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Adoption of German International Corporation (GIZ) technology intervention on shea nut processing in Niger State, Nigeria

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This study assessed the activities GIZ technology intervention on Shea nut processing in Niger State, Nigeria. The objectives were to identify the available improved shea nut processing technologies and the level of adoption of the improved GIZ shea nut processing technologies in the study area. A two-stage sampling technique was adopted for the study. Data were collected through interview schedule and analysed using percentages, and likert type scale. The data reveals that majority of the respondents (98.7%) adopted the GIZ improved processing technologies, while very few of the respondents (1.3%) did not adopt the GIZ improved processing technologies. In the seven sub-components in which a few of the respondents that did not adopt it might be due to some factors adduced to inadequate concrete platform, unavailability of some equipment/materials and inadequate knowledge of some concepts which they might have forgotten as taught under GIZ extension services. The study concluded that the intervention programme should be repeated and extended to non- beneficiary Local Government of the State to increase the economic activities of the processors on quality production of Shea butter.

Key words: Adoption, shea nut, processing, technology, german International Corporation (giz) and intervention, processors, beneficiary.

INTRODUCTION

Shea tree (Vitellaria paradoxa) is a versatile agroforestry tree crop that grows across sub- saharan Africa. It is also called a resourceful tree that can stand a wide range of climatic conditions.it has a high demand from several markets (Maranz and Wiesman, 2003a; Masters et al., 2004). It covers a vegetation of 5,000 km wide belt of savanna including West Afrian countries of Senegal, Mali, Cote d'Ivooire, Burkina Faso, Togo, Ghana, Benin, Cameroon, Nigeria, Niger, and further east in Uganda, Sudan and Ethiopia (Chalfin, 2004; Goreja, 2004). The merchants (Ferris et al., 2001) referred to shea parkland coverage as shea belt.

Shea tree produces fruits or seeds, the mesocarp are consumed by some peasant farmers in Africa as desert food crop during the peak period of farming activities when other crops have not matured for harvesting. It provides vegetative covers for farm lands which contribute to environmental protection, a lot of non-timber

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resources are derived from it, including income generating activities from food, medicine and shea butter (Teklehaimanot, 2004; Suleiman, 2008; Pouliot, 2012).

The shea fruits contain about (50%) oil that is edible and used as cooking oil, cosmetics, and skin care, pharmaceutical and medicinal purposes. Also, being used as substitute for margarine and coaco butter in the food industries and it is considered as second most valuable oil crop to oil palm in Africa (Alander, 2004; Moore, 2008; Suleiman, 2008).

The shea oil or butter that is being traditionally or mechanically extracted from shea kernel are exported from Africa countries including Nigeria to France, Great Britain, the Netherland, Denmark, North America and Japan (Elias and Carne, 2007). In these countries, it is extensively processed into varieties of food products including chocolate which is becoming more acceptable in the cosmetic industries (Schreckerberg, 2004).

Nigeria is blessed with wild coverage of shea parkland, Niger State ranks first amongst the shea nut producing States, followed by Kwara, Nassarawa, Zamfara, Kaduna, Kaduna, Sokoto, Jigawa, Kano, Plateau, Taraba, Benue, Adamawa, Bauchi, Edo, Yobe and Federal Capital Territory (FCT), Abuja (Suleiman, 2008).

Despite the availability of shea nut, it is characterized by traditional or local method of processing which result in low productivity and quality of shea butter produced by the processors in Nigeria and particularly in Niger State, where large population of shea trees are found, and high quantity of nuts are collected. In order to improve the production capacity and quality of shea butter processed by the processors, the Federal Government of Nigeria in collaboration with German International Corporation (GIZ), other NGOs and government Organizations have developed and disseminated improved shea nut processing technologies to traditional shea nut processors in Niger State. In addition, GIZ is a pro-poor growth and employment creation (SEDIN) that tracks a three tiered approach established in order to improve pro-per growth and employment creation in micro, small and medium sized enterprises (MSME). (GIZ) have facilitated different interventions in the Shea sector, aimed to increase Shea butter production in the state and improve the income base of the processors as well as their social well-being.

The objectives of the study were to identify available GIZ shea nut processing technologies and examine the level of adoption of GIZ shea nut processing technologies in Niger State.

