NASENI RESEARCH COMMERCIALIZATION GRANTS PROGRAMME (NRRCGP)
LETTER OF INTENT

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12th September, 2025.

The Executive Vice Chairman/Chief Executive,
National Agency for Science and Engineering Infrastructure (NASENI)
Plot 447, Airport Road,
Central Business District,
Abuja,
Nigeria.

Subject: Grant Proposal Submission: Commercial Production and Packaging of Oil Palm Fruit Mesocarp Juice (Banga sauce) in Flexible Aluminium Pouches

Dear sir,

On behalf of my research team at the End-Use Research Division, Nigeria Institute for Oil Palm Research (NIFOR), I am pleased to submit a grant proposal for your esteemed consideration under the NASENI Research Commercialization Grants Programme.

Project Title: Production and Packaging of Oil Palm Fruit Mesocarp Juice (Banga Sauce) in Flexible Aluminium Pouches.

This proposal presents an innovative model to transition the culturally significant Banga sauce from traditional household preparation to a commercial-scale, value-added product using cost-effective, locally fabricated technology and modern flexible aluminium pouch packaging. This

align with NASENI's mandate to promote indigenous technology, industrial innovation and local content development.

We seek to fabricate appropriate small-scale processing machinery, standardize production protocols, extend shelf life and reduce post-harvest losses through sustainable packaging innovations. The project offers a scalable and impactful agro industrial model capable of creating rural jobs, empowering youth and women, reducing waste and enhancing Nigeria's export potential. The expected outcomes align directly with NASEN's mandate to drive local technology development, promote indigenous innovation and strengthen Nigeria's industrial base for economic diversification.

Please find attached the full proposal package, including, detailed proposal, feasibility study report budget breakdown and supporting document.

We respectfully request NASENI's support and partnership in bringing this initiative to fruition. We assure you of our full commitment to accountability, transparency and measurable outcomes throughout the implementation.

Yours faithfully,

Dr. (Mrs.) Ofure Benedicta Imoisi
Principal Investigator,
NIFOR.

PROPOSAL TITLE: PRODUCTION AND PACKAGING OF OIL PALM FRUIT MESOCARP JUICE (BANGA SAUCE) IN FLEXIBLE ALUMINIUM POUCHES

1.0 Introduction

Oil palm *(Elaeis guineensis*), native to the Guinea Coast of West Africa, is the world's most productive perennial oil-yielding crop. In Nigeria, the oil palm belt stretches from swampy lowlands to the forest–savannah transition zone. Among the numerous uses of oil palm fruit, its mesocarp juice—popularly known as Banga sauce—is of major cultural and nutritional importance. Banga sauce is the base for Banga soup, consumed daily by more than 40 million Nigerians and increasingly by diaspora populations in the UK, USA, and Australia. Presently, most exports of the product to these regions are in canned concentrates, often imported from Ghana and Côte d'Ivoire.

Despite Nigeria being African's largest oil palm producer, it's by products remain underutilized. Banga sauce is a popular traditional delicacy but lacks commercial presence due to the absence standardized processing and packaging technologies. The sauce is currently produced manually, with short shelf life and limited hygiene, making it unsuitable for wide-scale marketing or export.

Banga sauce remains under-commercialized within Nigeria. Traditional methods—sterilizing fruit, manually digesting, and extracting juice—are labour-intensive, time-consuming, result in significant post-harvest losses and unsuitable for large-scale commercialization.

The commercialization of Banga sauce through modern processing and packaging innovation offers an opportunity to add value, reduce waste and create employment for rural households.

This proposal introduces an innovative approach: production of ready-to-use Banga sauce packaged in flexible aluminium pouches instead of conventional cans. Pouch packaging extends shelf life, food safety, market expansion, reduces logistics costs, is environmentally friendlier, and improves consumer convenience. Furthermore, the development of low-cost processing equipment will make small-scale production viable for rural farmers and entrepreneurs, democratizing technology transfer and promoting industrialization.

Preliminary economic analysis confirms feasibility: with a 20% extraction rate, a 454 g pouch costs about USD 0.39 to produce and sells for USD 0.44, yielding a 144% return on investment

and a payback period of less than one year. This positions the project as a scalable and sustainable agro-industrial enterprise.

