PROJECT: STDF/PG7172

EXPANDING NIGERIA'S EXPORTS OF SESAME SEED AND SHEANUT/BUTTER THROUGH IMPROVED SPS CAPACITY BUILDING FOR THE PRIVATE AND THE PUBLIC SECTOR

FINAL REPORT

JANUARY 2016

STDF 172
FINAL REPORT

[OCTOBER 2010 – SEPTEMBER 2014]

This report is not formally edited by the Nigerian Export Promotion Council nor the International Trade Centre

TABLE OF CONTENTS

PROJECT INFORMATION

Title

STDF PROJECT 172: EXPANDING NIGERIA'S EXPORTS OF SESAME SEED AND SHEANUT/BUTTER THROUGH IMPROVED SPS CAPACITY BUILDING FOR THE PRIVATE AND PUBLIC SECTOR

Implementing Agency

Nigerian Export Promotion Council (NEPC)

Partners

International Trade Centre (ITC) (Supervisory Agency)

Federal Ministry of Industry, Trade and Investment (FMITI)
National Agency for Food and Drug Administration and Control (NAFDAC)
International Institute for Tropical Agriculture (IITA)
National Cereals Research Institute (NCRI)
Standards Organisation of Nigeria (SON)
National Stored Product Research Institute (NSPRI)
National Centre for Agricultural Mechanisation (NCAM)
Agricultural Development Program (ADPs of the 8 participating States)
National Sesame Seed Association of Nigeria (NSSAN)
National Shea Products Association of Nigeria (NASPAN)

Start Date

October 2010

End Date

September 2014

Beneficiary

Nigeria

Budget

Project value:	US$545,040
STDF contribution:	US$364,240

LIST OF ABBREVIATIONS

ADP	Agricultural Development Programme
CPC	Consumer Protection Council
EU	European Union
FAO	Food and Agricultural Organisation of the United Nations
FFA	Free Fatty Acid
FIIRO	Federal Institute for Industrial Research Oshodi
FMARD	Federal Ministry of Agriculture and Rural Development
FMITI	Federal Ministry of Industry, Trade and Investment
FPIS	Federal Produce Inspection Services
FRIN	Forestry Registry Institute of Nigeria
FUTM	Federal University of Technology Minna
IAR	Institute of Agricultural Research
IC	International Consultant
ICCON	Institute of Chartered Chemists of Nigeria
IITA	International Institute of Tropical Agriculture
IPAN	Institute of Public Analysts of Nigeria
ITC	International Trade Centre
GAP	Good Agricultural Practices
GHP	Good Hygiene Practices
GMP	Good Manufacturing Practices
HACCP	Hazard Analysis Critical Control Point
MoU	Memorandum of Understanding
NAERLS	Nigerian Agricultural Extension Research and Liaison Services
NAFDAC	National Agency for Food and Drug Administration and Control
NASPAN	National Shea Products Association of Nigeria
NAQS	Nigerian Agricultural Quarantine Services
NCAM	National Centre for Agricultural Mechanization
NCRI	National Cereals Research Institute
NEPC	Nigerian Export Promotion Council
NIFOR	Nigerian Institute of Oil Palm Research
NIS	Nigerian Industrial Standard
NSPRI	Nigerian Stored Products Research Institute
NSSAN	National Sesame Seed Association of Nigeria
NTC	National Technical Coordinator
PC	Project Coordinator
RMRDC	Raw Materials Research and Development Council
SOA	School of Agriculture
SON	Standards Organisation of Nigeria
SOP	Standard Operating Procedure
SPS	Sanitary and Phyto-Sanitary (Measures)
STDF	Standards and Trade Development Facility
TCDMC	Tree Crop Development and Marketing Company plc.
TEF	Tony Elumelu Foundation
TG	Technical Group
TOR	Term of Reference
WG	Working Group

1. EXECUTIVE SUMMARY

Despite the fact that Nigeria's economy is largely dependent on revenues from sale of crude oil, agriculture constitutes the largest part of the employment in the country. Even though it has high agricultural productivity and comparative advantage in diversity, the country faces limitations on its exports, due to quality issues.

Nigeria's major export market is Asia. Exports to Europe are relatively limited, due to aflatoxins presence in sesame seeds. In addition to the sesame seeds, Nigeria stands between the top shea butter producers in the world. The main problem encountered with export of shea products is impurities in Free Fatty Acid (FFA) and aflatoxin content in the nuts. Food quality system and the aflatoxin surveillance, along the sesame value chain and shea production is not well developed to verify the effectiveness of safety management system and compliance with international standards.

Sesame and shea butter are leading agricultural export products with a potential for growth, foreign exchange earnings and international market penetration. These products were chosen at a specially convened focused group discussion by the Ministry of Commerce and Industry and consultants of Carana Corporation (USA) on 8 January 2008 at Abuja, Nigeria. This enabled Nigeria to seek assistance from the WTO to enhance safety and quality standards in the production of both products, resulting in formulation of the STDF Project 172.

The overall objective of the STDF Project 172 is to expand Nigeria's exports of sesame seed and shear nut/butter through improved SPS capacity building for private and public sector organizations, as well as improved quality control along the supply chain. The focus of the project is on developing effective aflatoxin, FFA and impurities control systems for the above-mentioned products. Via the implementation of this project, it is expected that the quality control system established, will provide compliance with the national and international standards. This will result in higher domestic consumption and exports to the targeted markets.

The Nigerian Export Promotion Council (NEPC) is an agency of the Federal Government of Nigeria. NEPC's vision is to promote non-oil exports, as key driver of the Nigerian economy and to take a leading position via exports for private sector earnings and sustainable economic development. The strategic objective of the Agency is to diversify the productive base of the economy away from oil and foster market-oriented and private sector-driven economy.

The NEPC was selected as an Implementing Agency for the STDF Project 172, with focus on eight states in Nigeria – four for sesame seed and four for shea nut/butter production. The project was funded 65% by the STDF and 35% by NEPC, where the Product Development Department (PDD) acted as an implementing division. The International Trade Centre (ITC) was appointed as the supervisory agency.

The project commenced in October 2010 and was supposed to end by September 2012, but due to time constraints and challenges with of some of the activities in particular the establishment of the processing sites, NEPC had to seek additional 18 months extension. This enabled completion of the project activities and its successful implementation. This resulted in additional commitment by NEPC in comparison to the project proposal, but successful implementation was achieved.

The project has five components described as follows:

- **Component 1: Baseline Documentation** – Improving documentation on current practices of quality control for Nigerian sesame seeds and shea products.
- **Component 2: Quality Control & Traceability** – Implementation of robust field quality control and traceability system for Nigerian sesame and shea products for exports
- **Component 3: Capacity Building** – Train producers, traders, exporters and enforcement officers to adopt and implement the improved food quality management system.
- **Component 4: Information Sharing and Empowerment** – Information dissemination on project activities, studies and results to all the relevant stakeholders.
- **Component 5: Collaboration and Sustainability** – Strengthening the public-private dialogue and partnership in the Nigerian shea nut and sesame seed sectors.

Under **Component 1**, Baseline Documentation, Socio-Economic Characterisation of Shea Value Chain in Nigeria study was conducted. The latter included field surveys in different states in Nigeria, where processors, local buyers and sellers, and exporters were interviewed. The results of the study had been analysed and shaped in a format of a report that was further used in the implementation stage of the project. In addition to the surveys, also testing sample analysis was done. It included sample collection for both products- shea and sesame seeds- and further lab analysis to determine the critical points where contamination occurs.

Based on all the results from the studies conducted, existing manuals on safety and quality on shea and sesame seeds, code of practices and national standards are also been updated. The country is now equipped with updated versions of the Nigerian Industrial Standard Sesame Seed (Sesamum indica L) – NIS 580: 2013, the Nigerian Industrial Standard (NIS) for shea Nut/Kernels – NIS 572: 2013 and the Nigerian Industrial Standard (NIS) for shea butter (unrefined) – NIS 571: 2013 and with two Codes of Practices for Sesame Seeds and for Shea Nuts/Kernels and Shea Butter (unrefined).

Component 2 of the project focussed on the development and implementation of a field quality control systems and traceability plan for both products for exports. The project addressed some of the identified food safety and quality issues and production capacity by adopting a strategy of providing eight processing sites (4 for SN and 4 for SS) in eight States with the installation of four-sets of integrated sesame seed cleaning machines and four-sets of shea butter processing equipment. This was done with the assistance of trained personnel, who was able to operate the equipment. The sites have been commissioned to the local cooperatives. A partnership between private investor, the cooperatives and NEPC (as controlling body) was developed for the management of the processing sites and share the operation costs and profits.

The results of lab analysis were used to establish HACCP plan for Sesame seed, Shea nut, Shea butter. Furthermore, Traceability systems for Sesame Seeds Supply and Shea-nuts Supply chain are formulated.

Component 3 of the project focused on the capacity building element of the project, under which extension officers, traders, exporters and standards enforcement officers were trained on best practices for production and control.

Component 4 established the information sharing and empowerment part of the project. Under the latter, a website (http://www.law-union.com/stdf172/) was created where information was disseminated on the project activities, studies conducted and the results achieved. In addition to that, the component also enabled to advertise the project widely through the local media that lead to better visibility of the project.

Component 5 helped to create better collaboration and sustainability on the project. A number of meetings such as the project kick off, the mid-term and the completion ones were held to ensure the dialog between the private and public sector and guide the implementation / monitoring / evaluation of the project.

The project had about 14 collaborating partners, comprising of local agencies and trade associations, who conducted various tasks under the project activities. An International Consultant was recruited, to provide technical inputs, review project outputs and suggest changes. His work involved four missions to Nigeria during the implementation period of the project to better assess the situ ation on the ground. ITC`s role in the project, as supervising agency, was to provide advisory services and guidance to NEPC for adequate project implementation. The Project Coordinator, with the support of secretariat personnel in NEPC, was able to coordinate project's implementation. Some of the project activities were assigned to partner agencies.

After four years of implementation, the project was successfully concluded in 2014 and developed a stable food quality and SPS framework for sesame and shea production. As a direct output, risks associated with aflatoxin contamination along the sesame and shea value chains are minimized, enabling producers to export the commodities to key international markets. In addition, various guides on characterization of both products, predictive model for aflatoxin and fungi control, HACCP plan, traceability system, sampling plan, farmers' guide to quality production of shea and sesame, are produced.

Under the project, a public-private partnership model was adopted, to ensure sustainability after the completion of the project for the management of the sites. Technical assistance was provided by Austin Sidley LLP (law firm, USA) in drafting a Memorandum of Understanding (MoU) for the investors, to guide on the operationalization of the established processing facilities. The project also attracted strong commitment from the states, where the sites were built, as well as from the local government. As a result, a strong inter-agency collaboration was ensured, enabling successful implementation of the project. The processing sites are a pilot model with the high expectations of strengthening the sector and supply chains and if successful to be replicated across the country.

After the completion of the project NEPC has been following up with the processing centers and its investors, in particular with those in the Oyo State (Sheabutter) and Kogi State (Sesame) on the progress made. It was reported by NEPC and the investor that the center of the Oyo state is fully operational with 100 women and 5 men operating that recorded the first consignment of shea butter sent to the US in November 2015. Production is being scaled up with NAFDAC providing them quality assessment.

The project received wide acclaim for its successful implementation that gave rise to a possible collaboration of NEPC with Tony Elumelu Foundation towards replication of the project in other centres.

2. BACKGROUD

The STDF Project 172 was conceived with the overall objective of expanding Nigeria's exports of sesame seeds and shea nut/butter, through improved SPS capacity building for private and public sector organizations, and improved quality control along the supply chain.

CURRENT SURVEILLANCE SYSTEMS FOR FOOD QUALITY AND AFLATOXIN CONTROL IN NIGERIA

Nigerian sesame exports are mostly targeted to countries in East Asia, Southeast Asia and South Asia. The presence of aflatoxin is estimated to be the largest impediment to sesame exports from Nigeria to Europe. The major reason for the limited exports is poor quality and aflatoxin presence along the sesame and shea production supply chains. In addition, the overall safety management system in place was not harmonized with the international standards.

CHOICE OF SESAME AND SHEANUT/ BUTTER

Sesame and sheanut/butter were chosen as priority agricultural export products with a potential for growth, foreign exchange earnings and international market penetration. Before the project commenced, there was no national strategy existing to promote the sesame and shea products, therefore this project was the first step of prioritizing the production of high quality products ready to be exported internationally.

SESAME SEED

Nigeria is the second largest producer in Africa of sesame seed, producing about 120,000 mn tonnes per year (FAO 2012). The commodity is exported majorly as seeds, ranking amongst the top five exported products from Nigeria. Sesame production played an important socio-economic role, particularly in the northern states of Nigeria. It has a high nutritional value, being rich in proteins, fats, vitamins and selenium. A significant part of the local population, mostly SMEs represented by women, is directly or indirectly dependant on production of sesame seeds for the local and export markets. Development of this sector reduces poverty and improves standard of living, while contributing to the reduction of rural migration of people towards urban areas. Most of the sesame production takes place in the north of Nigeria, namely: Nasarawa, Jigawa, Benue, Kebbi, Taraba, Kogi, Borno, Niger, and Yobe. The major exports markets for Nigerian sesame seed are Japan, China, Turkey, United Arab Emirate.

Contamination of sesame seeds in the field and/or along the supply chain by high levels of aflatoxin is of a major concern for public health, causing tremendous trading problems, especially for the European Union (EU) commodity market.

SHEA NUT

Major concerns in the shea butter production are the Free Fatty Acid (FFA) and impurities. Nigeria is the world`s largest producer of shea nut, producing 325,610 mt per year (FAO 2012). Fruits are collected at the end of the rainy season, followed by selection, washing, drying and extraction of the oil. Shea nut production has an important socio-economic role in Nigeria. Significant part of the local population, largely represented by women, is involved in shea nut collection and butter extraction.

Until recently, shea had been the primary source of edible oil, traditionally used for frying, cooking, as well as used as cosmetics and medicine. In addition, it has a cultural value, being used at ceremonies. Over the past five years, demand for shea products has grown in the European Union and the United States, requiring sheanut producing countries to increase the exports of the latter. Shea is now commonly used in the production of cocoa butter, where equivalents or improvers (up to 5% content by weight is allowed under EU regulations) on chocolate, other confectionaries and margarine. The main problem encountered with export of shea products is its FFA and aflatoxin content in the kernels, caused by poor in-storage conditions.

GENERAL OBSERVATION

The following shortcomings were determined in the field of quality control for sesame seeds and shea products:

- Shea nut and sesame seeds collection, transport, processing and export were poorly managed and vary significantly between the different producing states.
- The critical points of aflatoxin contamination and other chemical contamination were not defined or known.
- Research and fieldwork to identify at which stage of the value chain and in relation to which variables such as moisture content, temperature, time, and chemical contamination and Aspergillus flavus/A. parasiticus and aftlaxin contamimation was not sufficient.
- Quality guides were in premature and lacked the required technical background, as well as further actions. There was a need to develop and disseminate guides for Good Warehousing Practices (GWP), Good Manufacturing Practices (GMP) and Good Hygiene Practices (GHP).
- Quality Control centers had been taking samples for aflatoxin analysis only prior to export. Systematic quality control checks along the production chain were missing.
- The sampling procedure and handling of the samples, which is crucial for aflatoxin analysis, was inadequate.
- Lack of adequate traceability system for shea nuts and sesame seed, both during the production chain and export procedures.

THE PROJECT BENEFICIARY LOCATION/STATES

For Shea-nut/butter

- Oyo State (Saki Town, Oyo State)
- Kwara State (Kaiama Town, Kwara State)
- Kebbi State (Bagudo Town, Kebbi State)
- Niger State (Babangi Town, Niger State)

For Sesame Seed

- Kogi State (Anyigba Town, Kogi State)
- Benue State (Gbajimgba Town, Benue State)
- Taraba State (Suntai Town, Taraba State)
- Borno State (Bama Town, Borno State)

3. PROJECT GOAL

The focus of the project was the development of an effective aflatoxin control system for sesame seeds and an effective FFA/impurities control system for shea nut exports. Below are the overall goals and impact of the project's implementation:

- To develop an improved documentation of quality control and traceability system of the targeted crops under the project on production, processing, storage, transport to ports of export.
- To improve importing country standards on cultivation and agricultural practices to ensure sustainable production.
- To implement a robust field quality control system for sesame and shea products, via construction and installation of cleaning and processing equipment.
- To establish HACCP, traceability System and Sampling Plan within the Nigerian shea nut and sesame seed production along the supply chain.
- To train producers, traders, exporters and standards enforcement officers to adopt and implement the improved food quality management system developed under the project.
- To disseminate project information, studies and results to all the relevant stakeholders along the value chain.
- To strengthen public-private dialogue and partnership.
- To reduce poverty and empower women in shea producing communities through provisions of improved production system and improved technical know-how.

4. PROJECT IMPLEMENTATION AND MANAGEMENT

The project management followed the structure as in the project proposal. Adjustments have been made whenever necessary.

(a) Implementing Agency

Under this project, the Nigerian Export Promotion Council (NEPC) had the role of an Implementing and Lead Agency with the support of the Federal Ministry of Industry, Trade and Investment. The project secretariat was placed in the NEPC offices and the tasks were carried out under the supervision of NEPC staff.

