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Profit Potential of Shea Nut Processing in Bosso and Borgu Local Government Areas of Niger State, Nigeria

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Abstract

The returns from Shea nut processing help rural communities to meet the cash requirements of the rural households. The processing of Shea kernels into butter is mostly done traditionally; these methods are inefficient in terms of the amount and quality of butter extracted. This research works however tend to evaluates the profit potential of Shea nut processing in some communities of Bosso and Borgu LGAs of Niger state, Nigeria. Specifically, the study looked at the processing techniques, its profit potential and the constraints associated with the processing. Four communities were purposively selected from two LGAs of zone II and III of Niger state. A total sample size of one hundred and fifty three (153) processors were randomly selected to whom the structured questionnaires were administered, this represent 61.7% of the sample frame used for this study. Data collected were analyzed using descriptive statistics, multiple regression and budgetary technique. The study revealed that more than 90% of the respondents were women and more than 80% used traditional method of processing. The total revenue and net revenue accrued to the processing business of Shea nut were found to be ₦9, 879, 480.00 and ₦2, 754, 197.22 respectively for all the respondents per month. The net return was calculated to be ₦18, 001.29 per respondents per month. The regression estimates revealed R^2 value of (0.99) and F-value of (544.1848827). The coefficients of years of experience and total revenue were found to be positive and statistically significant at 5% and1% respectively while educational level and total costs of processing were negative and statistically significant at 5% and1% respectively. Some major problems faced by Shea nut processors were lack of mechanized processing equipments, drudgery associated with processing, poor access to credit and storage facilities. Effort to mitigate these problems entails the provision of simple, affordable, mechanized and adoptable processing equipments to reduce labour intensity and to ensure quality standard, provision of credit will boost processing efficiency, productivity and the income of the rural households involved in the processing of the Shea nut.

Keywords: *inefficient, processing-techniques, randomly, coefficients, statistically, productivity.*

1. Introduction

1.1. Background to the Study

European explorers recorded the Shea tree as early as 1728 and first samples were collected by Mungo Park in 1796, [1]. It was some 30 years after Parks expedition to West Africa, that the tree was classified as *Vitellaria paradoxa* by von Gaertner in 1807. In 1865, the West African tree was re-classified as *Butyrospermum parkii*, by Theodore

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Kotschy, and the East African sub species was classified as *Butyrospermum nilotica*. The trees grow mostly in Africa and are found in the dry savannah belt of West Africa which encompasses the north central region of Nigeria. Shea trees also occur in all the states within the sudan-sahelian region of Nigeria. In Niger State, Shea butter trees are found in all the agricultural zones [2]. Based on distribution, two species of the Shea product has been identified; *Vitellaria paradoxa* and *Vitellaria nilotica*. Shea remains a wild fruit that is seasonally gathered by the local community, for industrial processors. Currently, Shea is undergoing renewed demand from the high value cosmetics companies. The very fact that Shea remains a wilderness crop that it is produced naturally, it has cultural and medicinal qualities and is collected and processed by women's groups in remote rural areas, all combine to create a fashionable marketing scenario for high profile cosmetics products. In both local and international markets, one of the most straightforward means of adding value to any commodity is processing of raw material into higher value end products, higher-quality butter will fetch a higher market price, and it is also preferred for home consumption and will keep longer in storage than poor-quality product. The fruit of the Shea tree ripens during the annual hunger season when food supplies are at their lowest ebb and agricultural labour requirements are at their peak. When the Shea fruits ripen, they fall to the floor and are gathered by hand. The fruit, which is green in colour, has a fleshy edible pulp rich in vitamins and minerals and not lacking in protein too. The Shea nut is processed primarily through the traditional methods. It is a major occupation of women in the communities. The wild harvesting and processing of Shea nut from forests and semi domesticated trees growing on-farm and homesteads can substantially boost rural income and employment opportunities in Africa [3]. Market and financial analyses in Africa showed that indigenous fruits contribute to household income, through value addition and fruit processing {[4; 5]}, mostly women and children are the major beneficiaries [6]. The Shea business was previously, a largely opportunistic trade, with little or no organization at community level. Men mostly do not participate in Shea nut gathering and processing in most parts of Nigeria and regard this as the preserve of women and children. It is called an "opportunistic business" because no one has ownership rights over the trees and gathering is equally open to all. Processed Shea butter has become a valued ingredient in the finest natural cosmetics [7] and even small amount in a formulation can earn a prominent display on the label. The cosmetic and pharmaceutical industries alone consume an estimated figure of 2,000 to 8,000MT of Shea butter each year, and this figure is expected to rise with growing demand in the world's markets. The market prospect of processed Shea butter is high both locally and internationally.