MATERIALS AND METHODS

Area of study

The study was conducted in Niger State which is located in the North Central zone of Nigeria and has its capital in Minna. It lies between latitude 3°–10°N and longitude 3°–8°E. It is bordered by Kebbi and Zamfara States to the North-West and to the South by Kwara and Kogi States while Kaduna State and the Federal Capital Territory (FCT) bordered the State to the East and South-East respectively. The State also shares a common international boundary with the Republic of Benin at Babanna in Borgu Local Government Area of Niger State. This gives way to common inter-border trade with the State. The State has a land mass of 76,363 Km^2 making it the largest State in Nigeria in terms of total land area and has twenty-five (25) local government areas. The State has the highest wild shea tree plantations in Nigeria with a substantial number of traditional rural processors of shea nut which cut across the agricultural zones of the State (Suleiman, 2008). It is divided by Niger State Agricultural Development Programme into three agricultural zones for better agricultural administrative activities, namely: zone, I, II, and III with headquarters at Minna, and the zones have their headquarters at Bida, Kuta, and Kontogora respectively (Figure 1).

In order to have a wide coverage and full representation, all the three Agricultural Development Programmes (ADP) zones were used for the study. A 3-stage sampling technique was adopted for the study. In the first stage, a purposive selection of 15 Local Government Areas (LGAs) of German International Corporation (GIZ) intervention site was made (GIZ, 2011, 2014) across the three zones. The purposive selection was carried out due the fact that there was high population density of shea trees and high participation of shea value chain particularly shea processing activities. At the second stage, from the profile list of GIZ Shea groups comprising 2970 processors GIZ, 2011; 2014 profile lists, a proportionate random selection, based on 10%, of Shea nut processors were made across the selected LGAs giving a total sample of 297. Also, in the same LGAs, snow-balling technique was used to randomly select 297 Shea nut processors that were GIZ non-beneficiaries, thereby making a total sample size of 594 as indicated in Table 1.

Data collection and instrument for data

The data for the study was obtained from both primary and secondary sources. The primary data were collected through interview schedule. The secondary data were sourced from published and unpublished documents of agricultural journals, internet and past studies. Trained enumerators of the State Agricultural Development Programme office and extension agents were engaged in the study area to collect information from the respondents.

Analytical techniques

Descriptive such as frequency counts and percentages were used in this study

Model specification

The available GIZ Shea nut processing technologies was measured using 3 point-likert type scale against the list of GIZ shea nut processing technologies. Respondents were asked to respond to the GIZ shea nut processing technologies put in place and coded as Available (1) Not Available (0). The level of adoption of GIZ Shea nut processing technologies was measured as Adopted (1) and Not-Adopted (0)