(b) Supervising Agency

The International Trade Centre (ITC) was appointed by the WTO/STDF as the Supervisory Agency of the project to provide required expertise and guidance on the project.

(c) Project Coordinator

The Director of Product Development in the NEPC was fully in charge of the coordination of the project activities. The project coordinator was supported by the international consultant, to deliver technical inputs. NEPC team and a team of local experts drawn from the Project Steering Group and Collaborating Agencies under ITC`s supervision also assisted the project coordinator in implementing the project. Over the duration of the project three Directors of Product Development in the NEPC led the coordination of the project: Ms Omowunmi Osibo, from its inception phase till 2013, Mr Olajide Ibrahim in 2013 and Mr Henry Otowo from 2013 to date.

(d) Project Steering Group (PSG)

The Project Steering Group served as the decision making organ on the implementation of the project, in addition to providing guidance and technical support to the PC. The membership of the PSG was expanded further in comparison to the proposed membership in the project document in order to enrich technical inputs and guidance to the PC.

The members of the group were:

- Nigerian Export Promotion Council NEPC (Chair)
- Representative of the Federal Ministry of Industry, Trade and Investment (FMITI)
- Representative of the National Agency for Food and Drug Administration and Control (NAFDAC)
- Representative of the International Institute of Tropical Agriculture (IITA)
- Representative of the Agricultural Development Programme (ADP) of each of the eight participating states
- Representative of the National Sesame Seed Association of Nigeria (NSSAN)
- Representative of the National Shea Products Association of Nigeria (NASPAN)

(e) The International Consultant (IC)

The IC was recruited with the assistance of ITC and his role was specified in the project document as follows:

- To provide technical inputs to the local technical experts.
- To review project outputs and suggest changes.
- To participate and advise the working group throughout the project implementation.
- To suggest changes required to the value chain of both sesame seeds and shea nut/butter.

(f) Collaborating Institutions

The organisations and partners/stakeholders who participated in the course of the project implementation, involved in contract services, capacity building and training programmes are as follows:

- The project's collaborating national institutions
- Federal Ministry of Industry, Trade & Investment,

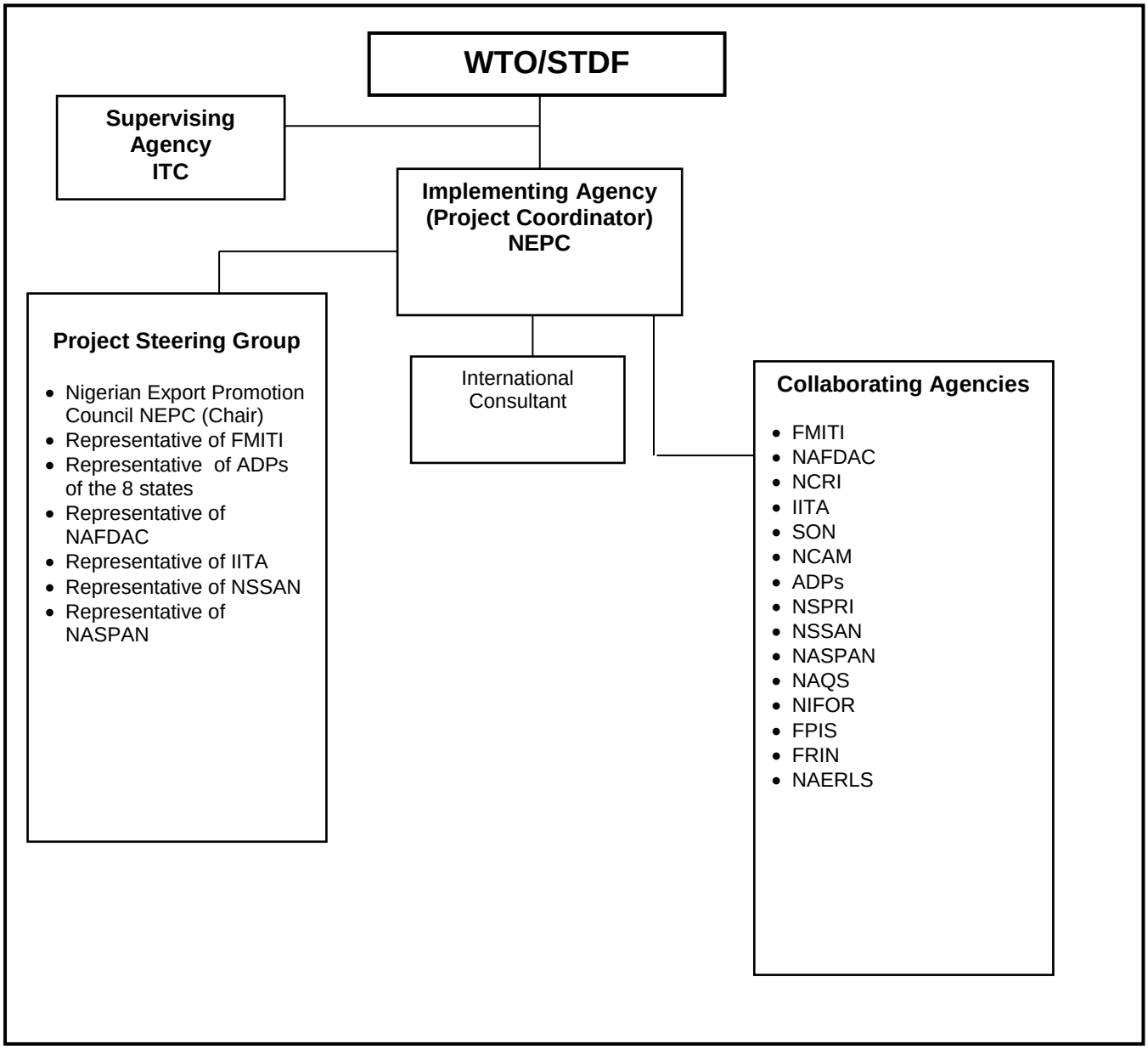
- National Agency for Food and Drugs Administration and Control (NAFDAC),
- National Cereals Research Institute (NCRI),
- International Institute of Tropical Agriculture (IITA)
- Standards Organisation of Nigeria (SON),
- National Centre for Agricultural Mechanization (NCAM),
- National Stored Product Research Institute (NSPRI)
- National Sesame Seed Association of Nigeria (NSSAN)
- National Shea Products Association of Nigeria (NASPAN)
- The Agricultural Development Programme (ADPs: the 8 states)
- Nigeria Agriculture Quarantine Service (NAQS)
- Nigerian Institute for Oil Palm Research (NIFOR)
- Federal Produce Inspection Services (FPIS)
- Forestry Research Institute of Nigeria (FRIN)
- Nigerian Agricultural Extension Research and Liaison Services (NAERLS)

A major drawback for the project in its management was the inability to have a long term candidate as national technical coordinator (NTC) based in Nigeria. The NTC was expected to assist the PC in the project implementation by facilitating and collaborating institutions assigned for various activities. The NTC was also expected to provide technical inputs for the submitted reports. A NTC was initially recruited in 2012, but resigned from his post shortly after that. The same position was filled by a NEPC team member and work was carried out until the end of the project.

(g) Coordination of Project Activities

The coordination of the project activities was carried out by the PC with the assistance and support of the project secretariat placed in NEPC. Various project outputs were forwarded to the IC for revision, comments and recommendations, while the coordination and management activities were carried out under the supervision of ITC.

Figure 1: Project Management Chart



5. PROJECT OBJECTIVE, OUTPUTS & ACTIVITIES

5.1 PROJECT OBJECTIVE

The project reached it overall objective of expanding Nigeria's Food exports of sesame seed and sheanut/butter through improved SPS capacity building for Private and Public Sector Organizations and improved quality control along the supply chain.

The project focused on developing an effective aflatoxin control system for sesame seeds exports and an effective FFA and impurities control system for shea butter exports.

5.2 OUTPUT 1: BASELINE DOCUMENTATION – IMPROVING DOCUMENTATION ON CURRENT PRACTICES OF QUALITY CONTROL FOR NIGERIAN SESAME SEED AND SHEA PRODUCTS EXPORTS

Activity 1.1. Preparation of Terms of Reference (TOR) and procurement of consultant services

At the kick-off meeting of the project in October 2010, the Project Coordinator, in consultation with stakeholder partners, established a Working Group (WG) to prepare a ToR for the procurement of the services on the project by the International Consultant (IC). The IC was expected to provide technical inputs, coordinate expected outputs, and assist the PC. The WG produced the draft ToR, which reflected stakeholders inputs and final draft was validated.

The ToR for the IC contained the following information:

- To provide technical inputs to the local implementing agencies and technical experts in the development of the project outputs.
- To ensure finalization of the activities according to the project log frame and work plan. In particular, the following activities were involved:
    - Improving documentation on current practices of quality control for sesame seed and shea products for export with focus on field level production, processing, storage and transport.
    - Implementation of a robust field quality control system for sesame seed and shea products for export.
    - Strengthening local capacity to implement quality control and traceability.
    - Strengthening private-public collaboration between the stakeholders.
- To conduct four missions to Nigeria, the first one to supervise the training component based on HACCP, in two sites.
- To provide technical inputs to the PC throughout the project implementation. Submit mission reports after each mission to the PC.
- Make reference to published and unpublished internal reports, literature, activities and complement it with field surveys, if necessary.
- Conduct a second mission to Nigeria, to attend the final project workshop.
- Submit the final report to the project coordinator outlining the activities covered and achievements at the end of the project.

An advertisement was placed in local media, NEPC and ITC websites for the position of the IC. The selected candidate was recruited with the assistance of the ITC - Mr. Bruno Doko, quality and food safety & standardization expert to UNIDO and other organisations, with relevant education and extensive experience in the field.

The IC conducted four missions to Nigeria:

- May 2011 to meet with institutional agencies and stakeholder partners. It included field visits to three sesame seed and shea butter production states - detailed information can be found in the mission report attached as **Annex A**.
- February 2012 to participate in the technical workshop with stakeholders. More detailed information on the workshop, visits and findings can be found in the report, attached as **Annex B**.
- August 2013 to attend the capacity building programs under Objective 3.
- May 2014 to present the results of the project, as the end-of-project workshop.

Activity 1.2 (a) Characterization of shea and sesame seed production and supply chain

SESAME SEED

The main objective of this activity was to improve documentation of current practices for quality control on sesame seed for exports, with focus on field level production, processing, storage and transport to ports of export. This activity enabled the project to conduct a study and produce a report of the socio-economic characterisation of sesame in five states with concentrated sesame production.

The objectives of the study were:

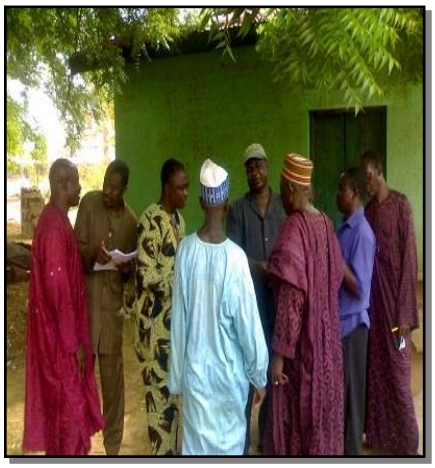
- To identify producing areas, volumes produced for local consumption and export purposes;
- To determine current production practices, the organization of the production and supply chain;
- To identify critical hazard control points in the supply chain.

This activity was directed by the NCRI as the Lead Agency, whereas NEPC and NSSAN acted as Supporting Agencies. The study team was formed and commenced the activity in 2011. Field surveys were conducted in the following states Benue, Borno, Kogi, Nasarawa and Taraba. Information was collected through visits to the farms and interviews with government officials, producers and marketers in order to better understand the value chain process. The analyses captured the production and went throughout the distribution and export of commodities. Collected data was analysed using descriptive statistics and gross margin analysis. Analysis of socio-economic characteristics showed, that the majority of sesame farmers were male with average age of 42 years. More detailed information on the surveys and the data obtained can be found under **Annex C**.

The study concluded that sesame seed mainly produced in Nigeria is for export purposes with low productivity level. The potential yield of improved sesame varieties without good management practices is about 400kg/ha, while same varieties produce up to 1000kg/ha when grown under good agricultural practices.

According to the findings of this survey, sesame seeds are transported in bulk vessels or carriers meant for other commodities that may cause cross contamination or adulteration of the sesame seeds.

Field exercise of the socio-economic characterisation of sesame seed



SHEA

The main objective of this activity was to improve documentation for current practices of quality control for Shea products for exports with special focus on field level production, processing, storage, transport to ports of export. As a result, this would allow to base recommendations for improvement to meet importing countries' standards and cultivation practices to ensure sustainable production.

The study was expected to produce two reports on shea value chain, based on two phases, in which the first component was undertaken as follows:

- Study of the socio-economic characterization of shea production and supply chain;
- Collection of technical data on sheanut/butter.

The specific objectives were:

- To identify producing areas, volumes produced, local consumption and export;
- To determine current production and processing practices, organization of production and supply chain;
- To identify critical hazard control points in the supply chain.

This activity was led by NCRI, in collaboration with NEPC and NASPAN as supporting agencies. In order to accomplish these objectives, in April 2011 field surveys were conducted in four states in Nigeria, i.e. Kebbi, Kwara, Niger and Oyo. Information was gathered through interviews with those involved in the collection and processing of shea nuts, local buyers, sellers and exporters, in order to understand the process of the whole value chain. An analysis of the study showed that shea value chain activities are dominated by women in the study area. More detailed information on the surveys and the data can be found under **Annex D**.

The study concluded that commercial production of shea nuts/butter is concentrated in twelve states. Majority of the collectors and processors are women, who process nuts into butter, using primary processing techniques that often results in high losses and low amount of butter extraction. The butter produced is mainly for local consumption. Very little products are collected by local buying agents to enter larger domestic and international markets. The majority of shea nut production for exports is done illegally. The study also flagged recommendations on how to address identified challenges in the SPS area.

Field exercise of the socio-economic characterisation of shea nut/butter

Activity 1.2 (b) Physico-chemical characterization of Nigerian sesame seed and shea

This activity was conducted by NAFDAC. It consisted of sample collection during the field exercise of the socio-economic characterization. The objective was to have a publication on a laboratory report on the physical and chemical characteristics of the Nigerian sesame seed and shea products.

SESAME SEED

The agency (NAFDAC) relied on two streams of samples for the exercise: stream A samples collected during the socio-economic field exercise in February 2011 and stream B collected in May 2011. Samples were tested both against quality and safety characteristics. Quality characteristic measures include: saponification value, iodine value, moisture content, ash content, oil content, peroxide value, trace metals and fatty acid profile. Safety parameters analysed were: total aflatoxins, pesticide residues and aerobic mesophilic count, mold count, coliform count and Escherichia coli. More detailed information on the data collected can be found in the report under **Annex E**.

The report contains information on the analyses conducted and the method used for each of them. In addition, quality parameters and the probability of occurrence had been analysed. The study showed that aflatoxin content is higher for produce harvested during the rainy season (June–October) and less during the dry season (January–April). The same principal is valid for the microbial count, sampled during the rainy season (high) and less during the dry season. However, the inorganic parameters remain fairly constant. This shows the importance of good handling practices (harvesting, storage) and timing management in order to obtain good qualities Nigerian Sesame Seed produce. The results are reflected in the two tables below.

