurs.

In order to achieve the set objectives, the Council carried out a study of the traditional methods of Shea butter processing in Kwara State. At the end of the study, the traditional method was upgraded to a small scale industrial grade process through the introduction of hammer mill for crushing of roasted Shea nut as opposed to crushing with mortar and pestle; adoption of disc mill to replace grinding stone in the milling of Shea nut; design and fabrication of kneading machine to mimic the use of legs/hands by the local processors; and introduction of a decanting vessel to replace the manual scooping of oil. After a successful demonstration of the operational units of the equipment, the setup was transferred to the Araromi Women Co-operative Shea butter Processing Centre, Agbaku-Eji, Kwara State. However, the technology is yet to be transferred to small and medium scale entrepreneurs.

RMRDC in collaboration with the National Centre for Genetic Resources and Biotechnology (NACGRAB), Ibadan has also embarked on the exploration and collection of Shea tree germplasm. The exercise was aimed towards the domestication and improvement of seed handling techniques of Shea tree.

7. Challenges of Development of Shea Value Chain in Nigeria

Apart from the challenges associated with the adoption of technology and machinery for Shea butter processing, other challenges in the development of the Shea value chain in Nigeria could be grouped into three: production/collection, processing and marketing stages (Ahmed, 2011).

7.1 Production/Collection Stage

The challenges of the production/collection stage include: Indiscriminate cutting of Shea trees and bushfire; Lack of enforcement of existing legislation with regards to the protection of Shea trees; Pickers of Shea nuts from the bush are mostly aged women; Weak organizational structures of pickers; Difficult access to Shea tree sites; Exposure to hazardous conditions during collection (e.g. snake bite and scorpion sting); and Lack of domestication of the Shea trees in Nigeria.

7.2 Processing Stage

Challenges of the processing stage include: Weak organizational structure of pickers and processors; No access to good water for Shea butter processing; Poor infrastructure in the processing communities; Lack of standardized method of processing good quality nuts/butter; and Lack of access to modern processing facilities by traditional processors.

7.3 Marketing Stage

Marketing challenges include: Lack of access to organized market (market dominated by local buying agents who determine the price); Lack of direct access to companies that use Shea butter within and outside the country; and Poor pricing of processed nuts/butter by local buying agents.

8. Strategies for harnessing the potentials of Shea Tree in Nigeria

Shea is among the economic tree crops grown in Central and Northern Nigeria and the industry has the potentials to

provide food, raw materials, income and employment to millions of Nigerians. In order to harness these potentials, the following steps are recommended:

Domestication of Shea Tree

Efforts should be made to domesticate Shea tree through research and development of modern propagation techniques. Also, awareness campaign is necessary for the conservation of natural plant populations by the local communities for future exploration of its resources

Utilization of Standard Process Equipment

Mechanized processing centre should be established for the application of new processing techniques to reduce the drudgery in traditional method and also boost production and quality of the butter. Technologies from research institutes could be harnessed and injected into the operations of SMEs.

Marketing

Aggressive and proactive marketing strategies should be used in exploiting new business opportunities. Entrepreneurs should develop capacity in key areas such as resource mobilization, efficiency of resource allocation, market opportunity identification, product quality promotion and business development. Marketing must make sure that the product is targeted towards the correct customer group. Upgrading of existing Shea butter cottage industries and good business environment for international linkages and marketing should be encouraged.

Formation of processing Clusters

Clusters should be established through Public-Private partnership to encourage small scale enterprises located in close proximity to come together to promote rapid economic growth and generate employment. The challenge of poor access to technology can be solved by applying the Cluster concept. This will reduce the cost of production and maintenance of the equipment since members of the clusters will effectively have access to common equipment and infrastructure.

9. Conclusion

The Nigerian Shea industry has the potentials to contribute significantly to the economic and industrial development of the nation, especially with the wide range of industrial application of Shea butter. The Public-Private Partnership should be employed in the development of Shea value chain through funding of research and development for the domestication of Shea tree, provision of appropriate technology for Shea nut processing, and establishment of Shea butter processing clusters. Also, the process technology developed by the Raw Materials Research and Development Council should be adopted and replicated in all Shea producing belts of the country. Successful development of the Shea value chain will create opportunities for employment and wealth creation at all levels of the value chain.