RESULT AND DISCUSSION

Table 2 shows the GIZ improved method of shea nut

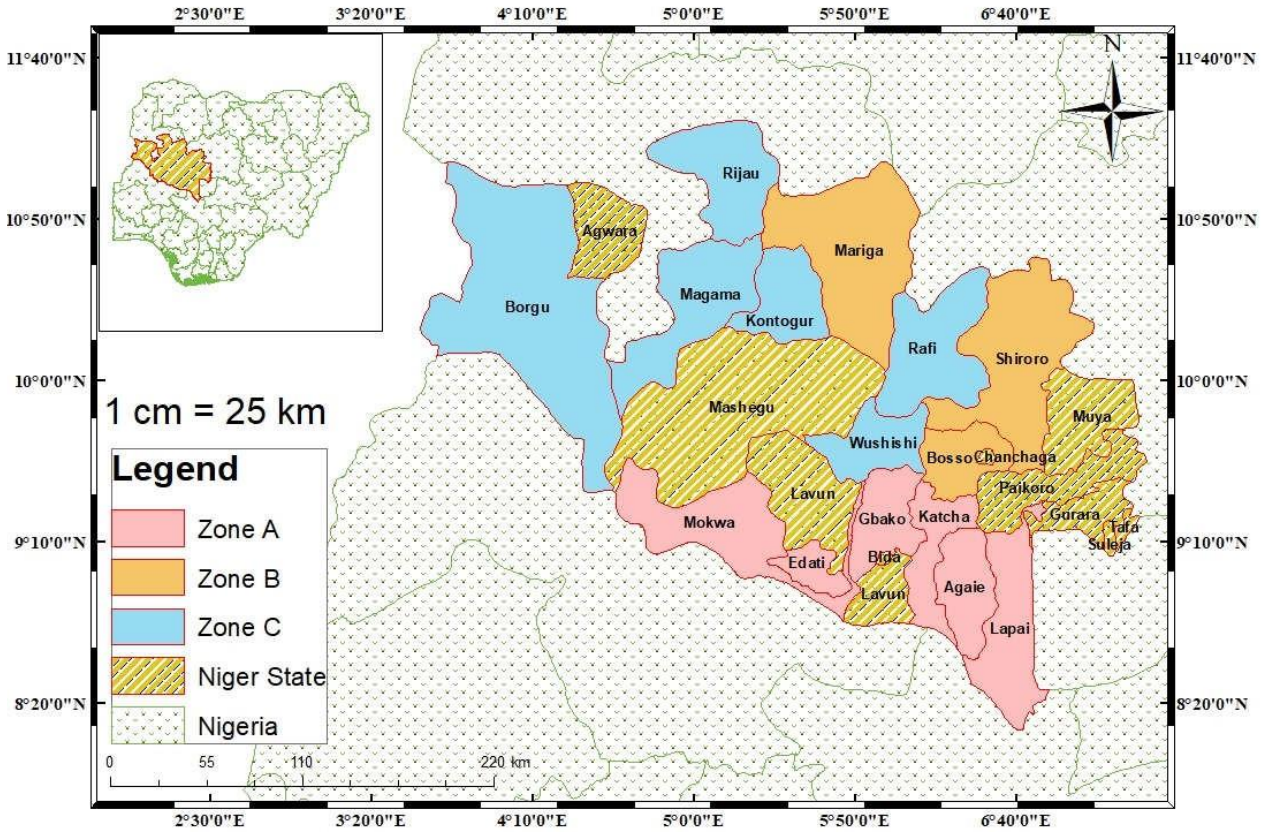

Figure 1. Map of Niger State showing local governments of GIZ intervention.
Source: GIZ Shea processors profile list, 2011; 2014.

processing technologies while Table 3 shows the percentage distribution of the GIZ Shea nut processors. The data reveals that majority of the respondents accepted that the first component which is the processing equipment for storage of shea nut were available to them, in the following steps picking and collection of dropped matured healthy and undamaged fruits or Shea nut (100.0%), de-pulping of Shea nut was done immediately to avoid fermentation process taking place (100.0%), per- boiling of Shea nut was done immediately after collection within 30 ≤ 45 min and draining after par-boiling using basket (100.0%), proper drying of Shea nut for 5 to 7 days or more until the nut were rattling inside the shells (99.3%), de-husking or cracking of Shea nut with due consideration to the damaging of the nut on clean platform and mats beneath it (100.0%) and drying of kernels to between 10 to ≤ 15% moisture content or until proper hardness of kernels are achieved (97.6%) and storage of kernels in jute bags or baskets in ware-houses with proper ventilation with barriers (94.9%). The reason could be adduced to very few farmers in some cases who claimed unavailability of some sub-components might be those that did not understand very well the concept at the period of training or forgot out rightly the concepts.

Table 4 and 5 shows the percentage distribution of the Shea nut processors by the adoption of improved Shea nut processing technologies. The data indicates that the sub-components of processing of shea kernel into shea butter, the respondents (100.0%) indicates that the sub-components of actual processing of shea kernel into shea butter, were available except drying of kernels to between 6 to ≤ 10% moisture content or until proper hardness of the kernel are achieved, roasting of kernel with rotary drier without any oil addition for 30≤60 min and boiling of kneaded kernel paste on recommended stove technologies where very few percentages of the respondents; 1.7, 3.0 and 1.7%% respectively indicated that they were not available. Also, as in the first components, the reason that could be adduced to a very few in some cases who claimed unavailability of some sub-components might be those that did not understand very well the concept at the period of training or forgot out-rightly the concepts. .The results is consonant with the findings of Ragasa and Mazunda (2018) that if smallholder farmers or processors become better informed about their technical options or for increasing yields, their productivity usually rises, leading to better working conditions on farms and higher food security.

Table 6 shows the percentage distribution of the Shea

Table 1. The distribution of the sample shea nut processors (beneficiaries and non-beneficiaries).