Table 1: Summary of Characteristics on Sesame by Producing States - Stream 1[1]

Parameters	Expected (Units)	States									
		BENUE		KOGI		TARABA		NASARAWA		BORNU	
		AV	RANGE	AV	RANGE	AV	RANGE	AV	RANGE	AV	RANGE
Moisture[1]	(%)	3.18	2.8-3.55	3.16	2.8-3.52	3.13	2.87-3.39	3.26	2.77-3.56	3.41	3.37-3.45
Ash	(%)	8.75	5.51-11.99	9.27	6.63-11.9	7.39	5.84-8.94	12.34	8.10-19.34	6.82	5.74-7.90
Calcium[3]	(mg/kg)	35.10	15.07-55.12	38.70	22.27-55.13	15.56	14.06-17.06	15.49	8.42-22.56	36.7	12.58-60.82
Magnesium[3]	(mg/kg)	2.83	1.73-3.93	2.8	1.73-3.87	2.62	1.96-3.27	2.73	1.84-3.61	1.94	1.79-2.08
Iron[3]	mg/kg)	2.32	0.31-4.33	2.38	0.42-4.33	0.53	0.31-0.74	0.3	0.26-0.34	4.99	0.28-9.69

[1] Stream 1- Dry period

Table 2: Summary Table of Means of Characteristics of Sesame Seed by Producing States - Stream 2[2]

Parameters	Expected (Units)	States									
		BENUE		KOGI		TARABA		NASARAWA		BORNU	
		AV	RANGE	AV	RANGE	AV	RANGE	AV	RANGE	AV	RANGE
Moisture[1]	(%)	3.37	3.05-3.59	3.29	2.81-3.83	3.74	3.29-4.61	3.46	2.64-4.25	3.61	3.17-3.81
Ash	(%)	5.80	4.55-7.53	5.83	4.62-6.64	5.58	4.81-6.40	6.38	4.36-8.19	6.11	5.96-6.12
Zinc[3]	(mg/kg)	0.82	0.66-1.13	0.84	0.84-0.95	0.89	0.71-0.99	0.88	0.78-0.98	0.94	0.83-1.04
Copper[3]	(mg/kg)	0.22	0.18-0.28	0.22	0.17-0.29	0.21	0.17-0.26	0,20	0.17-0.22	0.21	0.17-0.25
Calcium[3]	mg/kg)	76.64	70.93-80.80	76.17	67.78-81.23	72.32	66.07-79.63	70.47	64.52-79.45	77.74	73.02-82.19
Magnesium[3]	(mg/kg)	1.56	1.55-1.57	1.55	1.54-1.57	1.55	1.53-1.56	1.55	1.54-1.57	1.57	1.56-1.59
Iron[3]	(mg/kg)	1.16	0.9-1.68	1.22	0.76-1.48	0.88	0.53-1.17	1.49	1.20-1.64	1.14	0.94-1.45
Lead[3]	(mg/kg)	ND		ND		ND		ND		ND	
Cadmium[3]	(mg/kg)	ND		ND		ND		ND		ND	
Total Aflatoxin[4]	(µ/kg)	1.43	0.80-2.50	1.06	0.9-1.13	1.0	0.70-1.50	0.8	0.5-1.0	2.53	0.80-4.1
Oil Content[5]	> 47.5 (%)	59.30	53.88-72.35	54.61	2.10-57.03	57.06	54.47-59.60	55.47	51.71-60.78	56.48	55.59-57.50
Sapon. Val[7]	187-197 (mgKOH/g)	194.8	187.94-196.35	193.90	187.94-196.36	191.09	187.94-191.09	193.08	190.74-194.95	95.48	193.55-196.14
PeroxideValue[8]	10 (mEq/Kg)	0%	0.2-4.8	0%	0.8-2.6	0%	1.2-8.6	0%	4.2-6.8	0%	4.2-9.6
Iodine Value[9]	104-120 (WIJ's)	110.51	107.07-112.62	111.63	110.24-112.62	104.56	4.51-104.69	105	104.51-105.25	105.07	104.2-106.28
Organochlorine[11]		ND		ND		ND		ND		ND	

[2] Stream 2- Rainy period

Organophosphate[11]		ND	ND		ND		ND		ND	
Aerobic Count[12]	10000 cfu		260-760		120-840		680-1930		1200-1820	
Mould Count[13]	500 cfu	83%	80-580	100%	190-780	100%	120-920	67%	30-820	100%
Coliform Count[14]	100 cfu	67%	0-3500	100%	180-3700	100%	12000 - 14000	100%	960-18000	100%
E coli [15]	0 cfu	0	0		0		0		0	

ND: No Detection; %*: Percentage Occurrence

SHEANUT/BUTTER

The physico-chemical characterization studies of Shea nut/butter were carried out by NAFDAC. Two streams of samples were taken from sixteen areas of four states i.e. Niger, Kwara, Oyo and Kebbi in the southwest part of the country.

The samples were tested for both quality and safety characteristics. The quality characteristics that were measured include: saponification value, iodine value, moisture content, ash content, oil content, peroxide value and trace metals and fatty acid profile. The safety parameters analyzed were: total aflatoxins, pesticides residues and aerobic mesophilic count; others were mould count, coliform count and presence of Esherichia coli bacteria. The result of the characterization and the aggregated results can be found in **Annex F**, submitted as part of this report.

While the results confirmed presence of moulds and bacteria, the organochlorines and organophosphates were not detected. Mycotoxins were also detected in shea nuts; though at levels that were below permitted maximum levels, with the exception of only one state that had higher level than permitted. As a result of the analyses carried out, it is concluded that the aflatoxin levels present in the shea nut and butter at the commencement of the project were within the safety limits. The total amount of Aflatoxins detected in sheanut ranged from 0.05 - 1.0 ug/kg, below the Maximum Limit of 10ug/kg.

The research concluded that lower records of Aflatoxin incidences would be expected in the dry season in comparison to the rainy season. The results are reflected in the following tables.

Table 3: Summary Table of Means of Characteristics of Shea nut by Producing States - Stream 1 (Batch A)

s/n	Parameters	Expected (Units)	States							
			NIGER		KEBBI		KWARA		OYO	
			AV	RANGE	AV	RANGE	AV	RANGE	AV	RANGE
1	**Moisture**[1]	(%)	3.45	2.69 - 4.22	3.41	2.94 - 4.10	3.21	3.19 - 3.22	3.64	3.32 - 4.06
2	**Ash**[2]	(%)	2.95	2.66 - 3.29	2.74	2.41- 2.97	3.19	3.05 - 3.33	2.79	2.19 - 3.12
3	**Calcium**[3]	(mg/kg)	1.34	0.99 - 1.99	1.74	1.70 - 1.78	4.03	2.22 - 5.84	4.0	1.57 - 6.42
4	**Magnesium**[3]	(mg/kg)	1.91	1.33 - 3.68	2.53	1.69 - 3.38	1.62	1.62	1.06	0.50– 1.62
5	**Iron**[3]	(mg/kg)	0.33	0.24 - 0.41	0.31	0.29 - 0.33	0.32	0.31 - 0.33	0.37	0.26 - 0.37
6	**Lead**[3]	(mg/kg)	ND		ND		ND		ND	
7	**Cadmium**[3]	(mg/kg)	ND		ND		ND		ND	
8	**Total Aflatoxin**[4]	(µ/kg)	20%*	0.05	66%	0.05 - 1.00	ND	-	66%	0.40 - 0.69

%*: Percentage Occurrence
ND: Not Detected

Table 4: Summary Table of Means of Characteristics of Shea butter by Producing States - Stream 1 (Batch A)

s/n	Parameters	Expected (Units)	States							
			NIGER		KEBBI		KWARA		OYO	
			AV	RANGE	AV	RANGE	AV	RANGE	AV	RANGE
1	**Moisture**[1]	(%)	2.26	0.02 – 8.21	2.20	0.53 – 3.86	0.20	0.17 - 0.22	2.57	0.4 - 4.71
2	**FFA (as Oleic)**[6]	8 (%) max	5.3%	2 – 8.6	8.9	8.6-9.2	4.55	4.5-4.6	5.85	4.2-7.5
3	**Sapon. Val**[7]	170-190 (mgKOH/g)	181.2	175.31-186.53	173.91	Same	176.72	0-176.72	177.42	172.51-182.33
4	**PeroxideValue**[8]	10 (mEq/Kg)	5.2	2.0-7.2	4.6	4.4-4.8	3.4	3.2-3.6	6.0	5.2-6.8
5	**Iodine Value**[9]	50-60 (WIJ's)	54.58	52.13-56.36	54.79	54.1-55.47	55.23	55.11-55.34	54.39	51.1-57.68
6	**Melting Point**[10]	30-40 (^{0}C)	34.7	32-37	33	28-38	31.5	31-32	34.5	34-35

%*: Percentage Occurrence
ND: Not Detected

Table 5: Summary Table of Means of Characteristics of Sheanut By Producing States - Stream 2 (Batch B)

s/n	Parameters	Expected (Units)	States							
			NIGER		KEBBI		KWARA		OYO	
			AV	RANGE	AV	RANGE	AV	RANGE	AV	RANGE
1	**Moisture**[1]	(%)	5.18	3.49 - 6.87	4.73	4.42 - 5.05	3.96	3.83 - 4.09	5.01	4.66 - 5.35
2	**Ash**	(%)	2.90	2.2 - 3.59	2.40	1.99 - 2.80	3.17	3.11 - 3.22	2.28	2.17 - 2.39
3	**Zinc**[3]	(mg/kg)	0.21	0.12 - 0.30	0.23	0.2 1- 0.25	0.38	0.25-0.50	0.19	0.16 - 0.21
4	**Copper**[3]	(mg/kg)	0.02	0.01 - 0.03	0.02	0.01 - 0.02	0.013	0.003- 0.023	0.02	0.004 - 0.035
5	**Calcium**[3]	(mg/kg)	11.21	6.75- 15.66	16.46	13.48- 19.43	11.64	10.07- 13.21	13.72	9.80- 17.64
6	**Magnesium**[3]	(mg/kg)	1.38	1.33 - 1.42	1.37	1.36 - 1.38	1.41	1.38 - 1.44	1.38	1.36 - 1.40
7	**Iron**[3]	(mg/kg)	0.39	0.22 - 0.56	0.81	0.46 -1.16	0.36	0.28-0.47	0.42	0.30 - 0.53
8	**Lead**[3]	(mg/kg)	ND		ND		ND		ND	
9	**Cadmium**[3]	(mg/kg)	ND		ND		ND		ND	
10	**Total Aflatoxin**[4]	(µ/kg)	100%*	0.3 - 0.9	100%	0.6 - 0.7	100%*	0.2 - 0.7	100%*	0.3 - 0.6
11	**Oil Content**[5]	> 45 (%)	52.16	43.0- 61.32	55.49	54.2- 56.78	54.59	51.9- 57.28	62.02	58.63- 65.4
12	**FFA (as Oleic)** [6]	8 (%) max	50%*	4.0 - 10.6	100%*	11.1 - 13.6	0%	5.0 - 6.2	66%*	7.5 - 9.9
13	**Sapon. Value**[7]	170-190 (mgKOH/g)	176.5	171 - 182	183	178 - 188	185.13	185.13-185.13	175.5	171 - 180
14	**PeroxideValue**[8]	10 (mEq/Kg)	4	2.2 - 5.8	8.3	7.8 - 8.8	5.9	5.8 - 6.0	5.8	3.6 - 8
15	**Iodine Value**[9]	50-60 (WIJ's)	51.92	50.0-53.84	55.46	53.8- 57.11	57.30	56.3- 58.3	55.72	54.33-57.11
16	**Melting Point**[10]	30-40 (^{0}C)	31.5	30 - 33	33	32 - 34	33.5	32 - 35	33.5	32 - 35
17	**Organochlorine**[11]	(%)	ND		ND		ND		ND	
18	**Organophospate**[11]	(%)	ND		ND		ND		ND	
19	**Aerobic Count**[12]	10000(cfu)	3170	140 - 6200	1780	980- 2580	760	570 - 950	635	180 - 1090
20	**Mould Count**[13]	500(cfu)	460	280 - 640	210	40 - 380	305	140 - 470	515	210 - 820
21	**Coliform Count**[14]	100(cfu)	864	128 - 1600	135	0- 270	195	70 - 320	75	0 - 150
22	**E. coli**[15]	0(cfu)		0		0		0		0

%*: Percentage Occurrence; ND: Not Detected

Table 6: Summary of Means of Characteristics of Shea butter by Producing States - Stream 2 (Batch B)

s/n	Parameters	Expected (Units)	States							
			NIGER		KEBBI		KWARA		OYO	
			AV	RANGE	AV	RANGE	AV	RANGE	AV	RANGE
1	**Moisture**[1]	(%)	0.31	0.028-058	0.92	0.19-0.93	1.28	0.40-2.17	0.82	0.459-1.18
2	**Ash**[2]	(%)	-	-	-	-	-	-	-	-
3	**Zinc**[3]	(mg/kg)	ND	ND	ND	ND	ND	ND	ND	ND
4	**Copper**[3]	(mg/kg)	ND	ND	ND	ND	ND	ND	ND	ND
5	**Calcium**[3]	(mg/kg)	ND	ND	ND	ND	ND	ND	ND	ND
6	**Magnesium**[3]	(mg/kg)	ND	ND	ND	ND	ND	ND	ND	ND
7	**Iron**[3]	(mg/kg)	ND	ND	ND	ND	ND	ND	ND	ND
8	**Lead**[3]	(mg/kg)	ND	ND	ND	ND	ND	ND	ND	ND
9	**Cadmium**[3]	(mg/kg)	ND	ND	ND	ND	ND	ND	ND	ND
10	**Total Aflatoxin**[4]	(µ/kg)	ND	ND	ND	ND	ND	ND	ND	ND
11	**FFA (as Oleic)** [6]	8 (%) max	3.9	1.4-6.4	5.65	3.5-7.8	6.5	6.2-6.8	4.8	4.6-5.0
12	**Sapon. Val**[7]	170-190 (mgKOH/g)	180.23	171.11-189.34	180.93	176.72-185.13	180.93	179.52-182.33	179.52	171.11-187.94
13	**PeroxideValue**[8]	10 (mEq/Kg)	3.5	1.2-5.8	7.8	5.8-9.8	2.6	1.4-3.8		2.6-4.4
14	**Iodine Value**[9]	50-60 (Wij's)	52.40	50.04-54.75	50.77	50.4-51.15	50.95	50.76-51.13	50.39	50.01-51.12
15	**Melting Point**[10]	30-40 (^{0}C)	34	28-40	36	30-42	33	31-35		28-40
16	**Organochlorine**[11]	(%)	ND	-	ND	-	ND	-	ND	-
17	**Organophospate**[11]	(%)	ND	-	ND	-	ND	-	ND	-
18	**Aerobic Count**[12]	10000(cfu)	690	120 -1260	95	30-160	470	110 - 830	240	60 - 420
19	**Mould Count**[13]	500(cfu)	65	10 - 120	90	20-160	110	60 -1 60	80	30 - 130
20	**Coliform Count**[14]	100(cfu)	0		0		13.5	1-26	0	
21	**E. coli**[15]	0(cfu)	0		0		0		0	

ND: Not Detected

Activity 1.2 (c) and 1.3 Development of a simple predictive model for aflatoxin and fungi control in Nigeria Sesame and Shea production chain and analysis

This activity was assigned to IITA to carry out a predictive study on samples of sesame seeds and shea nut to determine optimal storage and transportation conditions as well as sets of checks on parameters such as temperature, humidity and moisture. Tests were also performed to establish critical limits for safe storage and transport time at different moisture contents and temperatures to control growth of fungi and development of aflatoxins during processing.

Aflatoxin contamination of agricultural products is influenced by environmental conditions (temperature, water activity and posts-harvest handling practices); therefore failure to comply with GAP requirements results in aflatoxin contamination of products, leading to serious problems, including restriction to trade. As a result of these factors, aflatoxin contamination occurs more often in tropical countries due to favourable fungal invasion conditions - high temperature and humidity, combined with poor agricultural practices.

SESAME SEED

Sesame seed is one of the commodities that have received international attention most recently due to unsafe aflatoxin levels.

The methodology of the study on sesame seeds was based on mathematic modelling, where mould growth and toxin production under different physical conditions (temperature, relative humidity, pH and water activity) were examined as a useful tool in predictive mycology. This has been used to predict the extent of mould growth and invasion in foodstuffs as a function of environmental conditions.

The modelling of aflatoxin development in the sesame seeds production chain was novel to Nigeria and the result helped to establish the hazard analysis critical control points in the value chain of the crop.

The objectives of the study within this activity were:

- To conduct a survey to identify the existing stages of production;
- To collect samples of sesame seeds at different stages in the sesame production chain from three major sesame-producing states in Nigeria;
- To identify Aspergillus spp associated with each stage in the sesame production chain;
- To determine the correlation between water activity, temperature, relative humidity and aflatoxin production in the sesame production chain in order to establish critical control points;
- To develop a predictive model for aflatoxin occurrence in the sesame production chain.

For the purpose of this study, surveys were conducted in three sesame producing states in Nigeria i.e. Kogi, Benue, and Nasarawa. Samples were collected from about twelve local government areas (LGAs) and at least three farmers per LGAs. Sample size was between 2-4 kg of sesame seeds, collected at different processing stages, such as farm gate stage (FG), cleaning stage (CS) and stored sesame seed (SS). A total number of 62 sesame samples (three varieties: Ex-sudan, E8 and black variety) were collected and transported to Pathology Unit IITA to be stored at 4 ºC. The temperature and relative humidity at the time of sampling was measured using a Thermo Hygrometer.

The study conducted, consists of the following stages:

- Sample preparation.
- Isolation of Aspergillus spp from samples.
- Multiplication of Aspergillus species on MRBA medium.
- Identification of Aspergillus isolates.
- Determination of free fatty acid (FFA) content.
- Determination of aflatoxin content in sesame samples.
- Measurement of water activity.
- Rehydration of the samples and determination of water activity levels.
- Inoculation and incubation of sesame samples.
- Enumeration of fungal spores on inoculated sesame samples after incubation.
- Extraction and quantification of total aflatoxins in inoculated sesame samples.
- Statistical analysis.

The results are reflected in **Annex G**. The results generated in the study indicated that contamination of sesame seeds by aflatoxigenic fungi across the sesame value chain from the farm gate to storage stage poses a major threat to food safety and the health of consumers. The high occurrence of A. flavus at all

stages of sesame production indicates that the initial contamination by these species happens either during harvesting or drying processes and when it is being transferred to the stores.

The high CFU (colony-forming unit) count of Aspergillus spp, observed in the farm gate (FG) samples across the states, suggests that FG stage is a critical control point, where fungal spores infect the crop and contaminate sesame seeds in the field. That leads to aflatoxin formulation in the produce and may also be caused from poor handling practices during the harvest or sun drying process.

Direct correlation between water activity and aflatoxin is present. When the water activity of the sesame seed samples was gradually increased, the aflatoxin level increased proportionately implying that water activity is significant in grain colonization by Aspergillus species, and increases aflatoxins concentration during drying and poor storage. Thus, drying seeds to safe moisture content within the shortest possible time before storage will reduce the rate of aflatoxin accumulation. The distribution of aflatoxin in the samples is reflected via Figure 9 and Figure 10.