1.2. Statement of the Research Problem

In view of the great economic and nutritional potentials of the Shea butter both locally and internationally, the demand for the commodity has been on a steady increase yearly. In spite of the high demand, the Shea butter produced by the processors is still of low quality implying that resources are not efficiently utilized to produce high quality butter that will meet both local and international standard {[2; 8]}. There still a wide variation between the physical input level used and the potential output level realised during processing. The processing methods used and the quality of the nut being obtained from the wild both have negative effect on the quality of the produced butter. It has become imperative therefore to disseminate information regarding the proper techniques of Shea nut processing for the purpose of achieving products of consistent quality that will meet market demand as well as the need to uncover problem areas for restoration. Processing of Shea nut into butter is one of the most challenging stages in the Shea value chain. Processing is done mostly traditionally using crude processing equipment. 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. It is estimated that the

production of small kilogramme of Shea butter takes one person several hours and that reasonable kilograms of wood fuel is needed to produce it [9]. This means that energy input is quite high and no estimates exist of the overall balance between costs of input energy used, potential output realised and the economic profit made from the sale of the butter. The profit being generated is generally low if compared with the rigor and risk involve in the gathering and processing of Shea nuts [10]. The fact is these; traditional techniques are time consuming, physically exhausting and requires large quantities of fuel wood and water; resources that are often scarce in the regions where the butter is produced {[2; 8]}. In general, these methods are inefficient in terms of the amount and quality of fat extracted to meet the international standard, thus, causing a drastic reduction in the demand and price of butter being produced in Nigeria in the international market. The questions to be addressed by this study are:

1. What are the socio-economic characteristics of the respondents involved in Shea nut processing?
2. What are the profit levels of the Shea nut processors?
3. To what extent do the Shea processor's socio-economic characteristics affect the profit margins?
4. What are the constraints associated with the processing of Shea nut

1.3. Objectives of the Study

The broad objective of this study is to evaluate the profit potential of processing Shea nut in Bosso and Borgu local government areas of Niger state, Nigeria. The specific objectives to be investigated were to:

1. describe the socio economic characteristics of respondents involved in Shea nut processing,
2. determine the profit potential of processing Shea nut into butter
3. estimate the influence of the socio-economic characteristics of Shea processors on the profit margin and
4. identify and describe the constraints associated with the processing of Shea nut within the sampled communities.

1.4. Justification of the Study

The economic and environmental benefits of Shea butter production to the nation's economy are eminent in providing avenues for increased returns from both export and local consumption. This research work will however investigate and uncover the limiting factors to better quality butter production and the study will form a baseline for further research in to proper techniques of Shea nut processing. The local Shea nut processors who on the other hand, have become more resourceful in processing of Shea nut will find the findings of this study useful in reorganizing their capital in order to create more wealth to sustain their families and to improve the quality of their lives. The results of a socio-economic study of Shea nut processing will not only unveil problem areas for rectification and throw more light on the profit potential of processing the nut, but will also serve as a guide for policy makers to effectively plan for the growth and development of the industry. It will also induce Shea processors to move into commercial production of the butter given reliable information on the efficient methods of Shea nut processing and its profit potential.

2. Literature Review

2.1. Shea Nut Processing Techniques

In Nigeria, processing of Shea kernels into butter is mostly done traditionally by women with crude processing materials which affect the quantity and the quality of butter produced. This inherently affects the market value as consumers will only be willing to pay more for higher quality products. Research has also established the typically unpleasant odour of locally processed Shea due to poor quality of butter of West African Shea, with the exception of the eastern subspecies *nilotica.* This was attributed to the problem of one or more of the step in post harvest processing, and that modifying these steps could reduce or prevent the odour [11]. In recent years, product certification according to quality criteria has been considered one avenue by which the value of Shea products may be raised for the benefit of primary producers {[1; 11]}.

The Shea nut is processed primarily through the traditional methods. It is a major occupation of women in the communities. The traditional method of processing involves minimum mechanical input, heavy drudgery and high input of firewood. It involves heating and kneading the crushed kernels and straining the resultant oily mass. The Shea butter thus produced is considered unsuitable for export, because it is difficult and expensive to store as it deteriorates very rapidly. Locally produced Shea butter is consumed locally, fetching very low price for the processors [12]. The nuts, which are embedded in a soft fruit, fall to the ground during the harvesting period between June and August in West Africa. The nuts are buries in pits, which causes the pulp to ferment and disintegrate. After fermentation, the nuts are dried for a few days and later shelled to reduce moisture content from about 40 per cent to about 7 per cent. The oil is extracted locally by a process involving the heating and kneading of the crushed kernels and straining the resultant crush to release the oil. Alternatively the oil is separated from the mash by heating the mash in hot water. Shea butter is produced on a commercial scale in Europe using hydraulic presses on the nuts and then placing them in hot air ovens. The product is then bleached with a hexane solvent. The butter must then be stored and transported in cool conditions and in airtight containers to avoid it becoming rancid. Though, the refining process removes most of the sun-protection, healing and antiseptic qualities of the natural butter. Despite this, most of the larger cosmetics companies prefer to use refined butter because of the natural product's reputation for unreliable quality and the occasionally high content of free fatty acids, the cause of rancidity [13]. Processing Shea nuts is a highly labour intensive process, taking a day to produce a sufficient amount for sales and home use. There are many variations around the main procedures, but essentially, the nuts are ground or pounded into rough grist, using motors and grinding stones and then roasted. In some cases the nuts are roasted prior to grinding. After heating the nuts are grounds into a paste. This paste is mixed with an equal amount of water and boiled. The oil is then skimmed off and held in a separate container. The oil is often rewashed and boiled to remove particles and mucilage from the first stage boiling. The oil is then left to cool. It can take 4-6 women a full day to produce 4-5 litres of oil, from 20 litres of nuts. This quantity can last a family 1-3 weeks depending on usage. Shelf life of the oil is from 1 to 3 weeks depending on the moisture content of the oil after processing [14].