Local govern-ent areas	Sample frame (No. of GIZ processors as contained in the profile list of GIZ Shea groups in Niger State)	No. of selected GIZ beneficiaries through proportionate sampling based on 10%	No. of selected GIZ non-beneficiaries	Total sample ofGIZ beneficiaries and non-beneficiaries
Zone A				
Lapai	297	30	30	60
Gbako	240	24	24	48
Katcha	313	31	31	62
Mokwa	243	24	24	48
Agaie	89	9	9	18
Edati	123	12	12	24
Zone B				
Shiroro	81	8	8	16
Bosso	289	29	29	58
Mariga	63	6	6	12
Zone C				
Kontagora	159	16	16	32
Borgu	445	45	45	90
Wushishi	146	15	15	30
Magama	379	38	38	76
Rijau	72	7	7	14
Rafi	31	3	3	6
TOTAL	2,970	297	297	594

Source: Field Survey, 2018.

nut processors by the adoption of GIZ Shea nut processing technologies. The data indicates that for the first component of the GIZ processing technologies, that is, storage of shea nuts before processing was adopted by all the respondents (100%) components except in the two cases of drying of kernels to between 10 to ≤ 15% moisture content until hardness is achieved and storage of kernels in jute bags/basket in store/ware houses where few percentages of (1.3%) and (9.1%) respectively did not adopt. The reasons adduced for the non-adoption of these sub-components were inadequate concrete or cemented platform for drying and scarcity of jute bags in the markets. The results concur with the findings of Warner et al. (2008) that a major factor of competitiveness that plays a role in agricultural value chains is farmers' having access to affordable physical infrastructure. Examples of such infrastructure is irrigation, energy, transportation, pre and post-harvest storage, telecommunications, covered markets, agro processing and packaging facilities, as well as bulk storage (Warner et al., 2008).

Table 7 and 8 shows the percentage distribution of the GIZ Shea nut processors by the adoption of improved Shea nut processing technologies. The data reveals that the adoption of second components of GIZ processing technologies and depict that in five sub-components, all the respondents (100.0%) adopted the technologies

Table 2. GIZ improved/sustainable method of shea nut processing technologies.

GIZ improved/sustainable method of shea nut processing technologies
(A) First Stage (storage of shea nut before processing into shea butter)
Picking and collection of dropped matured, healthy and undamaged fruits or Shea nut
De- pulping of Shea nut immediately to avoid fermentation process to take place
Parboiling of Shea nut immediately after collection within 30 ≥ 45 minutes and draining after parboiling using basket
Drying of Shea nut for 5-7 days or more until the nuts are rattling inside the shells
De-husking or cracking of Shea nut with due consideration to the damaging of the nut on clean platform and mats/leather beneath it
Drying of kernels to between 10% to ≥15% moisture content or until proper hardness of kernels are achieved
Storage of kernels in jute bags or basket in stores/ware-houses with proper ventilation with barrier on the floor or pellets
(B) First Stage (storage of shea nut before processing into shea butter)
Washing and removal of debris such as stones, dried leaves and other particles from the kernel
Sorting and grading of kernels into grades i.e. healthy/undamaged, damaged and diseased ones
Drying of kernels to between 6% to ≥ 10% or until proper hardness of the kernel are achieved
Pounding/machine crushing of kernel into smallest sizes using clean materials or containers eg plastic bowls
Roasting of kernel with rotary drier without any oil addition for 30 ≥ 60 minutes depending on the moisture content
Cool drying of pounded/crushed kernel for some period to reduce high temperature before grinding into paste
Grinding/milling of kernel into paste with clean and oil free materials but using plastic containers
Boiling of kneaded kernel paste on a recommended stove or burner with clean boiling materials for 45 ≥60 minutes to avoid smoke and destruction of active ingredient and to maintain required moisture content.(1st and 2nd stage boiling)
Clarification/filtration and solidification of Shea butter (separation of oil) using white and clean cloth/materials in a plastic container
Packaging and standardization of Shea butter in air tight, rust and water proof container, and keep away from direct sunlight
Storage of Shea butter in a separate safe and well ventilated store/ware-house with shelves or on barriers created on the floor in a cool and dry place

Source; GIZ (2010).

Table 3. Distribution of respondents by the available GIZ shea nut processing technologies put in place.