Overall, the study showed that water activity was the most important factor affecting sporulation and aflatoxin contamination in sesame. The effect of temperature was found also to be significant in aflatoxin accumulation in sesame. The models developed can be used to predict the safe environmental storage boundaries for sesame and conditions, which represent a high risk for aflatoxin accumulation in sesame. These models are also useful to determine the storage conditions for grain for export, and those involved holding sesame prior to processing.

Farmers shall be advised to plant on time to avoid moisture stress during crop growth and drying of sesame to save moisture content (<12%) within the shortest possible time. This is a critical control point because prolonged or inadequate drying increases the risk of contamination by mycotoxigenic fungi; therefore, use of driers, determination of the moisture, and proper storage pending transportation is highly recommended.

Bagging and storage is another critical control point, because most often, storing in improper moisture condition increases the moisture content and growth of mycotoxigenic fungi. In addition, aflatoxin concentration may increase if rewetting occurs in the storage facility. Hence, packaging materials shall be properly selected to minimize and limit aflatoxin contaminations. Packing in air tight sealed bags may reduce insect infestation and subsequently aflatoxin contamination in the store.

Table 7: Distribution of Aspergillus isolates in sesame seed samples collected at different processing stages in some states in Nigeria

State	Sample Type	No Isolated	A. Flavus (%)	Strain S_{BG} (%)	Parasiticus (%)	A. Tamarii (%)	A. Niger (%)
Benue	FG	120	99.0	1.0	0.0	0.0	0.0
	CS	220	86.8	7.4	0.5	5.3	0.0
	SS	80	77.1	2.5	0.0	20.5	0.0
Nasarawa	FG	80	88.2	3.9	1.4	7.9	0.0
	CS	255	91.6	4.2	0.0	2.8	0.0
	SS	120	79.5	18.7	0.0	1.8	0.0
Kogi	FG	118	93.7	0.9	0.0	5.4	0.0
	CS	120	88.4	2.5	0.0	9.1	0.0
	SS	77	85.7	0.0	0.0	0.0	14.3

FG- farm gate stage, CS- cleaning stage, SS- storage stage.
A. flavus = L-strain of Aspergillus flavus; Strain SBG = unnamed taxon of Aspergillus flavus; A. parasiticus = Aspergillus parasiticus; A. tamarii = Aspergillus tamarii, A. niger = Aspergilus Niger

Table 8: Aflatoxin concentration (ng/g) in sesame samples collected at different processing stages in some states in Nigeria

Location	Type of sample	Range Mean (n)	Aflatoxin concentration (ng/g)			
			B_1	B_2	G_1	G_2
Benue	FG	Range	1.3 – 19.0	0.0 – 15.7	0.0 – 24.7	0.0 – 14.1
		Mean (n = 6)	8.5	3.8	14.4	8.6
	CS	Range	0.0 – 31.4	0.0 – 7.0	0.0 – 23.9	0.0 – 12.8
		Mean (n = 12)	4.2	2.7	4.9	3.2
	SS	Range	0.7-7.9	0.0- 1.1	0.0 - 0.0	0.0 - 0.0
		Mean (n = 4)	2.5	0.7	0.0	0.0
Nasarawa	FG	Range	0.0 – 19.6	0.0 – 12.7	0.0 – 9.1	0.0 – 4.4
		Mean (n = 4)	11.9	3.5	2.9	2.8
	CS	Range	0.0 – 20.9	0.0 – 10.9	0.0 – 35.5	0.0 - 10.6
		Mean (n = 14)	5.2	3.3	6.6	2.3
	SS	Range	0.6-8.1	0.0 - 5.5	0.0 - 2.6	0.0 - 2.0
		Mean (n = 6)	3.6	1.2	1.2	1.1
Kogi	FG	Range	2.0 – 17.6	1.9- 33.1	0.0 – 21.0	0.0 - 19.3
		Mean (n = 6)	5.8	9.7	12.5	6.4
	CS	Range	0.0 – 3.5	0.0 – 1.6	0.0 – 14.8	0.0 – 4.4
		Mean (n = 6)	1.6	0.8	5.9	2.5
	SS	Range	0.0 - 2.3	0.0-3.1	0.0 – 2.0	0.0 - 1.6
		Mean (n= 4)	1.0	1.1	0.8	1.0

FG- farm gate stage, CS- cleaning stage, SS- storage stage

SHEANUT/BUTTER

The recurring problems with moulds shea-nuts/kernels and high FFA and impurities in shea butter are due to the lack of established Hazard Analysis and Critical Control Points (HACCP) in the Nigerian shea nut/butter production chain. However, modelling of aflatoxin production in Shea butter production chains was novel. Under this project, extensive analyses on aflatoxins were conducted and the result helped to establish the hazard critical control points (HACCP) in the value chain of the crop.

The following objectives were covered in the study:

- To conduct a survey to identify the existing stages of shea butter production.
- Sample collection of shea kernel/butter at different stages from the major shea nut producing states in Nigeria.
- To identify moulds associated with different stages of shea production chain.
- To determine the correlation between water activity, temperature, relative humidity and aflatoxin contamination in shea-nut value chain.
- To develop a predictive model for aflatoxin production in the shea production chain.

Surveys were conducted in three shea-producing states in Nigeria (Niger, Kwara and Oyo States) and samples were collected from at least three locations in each state. Sample size was between 2 and 5 kg, taken from 5 major production stages of Shea butter: fresh-in-shell nuts (FIS) n=9, boiled-in-shell nuts (BIS) n=4, dried kernels (DK) n=10, roasted-crushed-kernels (RCK) n=7 and Shea butter (SB) n=10. Samples were collected from the following locations: Bosso, Etsu Audu, Dogongari, Karabunde (Niger State) Nuku, Kaiama, Agbaku-eji (Kwara State), Kisi, Igboho, Igbeti (Oyo State). A total of 40 Shea samples were collected and stored at 4 ºC. The temperature and relative humidity at the time of sampling was measured with a Thermo Hygrometer.

The study consists of the following stages:

- Sample preparation
- Isolation of Aspergillus spp from samples
- Multiplication of Aspergillus species on MRBA medium
- Identification of Aspergillus isolates
- Determination of free fatty acid (FFA) content

- Determination of aflatoxin content in shea nut samples
- Measurement of water activity
- Rehydration of the samples and determination of water activity levels
- Inoculation and incubation of shea nut samples
- Enumeration of fungal spores on inoculated shea nut samples after incubation
- Extraction and quantification of total aflatoxins in inoculated shea nut samples
- Statistical analysis

This study was the first to observe the distribution of *Aspergillus spp* across the Shea-kernel/butter production chain and to study the possible effects of this distribution, such as FFA and aflatoxin contamination. The result showed the occurrence of *Aspergillus flavus L* as the predominant Aspergillus sp through the shea value chain. In addition, it has been observed that contamination of shea starts from the field: when the shea fruits drop from the tree to the ground and are not picked up on time, contamination occurs and develops very rapidly. When abandoned in the field for longer period *Aspergillus spp*, which are abundant in the soil, begin to decompose the fruit and subsequent cause accumulation of aflatoxins.

The study also indicated that the aflatoxin contamination values were relatively low in the shea products across the value chain. Aflatoxin contamination is present in 13.2% out of the 40 samples collected. The amount of the aflatoxins is 4 µg/Kg (ppb), which is the acceptable limit for total aflatoxins in oil seeds and nuts in the EU countries.

However, the fact that aflatoxins occurs throughout all the processing stages, displays possible aflatoxin cross contamination along the value chain. All the DK samples in the three states were contaminated with low levels of aflatoxins, which explained the high *Aspergillus CFU* counts at the processing stage.

High CFU counts in the BIS and DK stages of processing indicate that the boiling process should be followed by rapid drying of the nuts on a mat or raised platform. The drying process of the kernels to a safe moisture level (< 7%) also is recommended to be done rapidly to avoid contamination by microorganism which contributes to the mould load and consequently the FFA values. These latter are also important quality parameter for rating shea kernels/butter in different quality grades (Tables 9-11).

Besides FFA, acidity, saponification value, peroxide value, and iodine value, which are dependent on how fast the nuts are picked up when they fall from the trees to the ground, the parboiling, the drying method and duration and processing technique should be given more attention.

The study, that is further explained in **Annex H**, concludes that the critical points for contamination are collection, drying and processing of the fruits. The time of picking of the nut is critical in the quality of butter that is obtained, fruits should be should be picked up and processed immediately. Some of the farmers use direct flame for the drying process that causes poly-cyclic aromatic hydrocarbons that are proved to be cancerogenic. The use of this type of drying techniques shall be strictly limited, instead roasters shall be used.

Table 9: Distribution of Aspergillus isolates in Shea samples collected at different processing stages in some states in Nigeria

State	Type of Sample	No. Isolated	% of Fungal Species				
			A. Flavus	*A. Tamarii*	*A. Niger*	*A. Tereus*	*A. Fumigants*
Niger	FIS	66	69.7	0.0	4.6	22.7	3.0
	BIS	40	100.0	0.0	0.0	0.0	0.0
	RCK	50	42.0	6.0	48.0	4.0	0.0
	DK	127	74.0	6.3	18.9	0.8	0.0
	SB	47	42.6	0.0	57.5	0.0	0.0
Oyo	FIS	11	27.3	0.0	72.7	0.0	0.0
	RCK	7	28.6	0.0	71.4	0.0	0.0
	DK	102	65.7	2.0	32.4	0.0	0.0
	SB	8	50.0	0.0	50.0	0.0	0.0
Kwara	FIS	34	88.2	0.0	8.8	0.0	2.9
	BIS	53	66.0	0.0	33.9	0.0	0.0
	RCK	33	30.3	0.0	69.7	0.0	0.0
	DK	162	74.1	3.7	22.2	0.0	0.0
	SB	26	30.8	0.0	69.2	0.0	0.0
			27.8	8.4	6.8	5.2	2.0

LSD (P = 0.05)
FIS – Fresh-in-shell nuts ; BIS – Boiled-in-shell nuts ; RCK – Roasted crushed kernels ; DK – Dried kernels; SB – Shea butter; LSD-Least significant difference = 0.05

Table 10: Aflatoxin concentration (ng/g) in Shea samples collected at different processing stages in some states in Nigeria

Location/ State	Type of Sample		Aflatoxin concentration (ng/g)			
			B_1	B_2	G_1	G_2
Niger	FIS	Range	– 0.6	1.9 -5.6	0.0 – 2.7	0.0 – 0.0
		Mean (n=4)	0.2	1.9	0.7	0.0
	BIS	Range	0.8 - 2.0	0.4 - 0.9	0.0 - 0.0	0.0 - 0.0
		Mean (n = 2)	1.02	0.62	0.0	0.0
	RCK	Range	0.0 - 8.8	0.0- 1.6	0.0 - 0.0	0.0 - 0.0
		Mean (n = 3)	2.9	0.5	0.0	0.0
	DK	Range	0.0 - 6.0	0.0 - 3.1	0.0 - 0.0	0.0 - 0.0
		Mean (n = 4)	3.4	1.4	0.0	0.0
	SB	Range	0.0 - 2.5	0.0 - 0.9	0.0 - 2.3	0.0 - 2.1
		Mean (n = 4)	1.2	0.4	0.9	0.9
Oyo	FIS	Range	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
		Mean (n = 3)	0.0	0.0	0.0	0.0
	DK	Range	2.0 - 5.9	0.0 - 3.3	0.0 - 0.0	0.0 - 0.0
		Mean (n = 3)	3.4	1.5	0.0	0.0
	SB	Range	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
		Mean (n = 3)	0.0	0.0	0.0	0.0
Kwara	FIS	Range	0.0 - 1.9	0.0 - 0.6	0.0 - 0.0	0.0 - 0.0
		Mean (n = 3)	0.9	0.2	0.0	0.0
	BIS	Range	0.0 - 0.4	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
		Mean (n = 2)	0.2	0.0	0.0	0.0
	RCK	Range	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
		Mean (n = 3)	0.0	0.0	0.0	0.0
	DK	Range	1.1 - 3.3	0.4 - 1.2	0.0 - 0.6	0.0 - 0.4
		Mean (n = 3)	2.5	0.9	0.4	0.1
	SB	Range	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
		Mean (n = 3)	0.0	0.0	0.0	0.0

FIS – fresh-in-shell nuts, BIS – boiled-in-shell nuts, RCK – roasted crushed kernels, DK – dried kernels, SB – Shea butter. At the time of the survey, only samples at storage were available for sesame, while for Shea, samples were collected from at least four stages of production.
Aflatoxin concentration value 0 = non detectable; The minimum detection limit was 0.1 ng/g Aflatoxin; Recovery rate was 86.6%

Table 11: Free fatty acid content of Shea samples collected at different processing stages in some states in Nigeria

Location/ State	Type of Sample	No. of Samples	Mean FFA (%)	Range (%)
Niger	FIS	4	2.7	1.4 - 4.1
	BIS	2	3.7	0.0 - 0.0
	RCK	3	3.0	1.7 - 5.5
	DK	4	5.2	3.0 - 7.7
	SB	4	2.2	0.3 - 4.2
Oyo	FIS	2	2.8	2.3 - 3.3
	RCK	1	1.1	0.0 - 0.0
	DK	3	3.9	1.2 - 8.4
	SB	3	5.8	2.9 -11.3
Kwara	FIS	3	1.9	1.1 - 3.0
	BIS	2	3.8	0.0 - 0.0
	RCK	3	4.5	2.3 - 6.2
	DK	3	5.8	4.7 - 7.2
	SB	3	3.7	1.9 - 6.3

FIS – fresh-in-shell nuts, BIS – boiled-in-shell nuts, RCK – roasted crushed kernels, DK – dried kernels, SB – Shea butter, FFA = Free Fatty Acids

Activity 1.4. Updating existing manuals of safety and quality on Nigerian sesame and shea

This activity aimed at updating the existing manuals of safety and quality in Nigerian sesame and shea via the following activities:

- Identification of the Critical Control Points using the information obtained and the developed model.
- Draft recommendations to update the existing manuals on safety and quality in Nigerian sesame and shea, including the development of appropriate post-harvest technologies and traceability system.
- Circulation of the recommendations to the relevant stakeholders to collect comments on the feasibility of the proposed changes
- Finalise the manual according to the recommendations.

1.4.1 Review of existing NIS Standards on sesame and shea nuts

This activity was assigned to SON, being the Nigerian custodian of standards, to update the 2008 NIS version of sesame and shea standards.

SESAME SEED

The standard was revised by a Technical Group (TG) for oil seeds in order to ensure its adequacy to meet produce quality, protection of health and fair trade practices. In this revision, grading and normative references were introduced. Also, the standard was edited in line with the new format for food standards.

The TG was represented by members from SON, FIIRO, FPIS, CPC, FMARD, NAFDAC, IPAN and NSPRI.

The final reviewed document is titled Nigerian Industrial Standard Sesame Seed (Sesamum indica L) – NIS 580: 2013.
The updated NIS Standards for Sesame Seed contained the following updated parameters:

- Terminology
- Quality requirement (general, specific, grading, contaminants)
- Hygiene
- Packaging
- Labelling
- Sampling
- Test methods

Table 12: Specific Requirements

Characteristic	Natural Sesame Seed	Hulled
Bulk Density (kg/m3)	**570**	**579**
Moisture (%) (w/w) (max)	**6.0**	**5.5**
Protein (%) (w/w) (min)	**18**	**17.5**
Fat (%) (w/w) (min)	**38**	**35**
Ash (%) (w/w) (max)	**3.5**	**1.5**
Crude Fibre (%) (w/w)	**6-8**	**2-4**
Free Fatty Acidity (%) (w/w) (max)	**1.0**	**1.0**

SHEA KERNELS

The Technical Group (TG) for shea products elaborated the "Nigerian Industrial Standard (NIS) for shea Nut/Kernels – NIS 572: 2013 Standards for shea nuts/kernels" that replaced the 2008 version. The increase in the demand for shea nuts/kernels for the production of shea butter known for its nutritional, medicinal, cosmetic properties and other uses has led to the increase in both local and international trade of the shea nuts/kernel. This standard was reviewed in order to keep up-to-date with latest technology innovations and quality control to ensure consumer safety/fair trade practices.

The TG was represented by: SON, IPAN, FIIRO, FPIS, RMRDC, IAR, NCRI, SOA, NEPC, NAFDAC, FUTM, NSPRI, TCDMC, NASPAN and ICCON.

The updated NIS Standards for shea kernel contains the following updated parameters:

- Terminology
- Quality requirement (general, basic characteristics, specific characteristics, defects)
- Contaminants (heavy metals, pesticide residue, chemical contaminants, hygiene, microbiological requirement)
- Packaging and labelling
- Sampling and analysis (moisture content, oil content, acidity, impurity level, unsaponifiable matter content)
- Criteria for conformity

Table 13: Specific quality requirements for Shea kernel

Parameter	Grade 1	Grade II	Grade III
Free Fatty Acid (FFA) (%) (m/m)	**2 max**	**>2 – 3**	**>3 - 5**
Peroxide Value (meq/kg)	**5 max**	**>5 – 9**	**>9 - 15**
Moisture Content (%) (m/m)	**5 max**	**>5 - <7**	**7 - 8**
Impurities (%) (m/m)	**0.5 max**	**>0.5 – 0.8**	**>0.8 – 1**

SHEA BUTTER (UNREFINED)

The Nigerian Industrial Standard (NIS) for shea butter (unrefined) – NIS 571: 2013 Standards for Shea butter (unrefined). was elaborated by the Technical Group (TG) for shea Products and replaces the 2008 version. The increase in the demand for pure unrefined shea butter has been observed, due to its nutritional, medicinal, cosmetic properties and other uses. This standard was reviewed in order to keep up-to-date with the latest technology innovations and quality control to ensure consumer safety, as well as fair trade practices.