This proposal seeks NASENI's support for hygienic processing and packaging of Banga sauce.

2.0 Justification

Value Addition: Commercializes an underutilized by product of oil palm. The project addresses the gap in industrial utilization of palm mesocarp juice by converting it into a commercial product.

Technology Development: Promotes indigenous innovation and fabrication.

Export Potential: creates a globally competitive, packaged Nigeria product.

Food Security: Enhances availability of Banga sauce all year round in a ready to use form.

Employment Creation: Encourages small-scale agro-processing industries, SME driven processing clusters especially among women and youth.

Technology Innovation: Aligns with NASENI's mandate of indigenous technology development and local fabrication.

Environmental Sustainability: Reduces wastage and promote sustainable utilization of oil palm resources.

Alignment with NASENI Goals: supports local innovation, economic diversification and industrialization.

3.0 Purpose

The project seeks to transform Banga sauce from a labour-intensive, household-prepared delicacy into a modern agro-industrial product that is affordable, convenient, and competitive globally. Specifically, it will:

- Diversify end-use applications of oil palm fruits.
- Boost local production and consumption of Banga sauce.

- Increase incomes for farmers through higher demand.
- Establish Nigeria as a regional and international player in indigenous food processing.
- Increase revenue by more than 200%without additional raw materials. To provide the facilities for training prospective investors in Nigeria.
- Diversification of income base of oil palm fresh fruit bunch producers. Enhanced livelihood of small and medium scale operators.
- Food system transformation

4.0 Objectives

The project aims to develop and adapt appropriate small-scale technologies for Banga sauce production and packaging.

Specific objectives:

1. Small scale technology already exists in NIFOR; however, there is need to develop and fabricate cost effective improved small-scale technology for Banga sauce processing and flexible pouch packaging.

2. To standardize processing methods and package Banga sauce in flexible aluminium pouches for convenient, hygienic, and shelf-stable packaging for wide-scale rural and urban distribution.

3. To conduct laboratory analysis for quality assurance (chemical, microbial and sensory evaluations).

4. To eliminate manual rigour in preparation and promote household adoption of ready-to-use sauce.

5. To train rural farmers, women and youth entrepreneurs on the use of developed technologies.

6. To produce extension materials for dissemination and promote adaption in all oil palm growing regions.

7. To commercialize Banga sauce production while supporting the growth of rural-based SMEs.

8. To empower communities through technology transfer, training, and capacity building in collaboration with NIFOR and NASENI.

9. To disseminate outcomes through trade exhibitions, agricultural fairs, and extension services.

10. To increase rural incomes, reduce post-harvest losses, and contribute to poverty alleviation.

4.0 Methodology

- Technology Fabrication: Design and build pilot processing with small-scale machinery (fruit sterilizer, digester, pouch sealer)
- Fruit Pre-treatment: Quartering, bunch knocking, fruit screening, sterilization.
- Juice Extraction: Digestion, filtration, concentration.
- Packaging: Filling into flexible aluminium pouches with locally fabricated machines.
- Quality Assurance and product standardization: Physico-chemical analysis including (nutrients, carotenoids), microbial such as (APC, Salmonella), and shelf-life studies, quality and packaging.
- Training and Adoption: Capacity building for rural farmers, SMEs and women and youth entrepreneurs.
- Market introduction: Branding, marketing, exhibitions and export readiness assessment.
- Technology Diffusion: Training workshops, extension bulletins, agricultural fairs, exhibitions, and NASENI-backed pilot hubs.

This will build on earlier NIFOR prototypes of canned Banga sauce, scaling them into pilot-level production using pouch packaging and NIFOR locally fabricated equipment.

NIFOR packaged Banga sauce in cans.