Improved Technologies	Available		Not Available	
(Stage 1: Storage of shea nut before processing) sub-components of stage 1	**Frequency**	**%**	**Frequency**	**%**
Picking and collection of dropped matured, healthy and undamaged fruits or Shea nut	297	100	-	-
De- pulping of Shea nut immediately to avoid fermentation process to take place	297	100	-	-
Parboiling of Shea nut immediately after collection within 30 ≤ 45 min and draining after parboiling using basket	297	100	-	-
Proper drying of Shea nut for 5-7 days or more until the nuts are rattling inside the shells.	295	99.3	2	0.7
De-husking or cracking of Shea nut with due consideration to the damaging of the nut on clean platform and mats/leather beneath it.	297	100	-	-
Drying of kernels to between 10% to ≤ 15% moisture content or until proper hardness of kernels is achieved	290	97.6	7	2.4
Storage of kernels in jute bags or basket in stores/ware-houses with proper ventilation with barrier on the floor or pellets.	282	94.9	15	5.11

Source: Field Survey (2018).

in seven sub-components, though not all but majority of the respondents adopted the technologies. In the seven sub- components in which few of the respondents that did not adopt it might be due to some factors adduced to inadequate concrete platform, unavailability of some equipment/materials and inadequate knowledge of some concepts which they might have forgotten as taught under GIZ extension services.

Table 9 shows the percentage distribution of GIZ Shea nut processors by the level of adoption of giz Shea nut

Table 4. Distribution of respondents by the adoption of improved shea nut processing technologies.

Improved technologies (Stage 2: Actual processing of shea nut)	Beneficiaries (N=297)			
	Available		Not available	
	Frequency	%	Frequency	%
Proper washing and removal of debris such as stones, dried leaves and other particles from the kernel	297	100	-	-
Proper sorting and grading of kernel into grades, that is, healthy/undamaged, damaged and diseased ones	297	100	-	-
Drying of kernels to between 6% to ≤ 10% or until proper hardness of the kernel is achieved.	292	98.3	5	1.7
Pounding /machine crushing of kernel into smallest sizes using clean materials or containers e. g. plastic bowls	297	100	-	-
Roasting of kernel with rotary drier without any oil addition for 30 ≤ 60 minutes depending on the moisture content	288	97	9	0.3
Cool drying of pounded/crushed kernel for some period to reduce high temperature before grinding into paste	297	100	-	-
Grinding/milling of kernel into paste with clean and oil free materials but using plastic containers	297	100	-	-

Source: Field Survey (2018).

Table 5. Distribution of respondents by the adoption of improved shea nut processing technologies (Continued).

Improved technologies (Stage 2 :Actual Processing of Shea nut)	Beneficiaries N=297			
	Available		Not available	
	Frequency	%	Frequency	%
Kneading/churning/stirring of kernel paste with clean materials/containers and bole hole/clean water with due consideration to weather condition, that is, use of cold or warm water mixing and cold water separation in the kneading process.	292	98.3	5	1.7
Boiling of kneaded kernel paste on a recommended stove or burner with clean boiling materials for 45 ≤ 60 minutes to avoid smoke and destruction of active ingredient and to maintain required moisture content (1st and 2nd stage boiling).	292	98.3	5	17
Clarification/filtration and solidification of Shea butter (separation of oil) using white and clean cloth/materials in a plastic container.	297	100.0	-	-
Packaging and standardization of Shea butter in air tight rust and water proof, and keep away from direct sunlight.	297	100.0	-	-
Storage of Shea butter in a separate safe and well ventilated store/ware-house with shelves or on barriers created on the floor in a cool and dry place.	297	100.0	-	-

Source: Field Survey (2018).

Table 6. Distribution of respondents by the adoption of Giz shea nut processing technologies.

Stage 1: Storage of shea nut before processing (Sub-components of Stage 1)	Improved technologies			
	Adopted		Not adopted	
	Frequency	%	Frequency	%
Picking and collection of dropped matured, healthy and undamaged fruits or Shea nut	297	100.0	-	-
De- pulping of Shea nut immediately to avoid fermentation process to take place	297	100.0	-	-
Parboiling of Shea nut immediately after collection within 30 ≤ 45 minutes and draining after parboiling using basket	297	100.0	-	-
Proper drying of Shea nut for 5-7 days or more until the nut is rattling inside the shells	297	100.0	-	-
De-husking or cracking of Shea nut with due consideration to the damaging of the nut on clean platform and mats/leather beneath it.	297	100.0	-	-

Table 6. Contd.