The TG was represented by: SON, IPAN, FIIRO, FPIS, RMRDC, IAR, NCRI, SOA, NEPC, NAFDAC, FUTM, NSPRI, TCDMC, NASPAN, ICCON.

The updated NIS Standards for Shea butter contains the following updated parameters:

- Scope
- Normative reference
- Terminology (consignment, lot, product definition)
- Composition and quality (raw materials, quality characteristics, identity characteristics)
- Food additives (colour, anti-oxidant)
- Contaminants (heavy metals, chemical contaminants)
- Hygiene
- Packaging and labelling
- Sampling
- Analysis
- Criteria for conformity

Table 14: Quality Characteristics of Unrefined Shea Butter

Parameters	Grade 1a	Grade 2b	Grade 3c
Moisture Content (%) (max)	**0.05**	**> 0.05 – 0.2**	**> 0.2 – 2.0**
Free Fatty Acid (FFA) (%) (max)	**1.0**	**> 1.0 – 3.0**	**> 3.0 – 8.0**
Peroxide Value (meq/kg) (max)	**10.0**	**> 10.0 – 15.0**	**> 15.0 – 50.0**
Insoluble Impurities (%) (max)	**0.09**	**> 0.09 – 0.2**	**> 0.2 – 2.0**

1.4.2 Development of Manuals and Charts on GAP, GHP, GMP, HACCP for Sesame and Shea nuts

Under this activity, it was concluded that manuals and charts on GAP, GHP, GMP, HACCP for sesame and shea nuts would be developed. The information provided in the form of manuals and charts guide farmers, processors and exporters to apply better practices in order to minimize the potential hazards in the produce.

Two manuals were developed by IITA "Quality Production of Shea butter in Nigeria" and "Quality Production of sesame seeds in Nigeria". These manuals were distributed to farmers and extension workers and used as background material for the training conducted by IITA. The manuals cover topics such as an overview of the STDF 172 project; occurrence of aflatoxin in crops and its impact on health, trade and income; current practices in production and processing of sheabutter / sesame seeds; critical control points for production; code of practices for production, processing, and storage; alternative uses of shea / sesame seeds.

Following the development of the above manuals, recommendations and general guidelines have been elaborated in a **farmer's manual for sesame seeds** that can be adapted and/or incorporated at any stage, focusing a number of primary components displayed into six main chapters including:

- Economic Importance of sesame;
- Agricultural Practices: Pre-Season Activities;
- Plant Protection Practices: Season Activities;
- Sesame Production Requirements: Season Activities;
- Plant Development and Recommended Practices: Season Activities;
- Harvesting and Post-Harvest Handling Practices: Post-Season Activities.

The Farmers' Guide provides a brief overview on the concept of GAPs and highlights some of the potential risk of not implementing those practices. GAP guidelines also include traceability system on tracing contaminated foods along the supply chain. The guidelines include relevant practices on production, processing, storage and transportation. In addition to that, self-auditing practices are recommended to be conducted on a regular basis to determine whether a stakeholder meets individual, government, and/or international GAP standards.

For sesame production, the farmer's guide produced displays a set of recommendations that can help to improve the quality and safety of the produce grown. The purpose of the manual is to provide farmers/producers, processors and exporters with the requisite knowledge and skills to strengthen the productivity, improve competitiveness and supply identified markets. This will enhance good quality production, create job opportunities and help in poverty alleviation. The Farmer's guider can be found as **Annex I** of this report.

The purpose of the manual therefore is to provide farmers/producers and marketers, and middlemen with the requisite knowledge and skills, strengthening the productivity, improving competitiveness, supplying identified market outlets with good quality product and thus enhancing the income and thereby well-being of farmers/producers. It is designed in a way that extension agents, trainers and other interested users would also find it beneficial.

Finally, NEPC contracted, with their own resources, Mr. Senyo Kpelly, Global Shea Alleance (GSA) consultant, to produce simple illustrative manuals on how to produce Good Quality Shea nuts and Shea Butter used for training purposes. The material complements the manuals developed under the STDF project. NASPAN, as product association for shea, makes use of the manual/chart for training purpose for sheabutter women groups with permission from NEPC. The manuals/charts are produced and displayed at operational centre (visible in the Saki centre).

1.4.3 Recommended Codes of Practice on the Nigerian Sesame Seeds and Sheanuts

Under this activity, two sets of documents are produced:
(1) Recommended Codes of Practice on the Nigerian Sesame Seeds;
(2) Recommended Codes of Practice on the sheanut/butter. The documents focus on GAP, GHP, GWP, SOP for processing and transportation system of the produce.

SESAME SEED

The Nigerian Code of Practice for Sesame Seed (Sesamum indicum L) – NCP 036: 2013 was developed by the Technical Group (TG) for oil seeds. Sesame seed (Sesamum indicum L) has wide application in food, feed and cosmetic industry with a great potential to contribute on Nigeria's economy. Due to poor practices in the production and handling, sesame seeds are often contaminated with fungi (Aspergillus spp), leading to the presence of mycotoxins exceeding the limits. In order to limit fungal growth and ensure consumer safety, the Code of Practice was developed. It provides guidelines on cultivation, harvesting, storage, packaging and transportation of sesame seed.

The Code of Practice can be found as **Annex J**. It consists of the following:

- The study scope
- Normative reference
- Terminology
- Pre-season activities
- Site selection
- Seed selection
- Land preparation
- In-season activities
- Sowing of sesame seed
- Fertilizer application
- Weed control
- Disease and pest control
- Harvesting
- Post-harvest activities
- Threshing
- Cleaning
- Drying
- Packaging
- Storage
- Transportation

SHEANUT/BUTTER

The Nigerian Code of Practice for shea nuts/kernels and shea butter (unrefined) – NCP 035: 2013 is developed by the Technical Committee for shea Products. Pure unrefined shea butter has nutritional, medicinal and cosmetic properties leading to its increased demand locally and internationally for the confectionary, cosmetic and pharmaceutical industry.

It is important that the intrinsic characteristics of unrefined shea butter, such as high levels of total fat, antioxidants, unsaponifiables, are maintained, as well as factors as high moisture content leading to free fatty acids, peroxide value, odour are limited. Besides the good practices, some of processing methods and handling practices may also have negative effects on the intrinsic properties.

The guidelines outlined in the Nigerian Code of Practice for shea nuts/kernel and shea butter are based on the best processing practices from the shea belt in Nigeria. It defines critical techniques and control points that must be improved and adhered to, in order to ensure high quality for consumer and comply with the industrial requirements of the shea products.

*The Code of Practice can be found as **Annex K**. It consists of the following:*

- Normative reference
- Terminology
- Preparation and storage of dry kernels
- Collection and picking
- Accumulation
- De-pulping
- Washing

- Heating/boiling and drying
- Cracking of nuts
- Sorting of nuts
- Drying of nuts
- Packaging/storage
- Inspection
- Preparation of the butter
- Cleaning
- Crushing
- Roasting
- Milling to paste
- Extraction
- Clarification
- Conditioning
- Packaging
- Documentation
- Record keeping and traceability
- Cleaning
- Drying
- Packaging
- Storage
- Transportation

Figure 2: Shea Kernel Process Flow Chart

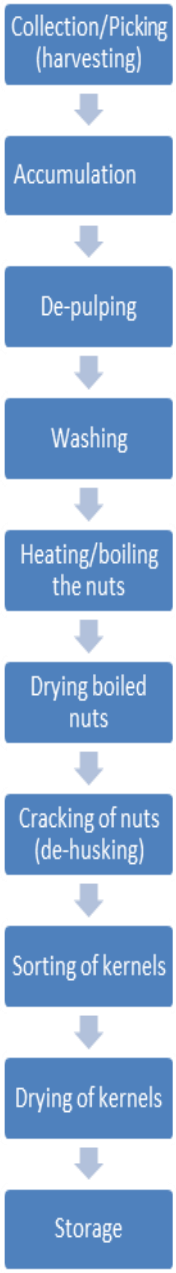
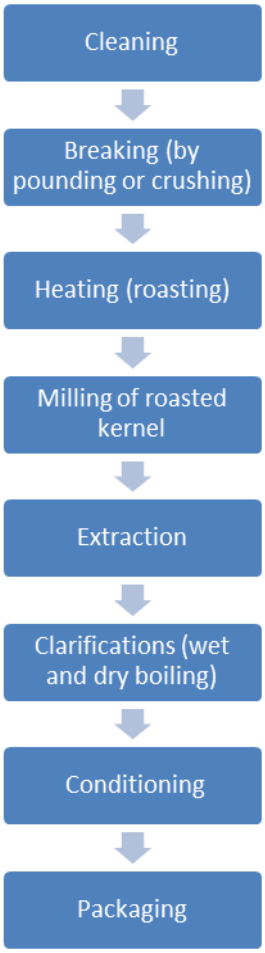


Figure 3: Shea Butter Process Flow Chart



MAIN RESULTS UNDER THIS OUTPUT

Under this project activity, the project contributed to improve documentation and knowledge on the current practices of quality and food safety controls for Nigeria sesame seeds and shea products for export through the following:

- Four reports, covering both sesame seed and shea products, are reproduced. Each of them explains current practices in Nigeria on production, commercialization, quality control issues and recommendations for implementing quality, food safety control systems
    - Socio-economic characterization of the Nigerian sesame
    - Socio-economic characterization of the Nigerian sheanut/butter value chains
    - Physico-chemical and biological characterization of the Nigerian sesame seed
    - Physico-chemical and biological characterization of the Nigerian sheanut/butter

- Two documented reports on simple predictive control of fungi and aflatoxin in sesame seed and shea nut/butter production chain
- Updated national standards on sesame and sheanut/butter
    - Nigerian Industrial Standard Sesame Seed (Sesamum indica L) – NIS 580: 2013.
    - Nigerian Industrial Standard (NIS) for shea Nut/Kernels – NIS 572: 2013
    - Nigerian Industrial Standard (NIS) for shea butter (unrefined) – NIS 571: 2013
- Two sets of Recommended Codes of Practice on the Nigerian Sesame seeds and shea nut/butter:
    - Nigerian Code of Practice for Sesame Seed (Sesamum indicum L) – NCP 036: 2013
    - Nigerian Code of Practice for shea nuts/kernels and shea butter (unrefined) – NCP 035: 2013
- Updated Farmers' Guide for the production and post-harvest handling of sesame products in Nigeria
- Sets of Manuals on Good Practices for the production, processing and transportation of sesame and shea nuts.

5.3 OUTPUT 2 – QUALITY CONTROL AND TRACEABILITY

This objective focused on:

a) Implementation of robust field quality control system for Nigerian sesame and Shea product
b) Implement an improved contractual laboratory analysis and certification for quality control systems for sesame and shea products to meet importing country standard requirements.
c) Fabrication and installations of processing and storage equipment and establishment of Critical Control Points in the aflatoxin reduction, HACCP and Traceability Systems within the Nigeria shea nut and sesame seed production and supply chain

Activity 2.1.1 PROCUREMENT/CONSTRUCTION OF MACHINES

The result of this activity is to produce a robust field quality control system for both products and to involve the procurement of processing equipment needed for improved quality. The equipment procured by the project is listed below:

(A) MACHINES

Machines for sesame seeds

- Integrated Sesame Seed Cleaning Machines (ISSCM)
- Harvesters
- Silo (1metric ton capacity)
- Weighing scale
- Sealing machine

Components of the integrated sesame seed cleaning machine

Weighing scale

Harvester and tarpaulin

Machines for shea nuts

- Modified Imex engine
- Milling machine for nut
- Milling machine for cereal
- Crusher
- Roaster
- Churner
- Dehuller
- Dryer
- Dehydrater
- Clarifier
- Cream washer
- Butter washer

Sheabutter processing equipment

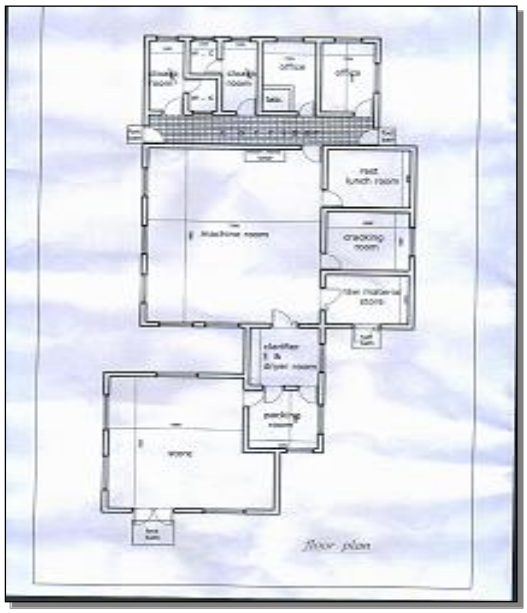
Under ITC`s supervision, a technical working group was formed to design this activity. The WG comprised of the following members: NEPC, NCAM, NSPRI, NCRI, IITA, NSSAN and NASPAN. Four meetings were held to finalize the needs and procurement process of the equipment purchased. The equipment purchased consists of four sets of shea processing equipment, comprising 12 machines each. The equipment was purchased by PTAA Benin Republic. The services of the equipment producer included installation, training of the staff and test run on the spot. This was done between October 2011 and February 2013. The capacity of the machine is to process 500kg shea butter/day.

The TG on machine fabrication inspecting a fabricator's shea butter equipment

After exhaustive deliberations, the TG decided that driers were not required for sesame seed, instead an Integrated Sesame Seed Cleaning Machine (ISSCM) that can clean sesame seeds is needed to reach the required level of quality for international market compliance. A producer in Kano State in Nigeria (Alkali International Limited) was contracted to produce 4-sets of ISSCM, one for each site. The contract agreement included installation, test-running and training of 4-personnel per site. The procurement was completed and machines delivered, installed and tested between before March 2013. It is completed that the ISSCM has the capacity to process and clean 15metric tons of sesame seed per day.

(B) ESTABLISHMENT OF THE PROCESSING FACILITIES

The STDF project proposal did not consider the provision or building of shelters for the fabricated processing and cleaning equipment in the host communities. In order to include that, NEPC paid a series of advocacy visits to the States to solicit support to build the shelters. NEPC engaged an architect for the design of the layout and the planning. NAFDAC provided inputs to this site plan to ensure compliance with GMP. The plan was consequently provided to the other States to aid in the construction of the shelters. The local government funded the project idea. NEPC supported the construction of the shelters in Saki Town, Oyo State to serve as a model and to motivate the other States to commence the construction.



Site plan for the shelter

STDF building in Saki Town

STDF building in Anyagba

STDF building in Bama


The TG inspecting on-going fabrication at PTAA's workshop in Benin Republic


Delivery of sheabutter equipment to Saki

The below table provides the list of the location of the processing facilities identified for the provision of the equipment. More detailed information on the centres can be found in the report in output 5.

Table 15: Processing centres of the project

S/N	LOCATION	Value Chain
1.	Saki Town, Oyo State	Sheabutter
2.	Tsamiya Town, Kebbi State	Sheabutter
3.	Kaiama Town, Kwara State	Sheabutter
4.	Babagi Town, Niger State	Sheabutter
5.	Anyagba Town, Kogi State	Sesame seed
6.	Suntai Town, Taraba State	Sesame seed
7.	Gbajimgba Town, Benue State	Sesame seed
8.	Bama Town, Borno State	Sesame seed

Activity 2.1.2 ESTABLISHMENT OF HACCP

This activity was expected to lead to the identification of hazards and establishment of critical control points (CCP) in processing of sesame seed and shea nut/butter. I was also expected to lead to the establishment of a monitoring system for HACCP, establishing corrective actions, verifications, documentations and good record keeping for sesame seed and shea products. The activity was assigned to and carried out by NAFDAC between 2011 and 2013. Three reports were generated and submitted with subsequent technical inputs from the IC and the ITC:

i. HACCP Plan for Sesame seed
ii. HACCP Plan for Shea nut
iii. HACCP Plan for Shea butter

(i) HACCP PLAN FOR NIGERIAN SESAME SEED

The report emphasises on Hygiene, Good Agricultural Practices (GAP), Pest Control, Good Handling Practices (GHP), Good Warehousing Practices (GWP), and Good Manufacturing Practices (GMP) in process of mechanised cleaning.

The HACCP Plan for Sesame Seed includes the following steps:

- Task 1: Select the HACCP Plan Drafting Team
- Task 2: Describe the Product
- Task 3: Identify Intended Uses
- Task 4: Construct Flow chart
- Task 5: Project Intervention Flow chart
- Task 6: Hazard Analysis
- Task 7: Determining CCP
- Task 8: Establish Critical Limits
- Task 9: Establish Monitoring Systems
- Task 10: Establish Corrective Actions
- Task 11: Establish Verification Plan
- Task 12: Establish Documentation and Record Keeping

(ii) HACCP PLAN FOR NIGERIAN SHEA KERNELS

The shea tree is known to be grown wildly in Nigeria, where fruit collection and processing are undertaken mostly by women and children. During the collection process hazards are identified to occur. The latter include physical, biological and chemical nature.