Most of the communities are fully involved in processing Shea nuts into butter in Niger state. In some cases additional nuts had to be purchased from the neighbouring communities that are only engaged in the collection process. Shea nuts processing is being carried out by traditional method which consist mainly of; roasting the seed, cracking of the seeds to obtain the nuts, frying the nuts, milling, kneading with excess water, scraping the oil and frying to obtain the final product. Apart from the milling process, which is normally done using milling machine often located at some distance

away from the community, women and young girls carry out the remaining stages manually. Shea butter extraction process is a tedious exercise and takes a lot of time, that may last about 10hrs or more to complete the processing of few kilogram's of nuts, from nuts collection in the forest, storage, fermentation, drying under the sun, shelling (using mortar and pestle or cracking between stones or beating the nuts in a sack with stick), winnowing (cleaning), roasting, pounding/crushing, milling, mixing and cooking to extract the butter.

2.2. Assessing Profit in an Enterprise

The surplus remaining after total costs are deducted from total revenue, and the basis on which tax is computed and dividend is paid, profit it is the best known measure of success in an enterprise. Profit is reflected in reduction in liabilities, increase in assets, and/or increase in owners' equity. It furnishes resources for investing in future operations, and its absence may result in the extinction of an enterprise; businessdictionary.com 2009 and investopedia.com 2011. Economic profitability is the soul of every business segments. Economic profit is the difference between the total revenue and its variable cost. In another word, it is the increase in wealth that a business has from making an investment taking into consideration all cost associated with that investment including the opportunity cost of capital. Profit arises when the resultant revenue from trading a particular product exceeds the variable cost of input, noting that these costs include all the cost of production. A business however is said to be making an accounting profit if its revenues exceeds the accounting cost [15]. Economic profit otherwise known as positive profit or super normal profit provides the processor with a long-term perspective in his marketing business, if a processor can consistently generate a higher level of personal income by using his or her money and labour elsewhere in the marketing system, he or she may want to examine whether the business worth's continuing or not. Most businesses have reporting systems that measure the overall financial performance of the market. But these reporting systems often fall short in their ability to provide financial performance data for specific business segments and without this critical information, it's difficult for management to determine where resources should be allocated to maximize profit. However, a cost and profitability analysis helps to provide this important data. This type of analysis not only serves as a tool to make more informed decisions as regards to profit making, but can also identify ways to improve market business process. A consideration of profitability analysis has several benefits: it identifies the extent to which major market/ business segments contribute more to profit; provide a method for management to compare performance of market businesses segments and assess a product's return to investment; allow traders to estimate the profit potential of new business opportunities and helps to improve market business processes and operational effectiveness.

3. Research Methodology

3.1. Study Area

Niger state, Nigeria is located between latitudes 8^0 20′N and 11^0 30′N and longitude 3^0 30′E and 7^0 20′E. It shares a foreign border with the Republic of Benin in the North West. The state covers an estimated land mass of 86,000 square kilometres, taking about 10% of Nigeria's total land mass, of which 85% is arable land. Borgu local government area with headquarters in the town of New Bussa lies between latitude 9^0N and 11^0 N and longitude 2^0E and 4^0E [16]. Analysis of the temperature of the LG from 1986-2006 show that the highest mean monthly temperature was 41.1^0C while the lowest mean monthly temperature was 34.9^0C [16]. The LGA is situated between the southern fringes of northern guinea savannah. The land lies predominantly in the guinea savannah climatic

zone, where all deciduous trees, associated with grasses, characterize the vegetation. The vegetation type of Borgu is a mixture of northern guinea and sub-sudan savannah, the zonal classifications of plants are *Burkea africana, Detarium macrocarpum, Isoberlinia tomentosa, Diospyrus mespiliformis, Terminaliamacroptera, vittelaria paradoxa* riparian forest, and woodland, each associated with grasses [16]. Bosso local government area of Niger state, Nigeria has an area of 1,592 km². It is located on longitude $6^{0}02$' East and latitude $09^{0}41$' North respectively [17]. The people in this area are predominantly farmers.