References

Ahmed, M.K. (2011). Shea Sector Development Issues, Challenges and Way Forward. Niger State Commodity and Export Promotion Agency

American Shea Butter Institute (ASBI) (2009). Shea Butter 5th Edition. 2009 International Shea Butter Convention, Atlanta, Georgia

Babatunde, O. O. and Olaoye, J. O. (1997). Improved processing procedure of Shea butter oil for rural women. Nigerian Society of Agricultural Engineers Proceeding of the Annual Conference, 19: 380-390

Boffa, J.M. (2000). West African agroforestry parklands: keys to conservation and sustainable management. Unasylva, 51(200)

Elias, M and Carney, J. (2005). Shea butter, Globalization and women of Burkina Faso. In: A Companion to Feminist Geography. Nelson and Seagar, eds. London, Blackwell

Eromosele, I. C. and Otitolaye, O. O. (1994). "Binding of iron, zinc and lead ions from aqueous solution by shea butter (Butyrospermum pakii) seed husks". Bulletin of Environmental contamination and Toxicology, 52: 530-537

FAO. (1988). Appendix 5, Forest Genetic Resource Priorities. 10. Africa. Report of Sixth Session of the FAO Panel of Experts on Forest Gene Resources, held in Rome, Italy, December 8-11, 1985, pp 86-89. FAO, Rome Fleury, J.M. (2000). The butter tree. IDRC Report, IDRC Publications, Ottawa, 10(2):7-9.

Godwin, J.V. & Spensley, P.C. 1971. Oils and oilseeds. Tropical Product Institute, Crop and Product Digests, 1: 138-142

Garba, I.D., Nwawe, C.N. and Oisakede, I.C. (2011). The Potentials of Shea nut Tree to the Nigerian Economy. International Journal of Agricultural Economics and Rural Development, 4(1):62-72

Hall, J. B.; Aebischer, D. P.; Tomlinson, H. F; Osei-Amaning, E. and Hindle, J. R. (1996).
Vitellaria paradoxa: A monograph. 8: 105pp. School of Agricultural and Forest Sciences, University of Wales, Bangor
Kent, R. and Bakaweri, C. (2010). Mechanisms to ensure participation in Shea value chain: A case study of two interventions in Northern Ghana. A report to FAO as an input to a workshop on "Institutional innovations and policy interventions in support of smallholder market participation", Rome, 3 – 4, 2010
Louppe, D. (1994). Le karate en Côte d'Ivoire. Project de Promotion et de Developpment des
Exportations Agricoles (PPDEA), composante recherché-developpment. CIRAD-Forêt. P29
Lovett, P.N and Haq, N. (2000). Diversity of Shea nut tree (Vitellaria paradoxer Gaertn C.F.) in Ghana. Genetic Resources and Crop Evolution, 47(3): 293-304
Niess, T. (1988). Technologie approprieé pour les femmes des villages. Développement de la presse à karité au Mali. Deutches Zentrumfür Entwicklungstechnologien, Deutsche Gesellschaft für Technische Zusammenarbeit vieweg & Sohn, Braunschweig. 42pp
Niess, T. (1983). New Shea butter technology for West African Women. GATE Magazine, GEZ Publication
Nikiema, A. and Umali, B.E., (2007). Vitellaria paradoxa C.F.Gaertn. In: van der Vossen, H.A.M. and Mkamilo, G.S. (Editors). PROTA 14: Vegetable oils/Oléagineux. [CD-Rom]. PROTA, Wageningen, Netherlands Olife, I.C., Uchegbu, K., Jolaoso, M.A. and Onwualu, A.P. (2011a). Honey Processing and Marketing in Nigeria. Proceedings of the 11th International Conference and 32nd Annual General Meeting of the Nigerian Institution of Agricultural Engineers (NIAE), October 17 – 20, 2011, Ilorin Nigeria. Vol. 32. 520 – 526
Olife, I.C., Jolaoso, M.A. and Onwualu, A.P. (2013). Cashew Processing for Economic Development in Nigeria. Agricultural Journal, 8:45-50. www.medwelljournals.com
Onwualu, A.P. (2012a). Agricultural Sector and National Development: Focus on Value Chain
Approach. Presented at the 5th Edition of the Annual Lecture of Onitsha Chamber of Commerce, Onitsha, May, 2012
Onwualu, A.P. (2012b). Growth and Development of the Nigerian Non-oil Sector: Key to Successful Economic Diversification. Presented at the51 AGM/Conference of National Association of Chambers of Commerce Industry, Mines and Agriculture (NACCIMA), Sagamu, 2012
Onwualu, A.P. (2011). Adopted Village Concept. A paper presented at the 3rd Annual Conference of the Pan African Competitiveness Forum, Entebe-Uganda, 2011
Schreckenberg, K. (2004). The contribution of Shea butter (*Vitellaria paradoxa* C.F. Gaertner) to local livelihoods in Benin, Chapter 6 of Forest products, livelihoods and conservation. Africa Volume 2
Wallace-Bruce, Y. 1995. Shea butter extraction in Ghana. In: Do It Herself: Women and technical innovation, pp. 157-161. H. Appleton, ed. Intermediate Technology Publications, London. 310pp
Yidana, J. A. (1994). Pollination in Shea trees. Cocoa Research Institute, Ghana, Annual Report 1992/93
UNIFEM. (1987). Oil extraction food cycle source book 1UNIFEM and ITDG Publication
USAID/WATH, (2010). Investing in Shea in West Africa. A U.S. Investor's Perspective. West Africa Trade Hub Technical Report