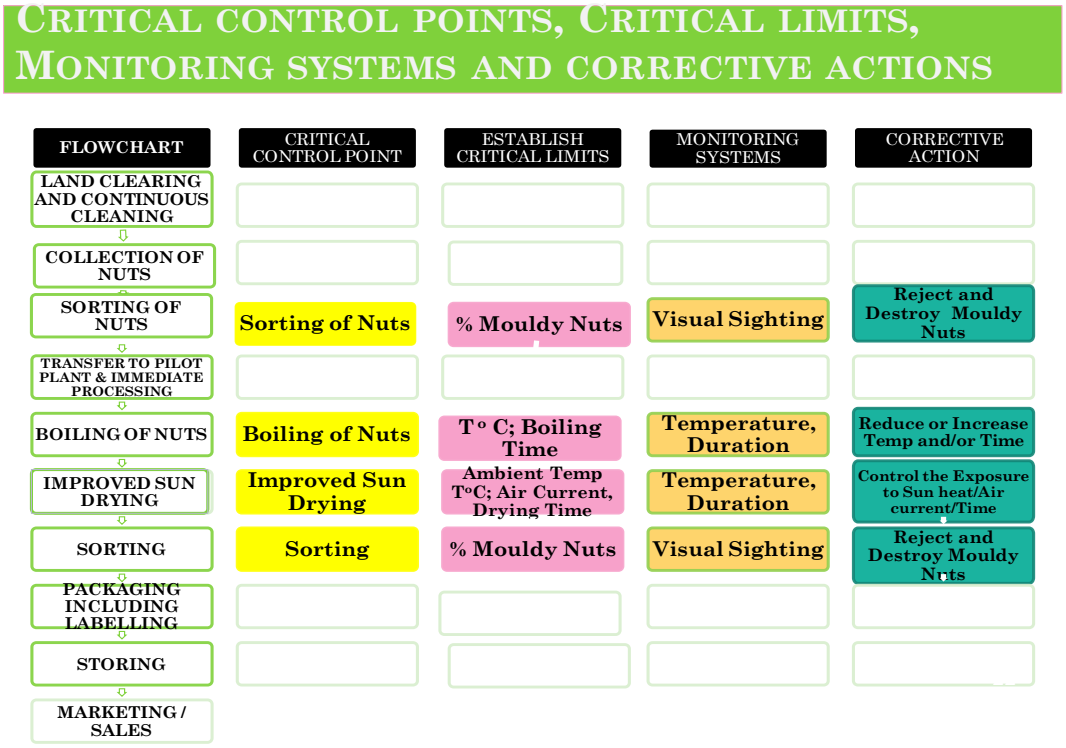
Identified possible physical hazards in addition to snake venoms, include contamination with animal dropping and virus from wild rodents; contamination from the environment during drying such as dust and tree twigs. Chemical hazards may include aflatoxins as metabolites from fungi, residues of pesticides and fertilizers from used bags, polycyclic aromatic hydrocarbons (PAHs) arising from smoke deposition and possible presence of high levels of heavy metals from inherent chemical properties of the kernel.

HACCP Plan for Shea Kernels includes the following:

- Task 1: Select the HACCP Plan Drafting Team
- Task 2: Describe the Product
- Task 3: Identify Intended Uses
- Task 4: Construct Flow chart
- Task 5: Project's Intervention: Flow chart
- Task 6: Hazard Analysis
- Task 7: Determining CCP
- Task 8: Establish Critical Limits
- Task 9: Establish Monitoring Systems
- Task 10: Establish Corrective Actions
- Task 11: Establish Verification Plan
- Task 12: Establish Documentation and Record Keeping

Figure 3 presents the Critical Control Points, the Critical Limits and Corrective Actions for Dried Shea kernel Production.

Fig. 3: Critical Control Points, Critical Limits and Corrective Actions for Dried Shea kernel Production



(iii) HACCP PLAN FOR NIGERIAN SHEA BUTTER

A HACCP based approach was used during the baseline study of the value chain of shea butter production in Nigeria. This study addressed the challenges of safety and quality of the products for the purpose of trade promotion on international market and creating more awareness on safe practices internally. The study involved collaboration with various groups, stakeholders, government and regulatory body representatives. It also demands a paradigm shift from existing way of practice; encouraging formation of strong rural association of women producers, buyers and local end users; and focussing attention of inspectors to safety and quality issues.

The findings (**Annex L**) were presented and recommended interventions were made periodically to the HACCP Team for scrutiny and reviewing. HACCP-based flowchart incorporating newly introduced equipment and improved units' operation steps was drawn after consultation with equipment manufacturers and extension workers and approval by the HACCP Team. Shortly after installation at Pilot Plants in Selected Production Areas and test running, training was carried out to introduce the areas of project intervention to the selected group.

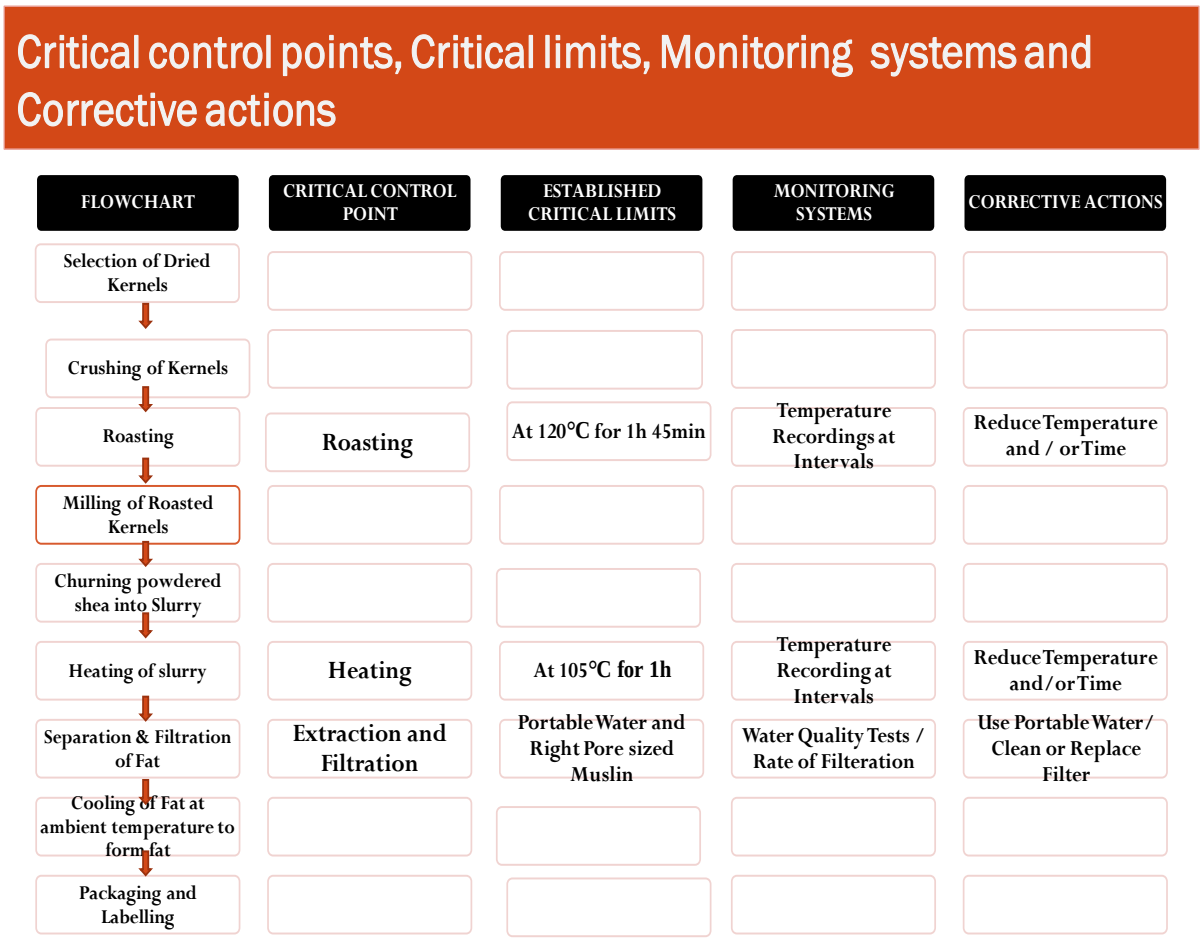
The study on the HACCP system on shea products in Nigeria was conducted and reviewed periodically with the HACCP team. The HACCP-based flowchart incorporating newly introduced equipment and improved units' operation steps at the processing sites was drawn. The plan was reviewed in consultation with the equipment manufacturers and extension workers prior to get it approved. As a result, a report- presented as **Annex L**- is produced. The report reflects HACCP flow chart and recommendations. Once the HACCP plan was prepared, staff was trained on the newly designed HACCP system, using the equipment installed under this project at the processing sites.

The steps under HACCP plan are described below:

- Task 1: Select the HACCP Plan Drafting Team
- Task 2: Describe the Product
- Task 3: Identify Intended Uses
- Task 4: Construct Flow chart
- Task 5: Project's Intervention: Flow chart
- Task 6: Hazard Analysis
- Task 7: Determining CCP
- Task 8: Establish Critical Limits
- Task 9: Establish Monitoring Systems
- Task 10: Establish Corrective Actions
- Task 11: Establish Verification Plan
- Task 12: Establish Documentation and Record Keeping

Figures 4 presents the Critical Control Points, Limits and Corrective Actions for Sheabutter Production

Figure 4: Critical Control Points, Limits and Corrective Actions for Sheabutter Production



(iv) CONCLUSION ON HACCP FOR SHEA KERNEL AND SHEABUTTER

The project identified 16 improved processing recommendations: seven in the kernel processing and nine in the butter processing stage. The interventions are basically in the areas of good hygiene, good manufacturing practices and process control; while some border on good agricultural practices. The machines at the processing sites were introduced to minimise human contact with the product; other interventions were based on adoption of improved practices over the existing methods of production.

For unrefined butter, three critical points have been identified:

- Roasting: a temperature of 120OC for a duration of 1 hour and 45 minutes
- Heating: a temperature of 105OC for 1 hour
- Separation of fat by filtrations and dehydration to reduce moisture and probability of recontamination and rancidity.

The monitoring system and required corrective measures include:

- Inspection of each batch
- Visual examination of the produce for percentage mould and rejection the batches that fail
- Change the heat treatment temperature when necessary
  - For boiling, monitoring the temperature and the duration which could be corrected by either reducing or increasing the heat and /or duration
  - Sun drying requires monitoring of ambient temperature, air current and the corrective measure will be reduction/increase of time or degree of exposure
  - For roasting and heating systems measures used for controlling boiling will also suffice
  - For separation and filtration, recording flow time and clogging of filter materials will serve for monitoring and replacement or cleaning of filter for corrective measures.

Verification and Documentation

The production system should be verified by regular inspections and application of necessary modifications. For each of the processing unit steps, records are recommended to include:

- % mouldy batches rejected;
- Record of receipt – name, source, date, quantity; date of production;
- Products distributed to stores and laboratory results on samples (moisture content, heavy metals, aflatoxins and FFAs).

Activity 2.2.3 Establishment of Traceability System (TS)

Traceability is a system intended to enable tracking of a product throughout the production, processing and distribution chain, from the source of raw materials and the supplier up to the final stage of consumption of the product by the consumer. This activity was aimed to establish a record keeping system and documentation. It was assigned to NAFDAC. A report detailing the traceability system for Nigerian sesame seed and shea products was released by the agency after 2 years of extensive field work (2011-2013). It detailed the definition, importance and key components of TS.

Traceability involves tracking and tracing and under this activity a clear traceability system is established. The document can be found under **Annex M.** This activity was undertaken by NAFDAC, where detailed information on the definition and key components of the traceability system on Nigerian sesame seed and shea products is provided. The report detailed the importance, key components, direction and principles of traceability.

The TS developed for Nigerian Sesame Seed emphasises the importance of the farmer and the extension officers in the areas of record keeping; it provides a template for the record keeping and the information required:

- At farm level (farm details, planting areas, land preparation, fertilizer application, record of pesticide used, record of harvest, semi-processing, packaging and sales)
- At buying agent level (farmer's details, store record, collation, sales and distribution record)
- At sea port/airport level by the exporter

The TS developed for Nigerian Sheanut/butter emphasises the important of record keeping at the nut picking and collection points by the women as well as the need for standardization, trained technical personnel and availability of capital. It provides a template for the record keeping and the information required:

- At plant entry level (record of picking, depulping the nut, processing, packaging and sales)
- At buying agent level (processing facility details, store record)
- At supplier's level (batching, sales and distribution record)
- At seaport/airport level by exporter

Figures 6 and 7 provides the Traceability Flow Chart in Sesame Seeds and Shea-nuts Supply respectively.

Figure 6: Traceability Flow Chart in Sesame Seeds Supply

Location	Process Flowchart	Information Required	Medium of Information
Farm	Planting	Farmer, Name of farm, Land preparation, history of pesticide used, fertilizer, source of seed, soil type	Farm record book/ Computer
Farm	Harvesting	Date, Method of harvest, pesticide treatment	Farm record book/ Computer
Farm	Semi Processing	Drying method, Sorting method, Cleaning method, Washing method	Farm record book/ Computer
Farm	Packaging	Packaging material, Date, Variety, Grade, Sources and Farm code No	Label record/ farm record book
Farm/Barn	Storage/Sales	Storage date, type of storage, store and product treatment, buyer's phone No	Store record book/ computer

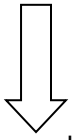
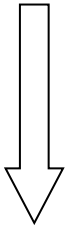
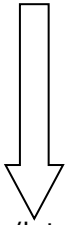
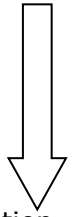
Location	Process Flowchart	Information Required	Medium of Information
Farm/Town	 Purchase and transport by supplier	Name and address of store, quantity, sources record, date of purchase, date of departure**,** distribution record, mode of transport	Store record book/supplier record book
Suppliers store /town	 Collation by Supplier	Farm code, batch number of sources, date marking, record of sales, destination and departure records**,**	Suppliers record book
Town	 Exporter/lots formation	Batch number of sources, sources record, new batch number, name of supplier, address of supplier, phone No, quantity	Exporters record book/Computers
Sea ports/air port	 Exportation	Shipping company, Destination record, quantity, Batch number of lot formed, date of departure, name of exporter, phone No	Sea port/air port record book

Figure 7: Traceability Flow Chart in Shea-nuts Supply

Location	Process Flowchart	Information Required	Medium of Information
Factory Gate	Receipt of Picked Kernels	Name of Picker, Location of Picking, Area Code, Conditions of Tree and Kernel,	Factory record book/ Computer
Raw Material Store/Room	Release to Production	Date, Details of Lots released for production	Store record book/ Computer
Production	Semi processing of Kernel	Records of volume of water used, temperature and duration of boiling	Production record book / Computer
Production	Sorting Weighing and Packaging Sorting Weighing and Packaging	% Rejects, Packaging material, Labelling (Weights, Date, Grade)	Production records
Finished Products Store	Storage Sales	Storage date, Quantity received, store and product treatment (if any)	Store record book/ computer

Location	Process Flowchart	Information Required	Medium of Information
		Name and address of buyer, Phone number and email address, Quantity Purchased and Price	Sales record book
Sales	Collation by Buyer	Batch number of sources, date making, area code, record of sales, destination and departure records	Buyers record book
Major Buyer	Exporter/lots formation	Batch number of sources, sources record, name of supplier, address of supplier, phone No, quantity, new batch number.	Exporters record book/Computers
Exporter in Town	Exportation	Destination record, quantity, Batch number of lot formed, date of departure, name of exporter., phone No, shipping company, phone No FPIS Inspector Stamp Information	Sea port/air port record book
Sea ports/air port			Government Records and Exporter's Record

Activity 2.2.3 ESTABLISHMENT OF SAMPLING PLAN

This activity was held to establish a sampling plan for sesame and shea nut/ butter. It was also assigned to and carried out by NAFDAC. It was conducted between 2011 – 2013. The report was produced and it is presented in **Annex N**. The objective was to obtain a representative sample from a lot for analysis, to determine the quality and condition of the product (shea nuts/sesame). This can be achieved when sampling is carried out by a trained personnel and using the right methods and procedure

The document consists of the following information:

- Objectives of the sampling
- Precaution to be taken
- The Sampling Method
- Preparation of Laboratory Samples
- Sample report
- Definition of terms

Contractual Laboratory Testing/Quality Control

This activity was based on a consultation between ITC and the IC, with input from the PSG. The PC and the IC undertook an assessment visit to NAFDAC laboratory to determine its suitability to carry out this task. It was agreed that NAFDAC should carry out this activity, since it holds the necessary capacity and has an ISO Certified Laboratory. The Contractual Laboratory Testing Agreement was agreed in principle with NAFDAC. The Agreement included conducting physico-chemical and biological analysis on samples from the eight centres established under the project for 6-months from date of commencement of operation. This would ensure that the products from the sesame seed and sheabutter centres are tested for compliance with food safety standard prior to export.