3.2. Sampling Procedure

The selection of Shea nut processors used for this research work follows a multistage sampling procedure. Niger state, Nigeria has three agricultural zones which consist of: zone I, II and III, these three zones which reflect the geographical structure of the state were decisively observed. In the first stage two zones (II and III) out of the three agricultural zones were purposively selected, based on the prevalence of Shea nut processing activities. This was followed in the second stage by a purposive sampling of one local government area each from zone II and III based on the high proportion of Shea nut processors. The third stage involved the purposive selection of two (2) villages from each of the selected local government area to sample out Shea nut processors within the processing communities. The villages selected are: Sabon gida and Jimi in Bosso LGA (zone II) as well as Baburasa and Gada Olli in Borgu LGA (zone III). In the fourth stage, the total number of processors in all the villages from the sample frame of two hundred and forty eight (248) was analysed to draw the sample size of one hundred and fifty three (153) individuals which represent the 60.7% of Shea nut processors used for this study. The fifth stage involved a random selection of Shea nut processors from the four (4) villages in the two local government areas; this form the 33, 37, 40 and 43 respondents representing 21.57%, 24.18%, 26.14% and 28.10% of the sample size respectively. The summary of the population (sample frame) of processors and selected study locations and the distribution of sample sizes are highlighted in (Table 1).

Table 1. Study Locations and Distribution of Sample Size

Agricultural Zones	LGAs	Village/processing units	Sample Frame	Sample size (Processors) (61.7% of SF)
II	Bosso	Sabon gida	49	33(21.57%)
		Jimi	52	37(24.18%)
III	Borgu	Baburasa	75	40(26.14%)
		Gada Olli	72	43(28.10%)
Total sample frame			**248**	
Total sample size				**153**

***** Source**:** Niger State Export Promotion Council and GIZ: German International Cooperation 2011.
*****Key**:** SF = Sample frame, LGA= Local Government Area

Sample size (total) from the sample frame=

$$n = \frac{N}{1 + N(e^2)} = at\ 0.05\ pL\ e^2\ [18]..... ....(1)$$

Where:
n = sample size
N = population size
e = level of precision or PL = precision level.

3.3. Methods of Data Collection

The study was based on primary data extracted from the field survey using a structured questionnaire that was administered to Shea nut processors. Data collected were as follows:

I. Socio-economic characteristics of the respondents such as age, marital status, level of education, major occupation, family size, sources of capital, membership of cooperative society, years of experience in processing.
II. Processing activities: The quantity of Shea nut being processed into butter, source of Shea nut, method of processing, inputs used, cost of processing such as cost of fire wood and water, cost of labour, cost of drying, milling cost and revenue realized.
III. Constraints: perception of processors on the problems associated with the processing of Shea nut.

3.4. Analytical Techniques

Both descriptive and inferential statistics were employed to analyze the data from the field survey. The specific tools employed were: budgetary techniques and multiple regression analysis.

3.4.1. Descriptive Statistics

Descriptive statistics was used to describe the socio economic characteristics of respondents involved in the processing activities (objective 1) and also was used to identify and describe the constraints associated with the processing of Shea nut (objective 4). The tools used were: cross-tabulations, frequencies, ratios and percentages.

3.4.2. Budgeting Technique

Budgetary technique was used to analyze the profit potential of processing Shea nut within the study area (objective 3). The budgetary analyses involved the use of net return (NR). The NR indicates how much profit a company makes after paying off its operating and fixed costs. The formula below was employed to examine the profit potential of processing Shea nut within the sampled communities:

$NR = \Sigma TR_i - \Sigma TC_i$ ..... (2)

$\Sigma TCi = (\Sigma TVC_i + \Sigma TFC_i)$ ..... (3)

And $\Sigma TR_i = p_i.q_i$ ..... (4)

Where:

Σ = summation sign
NR = net return (₦)
TR = total revenue (₦)
p = unit prices of Shea butter (₦)/kg)
q = quantity of Shea butter processed (kg)
TVC = total variable cost (₦)
TFC = total fixed costs (₦)

The variable cost items considered here are; costs of Shea nuts, cost of fuel wood, labour, water, milling cost, storage, rent, revenue and transfer cost. The fixed cost comprised of depreciation on capital items such as mortal & pestle, bucket, galloon, clay pot, sack grinding stone, crushing machine, milling machine, mixer etc. For ease of computation, the straight line method was used in depreciating the capital items to be included in computing fixed cost. The formula for calculating depreciation using the straight line method is given by:

$$D = \frac{P - S}{N} \quad \text{.....} \quad (5)$$

Where;
D = depreciation *(₦)*
P = Purchase value of the asset *(₦)*
S = salvage value, which is the value of the asset after its expected year of usage *(₦)*,
N = life span of the asset (years)

The prevailing market prices as at the time of the survey were used in computing both the costs and returns. The NFI was expressed as percentage profit margin, this is the total sales (revenue) minus the total cost of production, divided by the total sales (revenue), expressed as a percentage.

$$Y = \text{Profit Margin (\%)} = \frac{\Sigma TR_i - \Sigma TC_i}{\Sigma TR_i} \times 100 \quad \text{.....} \quad (6)$$

Thus, the profit margin for any processors will reflect the efficiency in turning the Shea nut into income. Thus, the larger the profit margins the higher the profit potential of processing Shea nut into butter. For example 50% profit margin depicts that 50 percent of all the sales in the business is profit. Lower profit margin however will depict that the business is making less profit.