Olife, Ifeyinwa is a Senior Scientific Officer with Raw Materials Research and Development Council, Abuja. She holds a M.Sc. Degree in Biochemistry from Nnamdi Azikiwe University, Awka.
Prof. Onwualu, Azikiwe is the Director-General, Raw Materials Research and Development Council, Abuja. He holds a doctorate degree in Agricultural Engineering from The Technical University of Nova Scotia, Halifax, Canada.
Dr. Jolaoso, Moyosore is the Director, Agriculture and Agro-Allied Department, Raw Materials Research and Development Council, Abuja. He holds a doctorate degree in Agronomy from University of Ibadan

Table 1: Fatty acid composition of Shea butter

Palmitic acid	5.0- 9.0%
Stearic acid	30.0- 41.0%
Oleic acid	49.0-50.0%
Linoleic acid	4.0-5.0%

Source: Godwin & Spensley, 1971

Table 2: Top Shea nut producing and exporting countries (2007/2008 season)

Country	Production (Tonnes)	Area harvested (Ha)	Export (Tonnes)
Nigeria	425,000	250,000	45,000
Mali	182,202	75,000	80,000
Burkina Faso	70,000	28,000	90,000
Ghana	65,000	22,000	50,000
Cote D'Ivoire	28,874	18,500	40,000
Benin	15,000	6,000	20,000
Togo	12,000	3,500	15,000
Guinea			10,000

Source: USAID/WATH, 2010

Table 3: Interventions in the Shea value chain

Level in chain	**Intervention**	**Actors**
Producer	Tree management Shea productivity	Research Institutes
Pickers/primary processors	Training on storage and handling	Relevant government agencies (local, state and federal) Non-Governmental Organizations (NGO)
Butter makers/secondary processors	Training Provision of machinery Support to producer organizations	Government at all levels NGO Public-Private Partnerships (PPP)
Wholesalers and exporters	Technical assistance Standards	West African Trade Hub (WATH) Government: Standards board in Nigeria – SON, NAFDAC