Main results achieved under this objective

- Installation of four integrated sesame seeds cleaning machines in the processing sites, each with capacity on processing of 15 metric tons per day, resulting in Aflatoxin reduction.
- Installation of four sets of twelve machines per set shea nut processing equipment in four processing sites. Each of them with capacity of processing 500kg of shea butter per day.
- Detailed standard operating procedures with training of operating personnel to use the equipment.
- 16 trained personnel are able to operate the shea butter processing equipment.
- 16 trained personnel able to operate the sesame seed cleaning machines.
- Establishment of processing sites with management structure in place.
- HACCP-based system for production of shea nuts in Nigeria.
- Production of templates for recording all the monitoring activities under the HACCP Plan.
- Production of documented Traceability System for (i) sesame seed and (ii) shea nuts.
- Production of documented Sampling Plan, including logistics for (i) sesame seed and (ii) shea nuts.
- Contractual laboratory analyses and certification system for quality control achieved for sesame and shea products.

5.4 OUTPUT 3: TRAIN PRODUCERS, TRADERS, EXPORTERS AND STANDARDS ENFORCEMENT OFFICERS TO ADOPT AND IMPLEMENT THE IMPROVED FOOD QUALITY MANAGEMENT SYSTEM

The core of this output is to train various stakeholders on the implementation of newly established HACCP and traceability system within the production and supply chain. In addition to the enhanced knowledge, stakeholders had the opportunity to build synergies and establish linkages for better trade.

ACTIVITIES CARRIED OUT UNDER THIS OBJECTIVE

Activity 3.1.1 TRAINING OF TRAINERS (EXTENSION WORKERS)

Two-day training on "Occurrence and levels of fungi and aflatoxin in sesame seeds and sheanut/butter" was delivered by the local experts from IITA, NCRI, SON, NASPAN, NSSAN and NSPRI in August and September 2013. The trainings were conducted in four locations for extension workers. The centres were: Saki centre for shea butter (27-28 August), Anyagba centre for sesame seed (30-31 August), Babagi (3-4 September) and Gbajimba (6-7 September).

The direct beneficiaries, nearly 200, were federal field extension workers, farmers, processors. The majority of the participants evaluated the training through written evaluation as between excellent and good. The training had spillover effect to transfer the knowledge to the state extension workers, other farmers and collectors from the regions. A booklet covering an overview of the project, occurrence of aflatoxin and impact health, trade and income and current practices was compiled by IITA for both sesame seeds and sheanut/butter and distributed to the participants. Detailed description is provided under **Annex O**.

ACTIVITY 3.1.2 TRAINING OF TRADERS, EXPORTERS AND STANDARDS ENFORCEMENT OFFICERS

Two-day training was anchored by NAFDAC for experts from SON, NEPC, NSSAN, NSPRI, where experts were trained on newly established HACCP and traceability system within the production and supply chain. The training took place in Lagos on 25 and 26 August 2013 attracting around 80 participants. Also, it allowed interactions amongst various key stakeholders of the Nigeria sesame and shea nut production chain. More detailed information can be found in **Annex P** in the Report on the Training Programme.

ACTIVITY 3.1.3 CAPACITY BUILDING WORKSHOPS

This activity was not foreseen in the project document, but was conceived and funded by the implementing agency - NEPC - to fill in some gaps identified throughout the project implementation. It was noted that there was no specified training or capacity building programme for the major beneficiaries, i.e. the sesame seed farmers and the shea butter women processors.

Via this activity, it is aimed for the extension officers to become master trainers abled to reach out farmers, and to build and develop the capacity of the direct beneficiaries (sesame seed farmers and shea butter women processors).

The following workshops were conducted:

- In 2012, the NEPC contracted a renowned Global Shea Alliance (GSA) consultant on shea quality, Mr. Senyo Kpelly to conduct a two-day capacity building workshop for the shea butter women processors in Oyo, Kwara and Kebbi States. About 600 women were trained.
- Between 2011 and 2012, NEPC engaged NCRI (The Institute on Development of Sesame Seed in Nigeria) and NSSAN, to train sesame seed farmers in Benue, Kogi and Taraba on new propagation techniques for sesame seed. This technique is based on increasing yield per hectare of sesame seed through sand propagation.
- In 2014, NEPC organised capacity building workshop for the female shea butter producers and sesame seed farmers in Saki Town and Anygaba Town. The trainers included STDF team members, as well as members from NAFDAC, NCRI, NSSAN and NASPAN.

Later in 2015-2016, after the project ended, NEPC conducted different training for the processing centres; in particular in Benue and Kwara States to enable them to kick-start activities. About 350 sheabutter women processors from Kaiama town and neighbouring town and villages participated in Kaiama, while about 300 participants comprising sesame seed farmers, traders, extension agents, financial service providers and ancillary service providers participated in Gbajimba. • The faculty included resource persons from NAFDAC, National Sesame Seed Association of Nigeria (NSSAN) and National Shea Products Association of Nigeria (NASPAN), who were all active participants in the successful implementation of the project. Detailed information on this activity **Annex Q**.

Banner of NEPC organised capacity building workshop in Saki and Anyagba

Participants (sheabutter women processor) at the workshop in Saki

Dignitaries at the workshop

Participants (sesame seed farmers) at Anyagba

The PC delivering the keynote address

PC donating improved seedlings to the farmers

MAIN RESULTS ACHIEVED UNDER THIS OUTPUT

- 190 master trainers mainly represented by Extension Workers trained on best practices for ensuring safe and quality production of sesame and sheanuts/butter
- 80 traders, exporters, standards enforcement and regulatory agency officers trained to ensure safety and quality in the production and trade of the produce
- About 1,000 trained shea butter women processors who are capable of producing good quality sheabutter.
- About 1,000 trained sesame seed farmers trained on propagation methods who have imbibed new method of propagating sesame seed as witness by increased yield from the 2014 harvest.

5.5 OUTPUT 4: INFORMATION SHARING AND EMPOWERMENT

This output is centred on disseminating project information, studies and results to all stakeholders by appropriate tools in order to ensure visibility of the project and relevant technical information. This was achieved through implementation of information systems, training courses, website development and technical publications.

The following audience was reached:

- All the participants of the project including private and public stakeholders of the Nigerian sesame and shea value chain.
- Different key stakeholders of the Nigerian sesame and shea value chain.
- Technical community including institutions and research centers.
- Regulatory authorities
- Non-Governmental Organizations.

ACTIVITIES CARRIED OUT UNDER THIS OUTPUT

ACTIVITY 4.1.1 DEVELOPMENT A PROJECT SPECIFIC WEBSITE

The NEPC engaged the services of a renowned ICT expert, Altracom Ventures, to create a website for the project - www.sesame-shea-stdf172.org.ng. The website had regular updates on project activities, information on studies conducted, press releases, workshops, training events, seminars and various publications. The website contained logos of the supporting organisations within the STDF programme, hyperlinks to their websites and other stakeholders` names. The webpage was active for 30 months, but due to lack of finances after extension of the project it was terminated. The sustainability of the website is considered by NEPC, in case additional financial resources are available. NEPC is working on merging it and hosting the project on its website.

ACTIVITY 4.1.2 PRODUCTION OF INFORMATION BROCHURES AND POSTERS

The purpose of this activity was to reach broad audience and bring awareness on the activities not only for the direct project beneficiaries, but also for other stakeholders in the shea nut and sesame value chain in Nigeria. A series of leaflets, brochures and fliers describing project activities were produced and distributed to the project beneficiaries. These publications were produced in simple language and easily readable by non-specialists for the purpose of disseminating information on the project implementation. This activity provided the project with enormous publicity mileage and increased the public awareness of the project, resulting in increased request by private sector partners to be involved and buy-in to the project outcomes.

Initially this activity was assigned to NAERLS during the start-off meeting in October, 2010, but the agency's inability to commence due to internal restructure necessitated the NEPC through the secretariat to undertake this activity with inputs from the key stakeholder partners. This activity was carried out under the direct supervision of NEPC.

The project was featured in ITC booklet on impact stories: http://www.intracen.org/news/itc-impact-nigeria/.

ACTIVITY 4.1.3 ADVERT, TV AND RADIO PROGRAMME

Under this activity, NEPC produced a series of radio advertisements in local language and English that was placed widely in the sesame seed and shea producing areas to disseminate information on the project and raise awareness. NEPC also carried out a series of announcements on the television via audio-visual documentary on the project.

MAIN RESULTS ACHIEVED UNDER THIS UTPUT

- Increased awareness on the project and on the improvement in the qualities of traded Nigerian sesame and shea nuts through press, radio and TV.
- Papers, reports and guidelines on the project were made available and widely circulated.
- Information on the improved system to ensure food safety and quality widely disseminated and distributed for each commodity.
- Design of a functional website, regularly updated on the project activities.

- Project promotional items widely disseminated to build awareness on food safety and quality, e.g. flyers, jingles, banners, etc.

5.6 OUTPUT 5: COLLABORATION AND SUSTAINABILITY

Under this output, a number of meetings were held to co-ordinate the implementation and execution of the project activities by the different partners as well as follow-up progress on the activities to ensure the effective execution of the work plan (review of the technical results and possible bottlenecks to be solved). For this purpose, four major meetings were held where implementation of the activities and progress was discussed (start-up meeting, first workshop, mid-term progress meeting, and a final end of project evaluation workshop).

This objective also strengthened the public-private dialogue and partnerships in the Nigeria shea nut and sesame seed sector. It helped to develop and institutionalise a process to control quality and safety including traceability in the value chain with participation of key stakeholders and directly impacting the major beneficiaries. It also assisted in developing a strong ownership within the farmers' community and a culture of excellence in providing high value and safe products to the international markets.

ACTIVITIES CARRIED OUT UNDER THIS OBJECTIVE

ACTIVITY 5.1.1 PROJECT COORDINATION AND START-UP MEETINGS WITH KEY STAKEHOLDERS

The first meeting was held on 14 October 2010 in Abuja to kick-start the commencement of the project with the participation of key representatives of the project partners. The objective of this meeting was to plan and organize the implementation and execution of the project activities by the different partners, including administrative, financial and technical issues. It was followed up by a kick-off meeting that included a workshop to synthesize and discuss the current context of the Nigeria sesame and shea nut sector. This meeting with the major project partners, including participation of ITC supervisory agency, and other key stakeholders from the public and private sector presented an opportunity for the different teams to meet, get to know each other better and understand their respective activities. It was chaired by the Project Co-ordinator (PC) and had about 25 participants in attendance.

ACTIVITY 5.1.2 MID-TERM PROGRESS MEETING

A mid-term progress meeting was held In February 2012 in Abuja to reflect the objectives achieved under the project. The meeting was attended by ITC Adviser on Export Quality Management, project partners and key stakeholders from the Nigerian sesame and shea nut production chain. During the meeting, project activities, burdens and possible solutions were discussed. In addition, field, laboratory and technical results were reviewed, analysed and interpreted; and solutions to the possible production chain bottlenecks considered. Administrative and financial issues were also addressed.

ACTIVITY 5.1.3 PROJECT COMPLETION EVALUATION MEETING

A two-day final workshop was organized at the end of the project in Abuja with the participation of all the project partners and other key stakeholders of the Nigerian sesame and shea nut production chain. It took place in May 2014 and was chaired by the PC with the technical assistance of ITC Adviser on Export Quality Management, the IC on quality and a representative of the STDF partner institution from Nigeria. The workshop circulated reports over the conclusions generated by the project to federal and international community. There was demonstration on the safety management tools (good practices, fungi and aflatoxin control). A communiqué was produced, read, amended and validated by stakeholders.

The workshop also assisted in identifying milestone achievements, project impact on food quality, initial impacts of increased exports, lessons learned, and strategies for sustainability in ensuring good quality of sesame and shea products in Nigeria. The workshop was a good occasion to happily celebrate the signature of the MoU between investors and farmers' communities of two processing sites (for more information see Activity 5.1.4 Sustainability of the project). This was a motivation for other investors to express interest in other centres.

The final workshop was well received by all the participants and high interest was expressed by the attendance of 80 participants. More detailed information on this can be found in **Annex R**.

ACTIVITY 5.1.4 SUSTAINABILITY OF THE PROJECT

This activity was not included in the project document but arise as a result of the need to ensure that the achievements of the project are sustained. The eight processing centres built, equipped with equipment for sesame seed and sheabutter, would require further maintenance in form of managerial and technical know-as well as funding for operational purpose. These centres were intended for the usage of the producing communities, in particular women. To ensure sustainability, the NEPC through the development of a Public-Private sector Partnership (PPP) strategy, conducted a selection of suitable qualified investors based on their capability, credibility and their ability to manage the sites as recognized reference export production centres for sheanut/ butter and sesame seed.

For this purpose, an MoU was designed under the legal advice of Mr. Neil Horner, lawyer from the US based law firm Sidley Austin LLP and Nigerian lawyers. Sidley served as pro-bono counsel to the cooperatives related to the management structure and operations of shea butter and sesame seeds processing site in cooperation with Nigerian lawyers. The MoU was considered to clarify the duties and responsibilities of the managing company that would take the lead in the operationalization of the sites and the communities. The process of development of the MoU was led under the direct supervisor of NEPC and ITC`s assistance. NEPC facilitated the visit of the lawyer from Sidley Austin LLP, to visit two centres (Saki, Oyo State and Anyigba, Kogi State), who met the cooperatives and the selected investors, resulting in the preparation of a workable and acceptable MoU for the management of the centres.

The first MoU between the NEPC, selected Investors and the representative of the Cooperatives for the centre in Oyo State (for sheabutter) and Kogi State (for sesame seed) were signed in May 2014 during the end of Project Completion Evaluation Meeting in Abuja. The ceremony was held in the presence of stakeholder partners, the ITC representative, the STDF member for developing countries in Nigeria as well as the IC. An MoU for four other centres in Benue and Taraba States (for sesame seed) and Kebbi and Kwara States (for sheabutter) were signed later in December 2014.

The project's successful implementation and its sustainability model attracted the interest of Tony Elumelu Foundation (TEF)[3]. TEF engaged Mr. Lawi Laktabai (a Kenyan studying in USA), serving as an intern for TEF, to embark on a three-month evaluation study of the project. The evaluation was done via visits to the centres in Saki Town (on shea butter) and Anyagba Town (on sesame seed) and extensive interviews with project partners. The Tony Elumelu Foundation (TEF) evaluation report commended the successful implementation of the project, its adopted sustainability model and made recommendation for partnership between the TEF and NEPC towards replication of similar processing centres as well as improving the current ones. The report can be found in **Annex S**.

Since the completion of the STDF project in 2014, NEPC has been following up on the sustainability model of the centres, by liaising with the investors, the cooperatives, and relevant stakeholders. NEPC facilitated training and links with buyers. The table below (Table 16) provides an updated status of the progress in each centre.

[3] http://tonyelumelufoundation.org/

Table 16: Current status of the processing centres of the project (January 2016)

S/N	LOCATION	INVESTOR	STATUS	REMARKS
1.	Saki Town, Oyo State (Sheabutter)	Shea Origin Nigeria Limited Mrs. Mobola Sagoe Email: mobola@sheaorigin.com mobola@icloud.com Telephone: +234-8034446007	Fully operational with the co-operatives and the investor jointly managing the centre and adherence to food safety quality management system. NAFDAC commenced registration of centre to certify products and first export to Shea Radiance in the USA in November, 2015.	NEPC's continuous support (financial and moral) has ensured the success of the centre
2.	Tsamiya Town, Kebbi State (Sheabutter)	Bilmor Nigeria Limited Hajia Bilikisu Magoro e-mail: bilmorn@yahoo.com Telephone: +234-8033139620	Centre is yet to be fully operational. Building is ready and machines installed but State yet to provide water and perimeter fencing. NEPC wrote to State Governor in January 2016 to seek his assistance towards full commencement of operation.	NEPC is seeking the state government intervention to ensure immediate commencement of operation
3.	Kaiama Town, Kwara State (Sheabutter)	Itiafa Consulting Limited Mr. Rotimi Agbogun e-mail: agbogunrotimi@yahoo.com Telephone: +234-8163307704	The Local Government decided to rebuild another centre, which is 80% ready, machines installed and cooperatives awaiting commencement. Training for co-operatives were organised 27th January 2016 by NEPC in preparation for commencement of operation (NAFDAC and NASPAN were trainers), also new partners and investors have shown interest and discussion on ongoing.	Centre will soon become fully operational as investor and the local government are discussing on completion of the shelter while NEPC will provide technical assistance
4.	Babagi Town, Niger State (Sheabutter)	Nil	Yet to be given to any investor. NEPC still seeking proven investor but the women cooperatives are using the machines currently in the centre which is ready with all necessary facilities.	Women co-operative using the centre for sheabutter production (40% operational)
5.	Anyagba Town, Kogi State (Sesame seed)	Nivik Investment Limited Mr. Victor Iyama e-mail: nivik2investment@yahoo.com Telephone: +234-7033924936	Centre is fully ready with installed equipment, but yet to become fully operational due to some issues between the cooperative and investor which have been resolved.	Partial operation on-going
6.	Suntai Town, Taraba State (Sesame Seed)	Shebag Nigeria Limited Mr. Sherif Balogun e-mail: sbalogun@hotmail.com telephone: +234-8036484132	Centre is fully ready with installed equipment, but yet to become fully operational due to logistics challenges.	Yet to commence operation.
7.	Gbajimgba Town, Benue State (Sesame seed)	Gisab Nigeria Limited Mr. Michael Iordye e-mail: michaeliordye@yahoo.com Telephone: +234-8035659495	Centre is fully ready with installed equipment, capacity building program (NAFDAC and NSSAN were the trainers) was organised for the co-operatives and investor on 25th January, 2016 in preparation for full commencement of operation	Commencement of operation after the training, investor is seeking some form of assistance from NEPC.
8.	Bama Town, Borno State (Sesame seed)	Nil	Shelter was fully built and machine delivered but yet to be installed due to the security challenges in the Borno axis where the insurgency was at full strength	Not operational.