3.4.3. Multiple Regression Analysis

Multiple regression analysis was used to analyze the influence of socio-economic factors of Shea processors on the profit margin, (objective 3). The socioeconomic variables hypothesized to influence the profit margin of Shea processors in this study include: educational level, years of experience in processing, total cost of processing, ownership of processing equipments, access to improved processing technology and the respondent's total revenue. The implicit form of the multiple regression analysis of factors influencing the profit margin of Shea processors can therefore be expressed as:

$$Y = f(X_1, X_2, X_3, X_4 X_5, X_6) \quad \text{.....} \quad (7)$$

Where:

$$Y = \text{Profit Margin (\%)} = \frac{TR - TC}{TR} \times 100 \quad \text{.....} \quad (8)$$

X_1 = educational level (no of years spent in school)
X_2 = number of years of experience in processing
X_3 = total cost of processing (₦)
X_4 = ownership of processing equipments (dummy: Yes = 1, 0 = otherwise)
X_5 = access to improved processing technology (Yes = 1, 0 = otherwise)
X_6 = Total revenue (₦)

Four functional forms (Linear, semi-log, exponential and double log) were tried. However, the lead equation (*i.e.*, equation of best fit) was used for further analysis. The selection of the lead equation was based on the following parameters:

i. The explanatory power of the model (R^2)
ii. Significance of estimated coefficients
iii. Magnitude of estimated coefficients
iv. Conformity of signs of estimated coefficients with a priori expectation
v. Significance of the F ratio

The explicit form of the functional forms tried, were specified as:

Linear:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + U \quad (9)$$

Double logarithm/Cobb Douglas:

$$\ln Y = \ln b_0 + b_1\ln X_1 + b_2\ln X_2 + b_3\ln X_3 + b_4\ln X_4 + b_5\ln X_5 + b_6\ln X_6 + U \quad (10)$$

Exponential:

$$\ln Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + U \quad (11)$$

Semi log:

$$Y = b_0 + b_1\ln X_1 + b_2\ln X_2 + b_3\ln X_3 + b_4\ln X_4 + b_5\ln X_5 + b_6\ln X_6 + U \quad (12)$$

Where: Y, X_1, X_2, X_3, X_4 X_5, X_6 is as defined above, b_o = constant/ intercept, $b_1 - b_6$ = regression coefficient/parameters to be estimated and U = Disturbance term

4. Results and Discussion

4.1. Socio-economic Characteristics of Shea Nut Processors

The socio-economic characteristic of Shea nut processors focuses on the following parameters: age, sex, marital status, educational background, household size, years of experience in processing as well as Shea nut processing method.

4.1.1. Distribution of Respondents by Age, Gender and Marital Status

The result of the analysis in Table 2 shows the percentage distribution of respondents by age, gender and marital status within the sampled Shea nut processing communities.

4.1.1.1. Distribution of Respondents by Age

The study revealed that about 49% and 46% of Shea nut processors were within the age range of 41-50 and 31- 40 years respectively. The high percentage within these age range depicts that the Shea nut processors falls within the active age group of agricultural practices. Youth within the age range of 11-20 and 21-30, representing 6% and 26% respectively were not found to be actively involved in Shea nut processing activities; this however could be attributed to rural urban drift by the youth in search of white collar jobs. The respondents in the age range of 51-60 and 61-70 years (20% and 6%) respectively were also few in the Shea nut processing businesses. This could be attributed to drudgery involve in Shea nut processing. This finding agrees with that of [2] who reported that high energy inputs and length of time required during processing activities could be a little difficult for aged people to cope.

4.1.1.2. Gender Distribution of Respondents

The studies revealed that more than 90% of the respondents were female, implying that women dominated Shea nut processing activities within the sampled communities. This agrees with the findings of {[4] and [5]; [19] and [2]}. They also reported high involvement of women in Shea nut processing. This could be attributed to the fact that Shea nut processing activities is regarded as being domestic venture much more exclusively to women.

4.1.1.3. Marital Status of Respondents

The study also revealed that more than 80% of the respondents were married. Only few of the respondents were single, widowed or divorced representing 9.15%, 7.84% and 1.96% of the respondents respectively.

Table 2. Distribution of Respondents by Age, Gender and Marital Status

Age range	Frequency	Percentage (%)
Age range:		
11-20	6	3.92
21-30	26	16.99
31-40	46	30.07
41-50	49	32.03
51-60	20	13.07
61-70	6	3.92
Total	153	100
Gender:		
Male	8	5.23
Female	145	94.77
Total	153	100
Marital Status:		
Single	14	9.15
Married	124	81.05
Divorced	3	1.96
Widow	12	7.84
Total	153	100

Source: field survey, 2012.