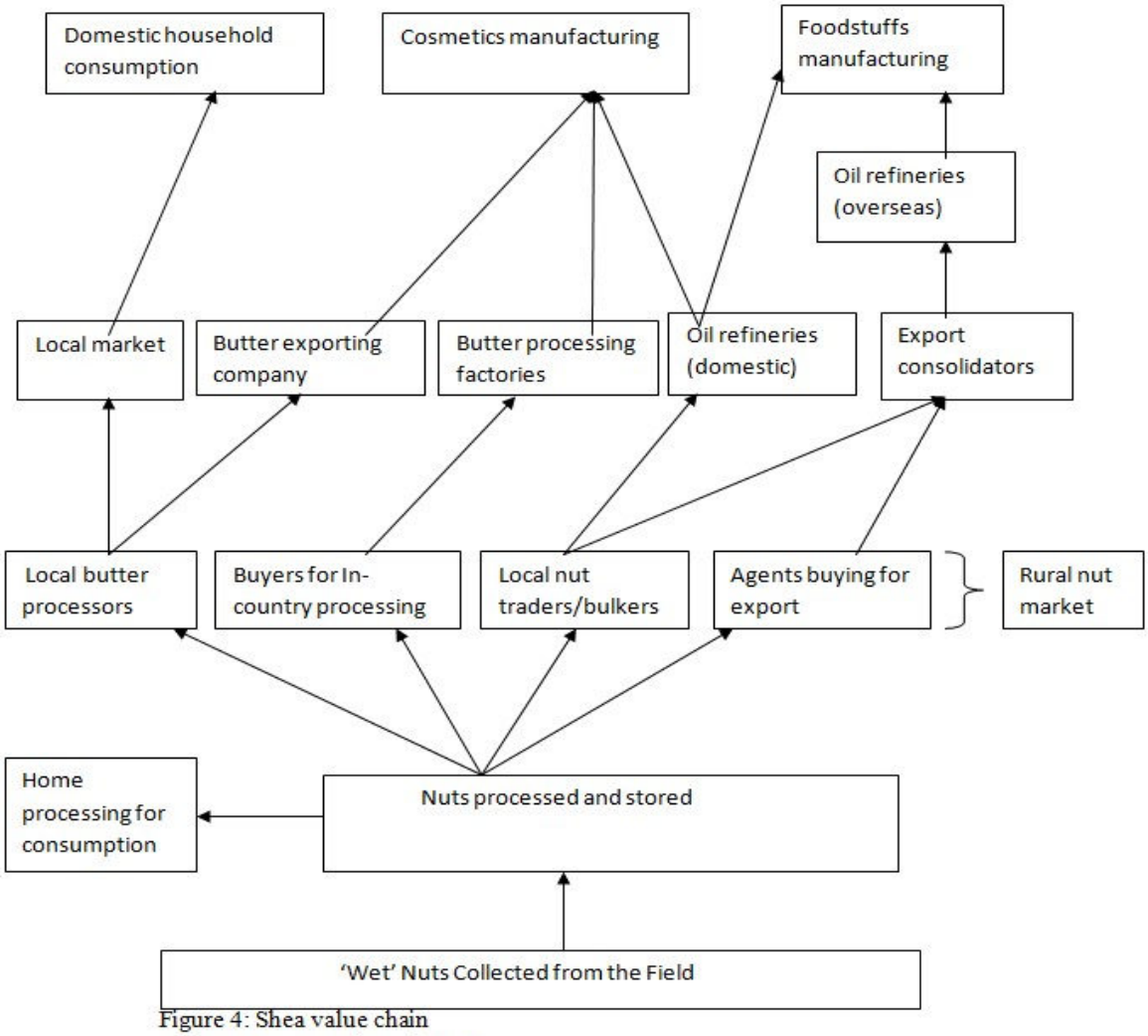

Figure 4: Shea value chain
Source: Kent & Bakaweri, 2010

This academic article was published by The International Institute for Science, Technology and Education (IISTE). The IISTE is a pioneer in the Open Access Publishing service based in the U.S. and Europe. The aim of the institute is Accelerating Global Knowledge Sharing.

More information about the publisher can be found in the IISTE's homepage: http://www.iiste.org

CALL FOR PAPERS

The IISTE is currently hosting more than 30 peer-reviewed academic journals and collaborating with academic institutions around the world. There's no deadline for submission. **Prospective authors of IISTE journals can find the submission instruction on the following page:** http://www.iiste.org/Journals/

The IISTE editorial team promises to the review and publish all the qualified submissions in a **fast** manner. All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Printed version of the journals is also available upon request of readers and authors.

IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digtial Library , NewJour, Google Scholar