Drying of kernels to between 10% to ≤ 15% moisture content or until proper hardness of kernels is achieved.	293	98.7	4	1.3
Storage of kernels in jute bags or basket in stores/ware-houses with proper ventilation with barrier on the floor or pellets.	270	90.9	27	9.1

Source: Field Survey (2018).

Table 7. Distribution of respondents by the adoption of improved shea nut processing technologies (continued).

Improved technologies (Stage 2: Actual processing of shea nut)	Beneficiaries (frequency and percentage rating (N=297))			
	Adopted		Not-adopted	
	Frequency	%	Frequency	%
Proper washing and removal of debris such as stones, dried leaves and other particles from the kernel	297	100.0	-	-
Proper sorting and grading of kernel into grades, that is, healthy/undamaged, damaged and diseased ones	294	99.0	3	1.0
Drying of kernels to between 6% and ≤ 10% or until proper hardness of the kernel are achieved	297	100.0	-	-
Pounding /machine crushing of kernel into smallest sizes using clean materials or containers e. g. plastic bowls	297	100.0	-	-
Roasting of kernel with rotary drier without any oil addition for 30 ≤ 60 minutes depending on the moisture content	293	98.7	4	1.3
Cool drying of pounded/crushed kernel for some period to reduce high temperature before grinding into paste	294	99.0	3	1.0
Grinding/milling of kernel into paste with clean and oil free materials but using plastic containers	297	100.0	-	-

Source: Field Survey (2018).

Table 8. Distribution of respondents by the adoption of improved shea nut processing technologies

Improved technologies (Stage 2: Actual processing of shea nut)	Beneficiaries (N=297)			
	Adopted		Not adopted	
	Frequency	%	Frequency	%
Kneading/churning/stirring of kernel paste with clean materials/containers and bole hole/clean water with due consideration to weather condition, that is, use of cold or warm water mixing and cold water separation in the kneading process.	297	100.0	-	-
Boiling of kneaded kernel paste on a recommended stove or burner with clean boiling materials for 45 ≤ 60 minutes to avoid smoke and destruction of active ingredient and to maintain required moisture content.(1st and 2nd stage boiling).	292	98.3	5	1.7
Clarification/filtration and solidification of Shea butter (separation of oil) using white and clean cloth/materials in a plastic container.	290	97.6	7	2.4
Packaging and standardization of Shea butter in air tight rust and water proof, and keep away from direct sunlight.	293	98.7	4	1.3
Storage of Shea butter in a separate safe and well ventilated store/ware-house with shelves or on barriers created on the floor in a cool and dry place.	293	95.3	14	4.2

Source: Field Survey (2018).

processing technologies. The data reveals that majority of the respondents (98.7%) adopted the GIZ improved processing technologies, while very few of the respondents (1.3%) did not adopt the GIZ improved

Table 9. Categorization of the level of adoption of Giz improved shea nut processing technologies.

Adoption categories of technologies	Beneficiaries (N=297)	
	Frequency	%
Adoption (1-19 technologies)	293	98.7
Non-adoption (0-18)	04	1.3
Total	297	100.0

Source: Field survey, 2018.

processing technologies. This implies that a high level of adoption of the GIZ technologies could be attributed to the credence of effective dissemination of the technologies and provision of necessary support by the programme to the respondents in the study area. The results is in consistent with Sharma (2016), that smallholder farming or processing participation in the global value chains is perceived as of prime importance for their inclusion in the agricultural development of developing countries.

Conclusion

From the findings, there was a high adoption of GIZ technologies both at the storage of shea nut with seven sub-components and actual processing of shea kernel into shea butter with twelve sub-components, though the beneficiaries complaint of being constrained by inadequate finance, poor market linkages/channels, inability to understand some complexities due to illiteracy, inadequate extension contact, poor processors' groups for annexing opportunities and inadequate capacity building and follow up, among others. The adoption of this technology by the beneficiaries has however helped to enhance their productivity (quantity of shea nut processed, output and income) and livelihood condition better than before the intervention.

Recommendations

Re-introduction and inclusion of more shea nut processors in non-GIZ villages especially for the state as a whole is highly necessary to enjoy large number of processors in order to enhance the shea butter industry.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests

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