4.1.2. Highest Educational Level, Household Size and Years of Experience in Shea nut Processing

The respondents' educational status, household size and years of experience in processing results are presented in Table 3.

4.1.2.1. Educational Level of Respondents

The study revealed that majority of the respondents (55.6%) had Quranic education while about 31% and 8% were found to have attained primary and secondary education respectively. This confirmed the study of [16] who reported that rural farmers/processors are characterized by low level of educational background. The low literacy level could affect, to a great extent, the efficiency of processing Shea nut in terms of adoption of innovation to improve processing and value addition to make more profit.

4.1.2.2. Household Size of Respondents

The study also revealed that majority of the respondents (52.29%) had household size of 11-15 people. Processing of Shea nut requires a lot of labour, particularly the traditional processing method that is predominant in the study area. Thus, respondents with larger household size are more able to cope with the rigor involve in the processing of Shea nut due to the availability of cheap family labour while smaller household size will require more hired labour. About 4.56%, 21.57, 19.61% and 1.96% of the respondents had household sizes of 1-5, 6-10, 16-20, and 21-25 people respectively.

4.1.2.3. Years of Experience of Shea Nut Processors

The analysis showed that majority of the respondents (64.71% and 31.37%) had between 11-20 and 1-10 years of experience in Shea nut processing. Only 3.92% had Shea nut processing experience of 21-30 years. Years of experience could stand as an added advantage in terms of efficiency in converting inputs into output and could be added advantage in strategizing processing methods to make more profit.

Table 3. Highest Educational Level, Household Size and Years of Experience of Shea Nut Processors

Variables	Frequency	Percentage (%)
Highest educational level		
Primary	48	31.4
Secondary	12	7.8
Quranic	85	55.6
None	8	5.2
Total	153	100
Household size		
1-5	7	4.56
6-10	33	21.57
11-15	80	52.29
16-20	30	19.61
21-25	3	1.96
Total	153	100
Years of experience in Shea nut processing		
1-10	48	31.37
11-20	99	64.71
21-30	6	3.92
Total	153	100

Source: field survey, 2012.

4.1.3. Shea Nut Processing Methods

Table 4 depicts that more than 80% of the sampled respondents used traditional method of Shea nut processing. This conform to the findings of {[20, 2, 10 and 19]}, who found that the traditional method of Shea nut processing is the most prevalent method used in Shea processing in Nigeria. The study shows only 18% of the respondents had access to mechanical method of Shea nut processing. The low level of adoption of mechanical method of processing could be attributed to the high cost of the equipment. Processing of Shea nut is mostly done with crude processing materials such as mortar and pestle, baskets, sacks, clay pot, buckets, jerry cans, cups, sticks, stones, calabash, mats. The stages as indicated by the respondents, includes: the collection of fresh fruits from the wild, (sometimes additional Shea nut are purchased from local collectors), storage, fermentation, drying under the sun, shelling (using mortar and pestle or cracking between stones or beating the nuts in a sack with stick), winnowing (cleaning), roasting, pounding/crushing, milling, mixing and cooking to extract the oil. While the mechanical method includes: shelling using (Cracker/Sheller), drying, frying, milling, first extraction, heating, filtering (second extraction), and packaging. The processing method and the nature of Shea nut seed used could affect the quantity and the quality of butter produced. The perception of the respondents on the disadvantages of the traditional method of Shea nut processing are; labour intensive and arduous, it require high energy inputs and is not efficient looking at the quantity and quality of butter being produced; only about 25% extraction rate putting into consideration the end product after processing. This agrees with the findings of [9] who reported that the traditional method of butter extraction efficiency is about 25%. The respondents also perceived that mechanical method of processing Shea nut has the advantage of being less tedious, more effective in processing and time saving compared to the traditional method of processing. The mechanical method also produces more quality butter, and the extraction efficiency using mechanical method was confirmed to be higher than the traditional method. This is in line with the findings of [9], who reported that the mechanical method of butter extraction efficiency is about 40-45%.

Table 4. Shea Butter Processing Methods

Processing methods	Frequency	Percentage (%)
Traditional	126	82.35
Mechanical	27	17.65
Total	**153**	**100.00**

Source: field survey, 2012.