In order to follow up on the progress made by some of the processing plants NEPC and ITC collected feedback on the functionality of the sheabutter centre in Saki, Oyo State, with the investor, Ms Mobola Sagoe, Managing Director Shea Origin Ltd. A recent feedback highlighted the following:

- the volume being produced at the centre in 2016 has reached 1ton/ week when the centre is in its full production
- the income generated is multiplied 10 times in comparison to 4 years ago, before the project implementation commenced
- employment rate is 100 women and 5 men helping to operate the machines and to secure the facility
- shea nut pickers in the neighbouring villages, that support the centre, have been trained on quality and safety requirements
- the centre recently received NAFDAC certification

Shea Origin has been actively involved in boosting the development of shea farming growth and investment in processing centres at the village level such as the one in Saki. Shea Origin, in collaboration with the National Shea Products Association of Nigeria (NASPAN) and with the support from the USAID Nigeria Expanded Trade and Transport (NEXTT) Program organized a two-day Shea sector development conference with the theme “Shea Sector Development in Nigeria - Challenges, Gains & Prospects” for more than 170 stakeholders. The event was aimed at addressing the challenges, gains and prospects for the industry, with particular focus on women empowerment and investments in processing centers at the village level to produce export-quality Shea butter. The workshop was an occasion to build awareness on quality standards for international markets, and promote the SON national standards developed under the STDF project. The report by SheaOrigin is available as **Annex V**.

The PC, Mrs. Osibo (2010-2013) and some representative of the collaborating institutions

Visit of the IC, Dr. Doko to Saki

Commissioning of the Saki centre

Representative of ITC, Ms L. Ghizzoni, NEPC former PC, Mrs. Osibo & IC, B. Doko at the commissioning

The Saki community at the commissioning ceremony

Visit of the Sidley lawyer (Neil Horner) on MoU drafting and finalisation to Saki and Anyagba

Neil Horner inspecting the sesame seed cleaning machine in Anyagba

From right: **former PC Mr. Ibrahim, IC Dr. Doko, ITC rep Ms L. Ghizzoni, rep. ED/CEO NEPC, the PC, Mr. Otowo and the rep. of STDF developing coutries, Mrs. Oraka, at the final workshop**

Participants at the final workshop in Abuja

The Saki centre parties at the MoU signing

The Anyagba centre parties at the MoU signing

The NEPC, investors and cooperatives at MoU signing for four centres in Abuja

Evaluation visit of the TEF to the Saki centre

Women processor at Saki centre

MAIN RESULTS ACHIEVED UNDER THIS OUTPUT

- Meetings and workshops provided great networking opportunities between the project stakeholders to boost the development of the sesame and shea value chains.
- Strengthened public-private dialogue and partnership in the Nigerian sesame and shea nut/butter sector.
- Stable collaboration between NEPC (implementing agency), ITC (supervisory agency), STDF (donor) and other partners in the implementation of the project.
- A partnership between private investors (i.e. exporters, producers, cooperative members from the sites), cooperatives and NEPC (as controlling body) is developed for managing the processing sites and share the operational costs and profits.
- An MoU has been developed as a model, with the support of Sidley Austin Law Firm on a pro-bono basis, that was signed between partnering parties and investors.
- Eight states benefited, attracting support from local government, communities and other relevant institutions for the first time in a project in Nigeria.
- Attraction by international buyers and donors to the sector
- Improved job opportunities and income generation, in particular for the women, operating and supplying the processing centres

6 FINANCIAL OVERVIEW

Table 1: Budget overview

Description	STDF Contribution (US$) 65%	NEPC Contribution (US$) 35%	Total (US$)	% of Total project cost
Projected Total project Budget (USD)	324,240 (15,000) [2] 339,240	180,800	505,040	100%
Increased Total project Budget (USD)	364,249 (including additional 40,000.00)[3]	-	545,040	-
Total expenditure to date (USD) including Additional funds	333,555	200,096	533,651	
Current balance with NEPC (Expenditures-inflow)	15,862			
5% Balance of STDF WTO Contribution (USD)	16,212			5%
Unremitted funds to date	32,074[4]			

Table 2: Five instalments (95% of total budget from STDF + 100% of total budget from NEPC)

Description	STDF contribution (US$)	NEPC contribution (US$)
Total sum received from STDF & NEPC to date	349,417	180,800
Total expenditure from STDF & NEPC contributions to date	333,555	200,096
Unspent funds of the instalments to date	15,862	(19,296)

[1] Extension of project duration from October, 2010 to September, 2013 was granted by the WG meeting.

[2] The total STDF contribution is USD 339,240 including USD 15,000 to cover ex-post project evaluation. The total project budget is USD 520,040 including ex-post project evaluation.

[3]Additional USD 40,000 was approved and released by WTO/STDF, which was included in the total sum received to date.

[4] USD 32,074 is the unremitted funds to date consisting of 5% balance of STDF-WTO contribution while USD 15,862 is unspent funds of the instalments to date.

[5] USD 19,296.10 is over expenditure incurred by NEPC due to extension of project duration with another USD 200,000 declared by NEPC to cover activities and expenses not captured in the project document but allocated to its successful implementation.

7 OVERALL PROJECT RESULTS AND LESSONS LEARNT

The project was largely successful in its implementation and met its planned objectives. The report of the assessment can be found in **Annex T** as part of this report. The overall project results are listed below.

7.1 RESULTS

1. A Quality and SPS framework was established, bringing:
   a) Better understanding of sesame seed and shea nut/butter products and risks associated with aflatoxin contamination along the value chain.
   b) Characterization of project crops, predictive model on prevention of aflatoxin and fungi control developed.

2. Implementation of a robust field quality control system for sesame and shea products for exports with improved documentation for current practices of quality control for exports with a focus on field level production, processing, storage, transport to ports of export:
   a) Updated HACCP Plan;
   b) Updated Traceability System;
   c) Updated Sampling Plan;
   d) Designed Farmers' guide to quality production of shea and sesame in Nigeria;
   e) Updated Code of practices (The Nigerian Code of Practice for Sesame Seed (Sesamum indicum L) – NCP 036: 2013, & The Nigerian Code of Practice for Shea Nuts/Kernels and Shea Butter (unrefined) – NCP 035: 2013)
   f) Updated national standards for sesame seed and shea nuts (Nigerian Industrial Standard Sesame Seed (Sesamum indica L) – NIS 580: 2013, Nigerian Industrial Standard for Shea Nut/Kernels – NIS 572: 2013, Nigerian Industrial Standard for Shea butter (unrefined) – NIS 571: 2013
   g) Improved guidelines on good practices for quality control on sesame seed and shea products for exports, with focus on field level production, processing, storage, transport to ports;
   h) Reports released on:
      - Socio-economic, physico-chemical and biological characterization of the Nigerian sesame seed and shea nut/butter;
      - Updated manuals of safety and quality on Nigerian sesame and shea.

3. Implementation of a contract laboratory analyses and certification system for quality control on sesame and shea products to meet importing country's requirements;

4. Established eight processing sites (4 for sesame seed and 4 for shea nut) in different states with installed sets of equipment to improve the production capacity and compliance of shea butter and sesame seed with Sanitary and Phytosanitary (SPS) measures. The sites have been commissioned and handed over to the local cooperatives and selected investors. An MoU between the project implementing agency, the investors and the cooperatives was signed on the operationalization of the sites. The sites have different level of development and implementation of management and operations. There are still issues to be addressed for few site to be fully operational. The sheabutter site in the Oyo State is the most advanced one; having more than 100 women operating and having exported a first consignment to USA.
   These are pilot models aiming at strengthening the sector and to be replicated.

5. Eight states benefiting for the first time in Nigeria from the a project that commissioned processing sites, four for sesame seed and four for sheabutter with enhanced production capacity, compliance and adherence to SPS measures

6. Four sesame seed producing and four sheabutter producing area that can become referral centers for production of quality product for exports thereby boosting revenue and reducing poverty

7. Three project workshops (start-up, mid-term progress and final) conducted with key stakeholders; this enhanced knowledge sharing and helped to build capacity;

8. Built capacity of:
   a) 200 extension workers trained to eventually train farmers on GAP;
   b) 100 exporters, traders and standard enforcement officers trained on best practices;
   c) Local cooperatives with about 1000 shea butter farmers and 1000 sesame seed farmers) in the communities of the eight states to become empowered

9. Dissemination of project information, studies and results to all stakeholders to strengthen public-private dialogue and partnership of the Nigeria shea nut and sesame seed sector:
   a) Website was designed;
   b) Study reports released;
   c) Leaflets and brochures developed.

10. Strong leadership, commitment, financial contribution from NEPC for the project (estimated more than USD 200,000 allocated in-kind and financial contribution) - a key factor in the success of the project, along with commitment and support by partners institutions, local communities and the state governments

11. Acknowledgment of good collaboration between NEPC (implementing agency), ITC (supervisory agency) and local agencies in the implementation, with leading role by NEPC in establishing and mobilising funds for the establishment of the processing sites.

12. Strong public-private sector collaboration among private investors (i.e. exporters, producers, cooperative members from the sites):
   a) The cooperatives and NEPC (as controlling body) developed an MoU, with the support of Sidley Law Firm on a pro-bono basis that was signed by the parties, in order to ensure the management of the sites;
   b) Increased awareness on international market standards on quality of shea butter;
   c) Trade contacts established with Savannah Fruits Limited UK and Shea Radiance LLC, USA for future trade opportunities on shea butter from Saki centr;
   d) Shea Radiance conducted a visit to the Saki centre in November 2014 where an immediate order for 500metrc tons of high quality shea butter was made.

7.2 LESSONS LEARNT

The project document had some shortcomings, as it did not provide enough resources for some of the important activities such as the establishment of the shelters for the machine. This should have been considered through project funding and in-kind and financial contributions by the stakeholders in Nigeria. This limited the eventual successful implementation of the project. The non-inclusion of these activities in the project document presented a big challenge and delay in the implementation of the project, leading to an extension by 18 months. The project proposal should have considered the limiting factors of building the facilities and the management model of the same.

The challenges faced include:

S/N	CHALLENGES	RESOLUTION
1.	Lack of funds to store the equipment before premises were finalized.	NEPC had to undertake series of visits to the state governments to seek their support, produce a site plan and undertake the construction of a model shelter in Oyo State.
2.	Technical Coordinator to lead the implementing partners was not appointed in the initial stage.	This was addressed fully by a team member from NEPC. NEPC appointed an internal resource person to implement the project.
3.	Not adequate duration of the project implementation time frame	NEPC requested an extension by 18 months from the STDF to ensure successful implementation.
4.	Deactivation of the website www.sesame-shea-stdf172.org.ng due to lack of funding.	The funding foreseen for the website under the project was 24 months, whereas NEPC provided funds for additional 12 months for the functionality of the website until the end of the project.
5.	Financial cost under the project proposal was not adequate for the duration of the project.	NEPC was able to address this shortcoming providing financial assistance estimated in about USD 200,000.

In addition to the existing shortcomings, continues improvement and capacity building, on how to handle exceeding aflatoxin levels in sheanut and sesame, is needed.

8 RECOMMENDATIONS

- **Recommendation 1:** Continuous monitoring and evaluation of the performance of the operators in the new eight centres by NEPC and the relevant institutes. The monitoring process aims to ensure compliance and implementation of the developed quality and safety control systems towards increasing sesame seeds and sheanut/butter yields.

- **Recommendation 2:** Continuous training and capacity building by the Institutional Agencies (NAFDAC, NCRI, SON, IITA) for the operators and stakeholders in sesame seed and shea butter sector to ensure implementation of the developed quality and safety system.

- **Recommendation 3:** Continuous public awareness creation on quality and food safety through print and electronic media as well as possible reactivation or merging of the project's website within the NEPC or other institutional websites.

- **Recommendation 4:** Mobilise support to the producing cooperatives to strengthen their competences and skills on management, production, packaging, branding, marketing, sales, record keeping, etc. with ITC and other international agencies as partners.

- **Recommendation 5:** Explore further product development and certification opportunities for sesame seeds and shea, for example possible organic certification to increase marketability of these commodities.

- **Recommendation 6:** Collaboration with the public and private sector to replicate more producing centres for sesame seed and shea butter, using STDF centres as models.

- **Recommendation 7:** Seek further development, collaboration and engagement of appropriate international/regional marketing channels for sesame seeds and shea butter.

- **Recommendation 8:** Explore the possibility of the development of a sector strategy for shea butter and sesame seeds to drive the agenda of the sectors.

- **Recommendation 9:** Owing to the largely successful implementation and completion of the STDF Project 172, the STDF, NEPC with possible support from ITC could collaborate to expand similar intervention in Nigeria for honey and palm oil.

9 ANNEXES

9.1 CONTACT LIST

NEPC

S/N	NAME	DESIGNATION	EMAIL
1.	Omowunmi Osibo	Retired Director, Product Development Department/Project Coordinator (2010-2013)	omowunmiosibo@yahoo.com biketoniosibo@gmail.com
2.	Olajide Ibrahim	Director, Office of the Chief Executive Officer/Project Coordinator (2013)	murijide2012@yahoo.com
3.	Henry Otowo	Director, Product Development Department/Project Coordinator (2013-date)	henryotowo@yahoo.com
4.	William Ezeagu	Deputy Director, Product Development Department/Deputy Project Coordinator	ezeagu@yahoo.com
5.	Afolabi Bello	Assistant Chief Trade Promotion Officer/Project Secretary	afobello@yahoo.co.uk

NAFDAC

S/N	NAME	DESIGNATION	EMAIL
1.	Stella Denloye	Director, Laboratory Services	denloye.s@nafdac.gov.ng denloye_stella@yahoo.com
2.	Bimbo Adegboye	Assistant Director, Laboratory Services	adegboye.a@nafdac.gov.ng

IITA

S/N	NAME	DESIGNATION	EMAIL
1.	Joseph Atehnkeng		j.atehnkeng@cgiar.org

NCRI

S/N	NAME	DESIGNATION	EMAIL
1.	Adegha Adagba	Assistant Director	akwayat@yahoo.com

SON

S/N	NAME	DESIGNATION	EMAIL
1.	Chinyere Engwuonwu	Assistant Director	chiokeyegwu@yahoo.com
2.	George Musa	Assistant Director	musa.george@son.gov.ng

ITC

S/N	NAME	DESIGNATION	EMAIL
1.	Ludovica Ghizzoni	ITC Adviser on Export Quality Management	ghizzoni@intracen.org

IC

S/N	NAME	DESIGNATION	EMAIL
1.	Bruno Doko	IC on Quality and Food Safety	brunodoko@yahoo.com

9.2 DOCUMENTS PRODUCED UNDER THE PROJECT

Annex A:	IC First mission report
Annex B:	IC Second mission report
Annex C:	Socio-economic characterisation of sesame seed value chain in Nigeria
Annex D:	Socio-economic characterisation of shea value chain in Nigeria
Annex E:	Physico-chemical characterisation of sesame seed in Nigeria
Annex F:	Physico-chemical characterisation of shea nut and shea butter in Nigeria
Annex G:	Development of a simple prediction model for mould growth and aflatoxin in the Nigerian sesame seed production chain
Annex H:	Development of a simple predictive model for mould growth and aflatoxin in the Nigerian shea
Annex I:	Farmers' guide
Annex J:	Nigerian code of practice for sesame seed
Annex K:	Nigerian code of practice for shea kernel and shea butter (unrefined)
Annex L:	Application of HACCP based systems to shea nut/butter in Nigeria
Annex M:	Traceability
Annex N:	Sampling plan
Annex O:	IITA training report
Annex P:	NAFDAC training report
Annex Q:	NEPC STDF training report
Annex R:	Final workshop report
Annex S:	TEF evaluation report (*not produced under the project*)
Annex T:	An overview of the implementation of the STDF Project 172
Annex V:	Report on shea sector development conference by Shea Origin (*not produced under the project*)

10 ACKNOWLEDGEMENTS

NEPC would like to acknowledge WTO`s and STDF Secretariat's role in providing technical and financial assistance through this particular STDF project on improvement safety and quality of sesame seeds and shea nut through SPS capacity building. This project assisted to ensure a competitive export market for Nigerian sesame seed and shea butter and position themselves as a key exporter of high quality products.

NEPC also appreciates ITC guidance and support which contributed towards successful project implementation.

On national level, NEPC acknowledges the support of its Supervisory Ministry, FMITI, as well as the local agencies, as NAFDAC, NCRI, IITA, SON, NSPRI and trade associations – NASPAN and NSSAN.

NEPC also acknowledges the advices given by Mr. Neil Horner, lawyer from the US based law firm Sidley Austin LLP, on a pro-bono basis, for the development of the MoU for the processing centres.

The contribution of the International Consultant, Dr. Bruno Doko, is highly appreciated. His experience and guidance contributed to build and develop adequate food safety quality management in Nigeria.