4.2. Costs, Return and Profitability of Shea Nut Processing

Table 5 presents the results of the profit potential of processing Shea nut. The analysis showed that variable costs components accounted for more than 90% of the total costs, these includes: cost of milling, labour cost, cost of water, fuel wood cost, packaging cost, storage cost, cost of transportation and Shea nut cost. Shea nut is the most important variable cost item in Shea nut processing, accounting for about 55.40% of the total variable cost amounting to ₦3, 947,100.00. This was followed by the costs of labour amounting to N1, 461,720.00 i.e. representing (20.52%) of the variable cost used, milling cost occupies (11.52%) and cost of fuel wood (6.39%) while cost of storage and water were the least in all the cost of production (0.83% and 0.70%) respectively. The high cost of labour (₦1, 461,720.00) could be attributed to the use of traditional method of processing which tends to require higher man power. The total cost was ₦7, 125, 282.78. This entails all the variable cost (VC) and fixed cost (FC) of ₦6, 994, 590.00 and ₦130, 692.78 respectively. Considering the total processed Shea butter output per month, the cost of processing a kilogram of Shea butter was estimated at ₦793.75. The total revenue accrued to the processed business of Shea butter was calculated to be ₦9, 879, 480.00 for all the respondents per month. Total revenue from the sale of the processed Shea butter was on the average ₦64, 571.76 per respondents per month. The net return (NR) was analyzed to be ₦2, 754, 197.22 per month for all the Shea nut processors. The net return accrued to the processing activities of Shea nut into Shea butter was therefore ₦18, 001.29 per respondents per month. The positive financial return is an indication that the processing of Shea nut has potentials for increasing rural income. This finding is in line with the findings of [20], which recorded positive financial returns in Shea nut processing and reported that the returns from its sale help rural households to feed themselves, to invest in livestock and other income-generating activities and to meet cash requirements of the rural households.

Table 5. Profitability Analysis of Shea Nut Processors per Month

Costs	Amount (₦)	Percentage (%) of Total Costs
Variable Costs:		
Cost of milling	821,100.00	11.52
Labour cost	1,461,720.00	20.52
Cost of water	49,950.00	0.70
Cost of fuel wood	455,430.00	6.39
Packaging cost	97,380.00	1.37
Storage Cost	59,400.00	0.83
Cost of Shea nut	3,947,100.00	55.40
Transportation cost	102,510.00	1.44
Fixed Cost:		
Depreciation on capital items	130,692.78	
Σ Costs:		
Total Cost (VC)	6,994, 590.00	**98.17**
Total Cost (FC)	130,692.78	**1.83**
Total Cost (TC)	7, 125 282.78	
Total Revenue (TR)	9,879, 480.00	
Net Return (NR)	**2,754, 197.22**	
Net Return (NR)/respondent/month	**18, 001.29**	

Source: computed from field survey data, 2012.

4.3. Effect of Processors' Socio-Economic Factors on Profit Margin

Regression estimates of the lead equation (Semi-log) on the socio economic variables influencing the sampled processors' profit margin are presented in Table 6. The model had R^2 value of 0.99. This implies that about 99% of the variation in profit margin (Y) of the respondents was explained by the independent variables included in the regression model while the remaining 1% is as a result of errors in estimation. The F-statistic was also significant at the 0.01 level which implies that the independent variables adequately explained the variation in the dependent variable. The regression coefficients of years of experience and total revenue were found to be positive and statistically significant at 5% and 1% respectively; indicating that any increment in years of experience in Shea nut processing and the total revenue realised while holding other factors constant will lead to an increase in the profit margin of the processors. While the regression coefficients of educational level and total costs of processing were also found to be negative and statistically significant at 5% and 1% levels respectively. This implies that there is an inverse relationship between profit margin of Shea nut processors and their educational level as well as the total processing costs incurred. The implication of this is that the higher the level of education of the processors the lower the profit margin. This could be attributed to the fact that more than 50 and 30% of Shea butter processors had only Quranic training and primary education respectively. It can therefore be deduced that the Quranic training and primary education received by the respondents is not related to Shea nut processing activities and even then the few educated processors are operating on part time basis and therefore used more of hired labour which tend to increase their total costs thereby reducing their profit margin. Similarly, the total cost of processing was found to be negative and statistically significant at 1%, which implies that any addition to the total costs of processing Shea nut will decrease the profit margins of the processors.

Table 6. Regression Estimates of the Socio-Economic Variables Influencing Gross Margin

Variables	Coefficients	t-values	Standard Error
Intercept	-1.3843208	(-0.26539)	5.216224072
Educational (X_1)	-0.2807459	(-2.41508) **	0.116246837
Years of exp. (X_2)	1.18642936	(2.01045) **	0.590131271
Total cost (X_3)	-66.390197	(-50.3498) ***	1.31857885
Ownership of pr. equip. (X_4)	-0.0729625	(-0.73428) **Ns**	0.099353105
Access to imp pr. tech. (X_5)	-0.1203469	(-1.22517) **Ns**	0.098228666
Total revenue (X_6)	66.5239603	(54.60274) ***	1.21836382
R-square (R^2)	**0.99 332944**		
Adjusted R^2	**0.98489019**		
F-value	**(544.1848827) *****		

Sources: Computed from field survey data, 2012.
NOTE; ***, ** and * imply significance at 0.01, 0.05 and 0.1 levels, **Ns** implies not significant. Values in parentheses are the respective t-ratios.

4.4. Constraints Associated with the Processing of Shea Nut

The perceptions of respondents on the problems associated with the processing of Shea nut within the study locations are presented in Table 7. More than 98% of the processors indicated drudgery in the traditional method of processing Shea nut while about 90% and

41.18% indicated poor access to water and fuel wood respectively. This conforms with the findings of [20] and [2], who reported in their separate studies that processing of Shea nut is tedious and consumes a lot of water and fuel wood; these resources are often scarce in the processing communities. The study also revealed that 94.12% and 96.08% of the processors complained of unstable price and lack of standard measurement of Shea products. More than 90% of the sampled processors within the studied locations indicated the problem of unavailability of processing equipments and high cost of milling; this could account for the fact that more than 80% of the respondents use traditional method of processing due to the limited access to mechanised processing equipment's and high cost of milling.

Table 7. Distribution of Respondents According to the Problems Associated with the Processing of Shea nuts. N=153

Associated Problems	Frequency	Percentage (%)
Transportation problem	69	45.10
Low price	81	52.94
Unstable price	144	94.12
Lack of standard measurement	147	96.08
High cost of milling	141	92.16
High Cost of fuel wood	63	41.18
Lack of processing equipments	150	98.04
Poor nut quality	54	35.29
Poor storage facility	60	39.22
Poor access to credit	99	64.71
Problem of water	138	90.20
Drudgery in processing	150	98.04

Sources: computed from field survey data, 2012.

5. Summary, Conclusion and Recommendations

5.1. Summary

The recent events, the interest on the Shea butter oil produced from Shea nut for industrial application in food, cosmetics, pharmaceutical and traditional needs at national and international levels which has increased necessitate this study. The processing of Shea nut is being done at subsistence level and traditionally. This research work attempted to evaluate the profit potential of processing Shea nut in Niger state, Nigeria as well as to identify and describe the constraints associated with the processing, in an effort to reveal the problem areas so as to improve the nature of nut processing for the growth and development of Shea industry. Random samples of one hundred and fifty three (153) processors were selected from four communities in Bosso and Borgu local government area of Niger state, Nigeria. Data were collected from the respondents using structured questionnaire. Data collected were analyzed using descriptive statistics, budgetary technique and multiple regression analysis. The study revealed that more than 90% of the respondents involved in Shea nut processing were women and more than 80% used traditional method of processing. Total revenue from the sale of the processed Shea butter was on the average found to be ₦64, 400 per respondents per month. The net return (NR) was analyzed to be ₦2, 754, 737.22 per month for all the Shea nut processors and the net return accrued to the processing activities of Shea nut into Shea butter was calculated to be ₦18, 004.82 per respondents per month, this indicate a positive financial return. The result of the socio-economic variables influencing the sampled processors' profit margin had R^2 value of 0.99 and the F-statistic was significant at the 0.01. The regression coefficients of years of experience and total revenue were found to be positive and statistically significant at 5% and 1% respectively; while the regression coefficients of

educational level and total costs of processing were found to be negative and statistically significant at 5% and 1% levels respectively.

5.2. Conclusion

This study aimed at evaluating the profit potentials of processing Shea nut in four communities of Niger state, Nigeria. The study noted that the production of the Shea butter from the kernel of the Shea nut is done at subsistence level using mostly traditional method and this affect the quantity and quality of butter produced. Based on the research findings, still some benefits were well-known to be associated with the processing of Shea nut, the total revenue of the processors was noted to have exceeded the total costs incurred during processing. This positive return however, is an indication that the processing of Shea nut has the potentials for increasing the rural income. However, the profit margin of the Shea processor can be enhanced by facilitating the use of modern Shea nut processing equipments to boost productivity and for product quality control, which will provide a practical, market-based incentive for the Shea nut processors in the domestic and world market. The research work will also serve as a base line for Shea nut processors to adopt new methods of processing to improve on the traditional techniques of butter production for a better quality butter that will attract higher price within and outside the country.

5.3. Recommendations

Based on the findings of this study, the following recommendations were made with a view to make the processing of Shea nut more attractive socially and economically.

1. Technical assistance in terms of provision of simple, mechanized and adoptable technology to processors to reduce the labour intensiveness of the business and also to ensure quality standard that is vital for the sustainability of the business. Transport to convey nuts from the bush to homes, parboiling equipment, dryers, packaging materials, storage and water facilities are all necessary stages that can be modernized through the assistance of government and NGOs.
2. The provision of credit facilities to the Shea nut processors either through government aid or by the private sectors will ease the difficulties involve in processing, it will make better the processors productivity in terms of butter quantity and quality to meet up with the local demand and for export. It will also make the processing of Shea nut more attractive and lucrative which can awaken more women and even men to go into commercial processing of Shea nut.
3. Mechanized processing centre can be established to assist the processors for the application of new processing techniques not only to ease the difficulties involve in traditional method of processing but to also boost the productivity of the processors and to ensure higher quality butter that will attract better price from both local and international markets. It will also assist the processors in the provision of substantial income to support their basic needs thereby alleviating poverty amongst the Shea nut processors in the Shea processing communities.

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