5.0 Beneficiaries and Impact

Target Beneficiaries	Impact
State and Local Government in Oil Palm Regions	Increased production, reduction in poverty, unrest, sustainable livelihoods, environmental benefits through agro forestation.
Women and Youth	Employment and inclusive empowerment via small-scale industries improved income, gender-inclusive technology adoption. Employment in processing, packaging, and distribution. All-inclusive industrial participation.
Rural Communities	Local economic development, access to innovation
Entrepreneurs	Low cost processing equipment and business models. Access to affordable locally fabricated equipment to establish SMEs.
Oil Palm Growing Communities	Reduced post-harvest losses, higher bargaining power, longer product storage, access to affordable technology.
Farmers	Increased demand for palm oil fruit., reduced post-harvest losses, higher income.
Consumers	Affordable, hygienic, shelf-stable indigenous product. Ready-to-use, antioxidant-rich, cholesterol-free sauce with longer shelf life.
Scientist and Researchers	Applied research opportunities, research publications, and innovation platforms. Broader Industrial Impact, Increased use of developed technology, enhanced professional capacity, career advancement.
Industrial Development	Creation of a new agro-processing value chain based on local raw materials and fabricated equipment
Import Substitution	Reduction of foreign imports of canned Banga sauce and machinery.
Technology Transfer	Training for rural entrepreneurs on equipment operation and maintenance.
Cluster Formation	Establishment of small-scale processing hubs in oil palm belts.
Export Promotion	Branding Nigeria as a global supplier of indigenous sauces in modern packaging.
National Economy	Revenue, import substitution, industrial growth.

6.0 Innovation and Novelty

- First application of flexible aluminium pouch packaging for Nigerian indigenous sauces.

- Integration of NASENI's mandate through local equipment design and fabrication.
- Provision of low-cost, scalable solutions accessible to rural communities.
- Combination of food technology, packaging science, and industrial policy into a holistic agro-industrial model.
- Alignment with global convenience food trends and domestic industrialization policies.
- Developed with locally fabricated equipment

7.0 Potential for Significant Impact

Economic: High return on investment (ROI) (144%), rapid payback (<1 year), foreign exchange savings, new SME opportunities.

Social: Job creation, women and youth empowerment, poverty alleviation, and rural development.

Technological: Local fabrication of processing machinery adaptable to other indigenous foods.

Health: Promotion of a cholesterol-free, antioxidant-rich traditional food.

Environmental: Flexible pouch packaging reduces transport emissions and packaging waste compared to cans.

8.0 Scalability, Sustainability, and Continuous Improvement

Scalability:

- Replicable equipment for rural processing hubs.
- Supported by strong Institutional infrastructure NASENI and NIFOR.
- Expansion to West African and diaspora markets.
- Adaptability to other indigenous sauces.
- Reduced environmental impact via sustainable packaging and low waste processing.

Sustainability:

- Economic viability through high return on investment (ROI) and rapid payback.
- Institutional sustainability via NASENI–NIFOR training and equipment fabrication support.
- Environmental gains through reduced packaging waste and potential biodegradable film innovation.

- Social sustainability by targeting women and youth employment.

Continuous Improvement:

- Ongoing R&D to enhance product quality, packaging durability, and consumer satisfaction.
- Technology upgrades toward semi- and full automation as demand grows.
- International quality compliance (ISO, HACCP, Codex Alimentarius).
- Alignment with Nigeria's food security and industrialization policies.

9.0 Important Assumption

I. Timely provision and release of funds.
II. Availability of materials and inputs.
III. Effective extension services for adoption.
IV. Stable socio-political and economic climate.
V. Commitment of equipment fabricators.
VI. Favourable import policies on machinery.

10.0 Logical Framework

Narrative summary	**Objective verifiable indicators**
Goal: • Commercialize Banga Sauce presence in Markets • Export licenses	SME adoption.
Purpose: • Technology transfer and packaging, training reports.	Shelf stable product in stores.
Outputs: • Equipment, product, training, number of pouches produced, trained individual	Number of Fairs hosted

Inputs: • Materials • Equipment (Fabricated units locally) • Chemicals and consumables, packaging • Multi-disciplinary personnel (Chemists, Engineers, Microbiologists, Extension officers). • Logistics (transport, training, seminars).	

11.0 Budget

1. Stainless steel mesocarp juice extraction Equipment

-Fruit cleaner
-Fruit washer
-Fruit sterilizer
-Digester Screw press
-Stainless steel storage tanks
-Palm oil storage tank
-Banga sauce storage tank
Total cost of fabrication……N70,000,000.00

The above equipment can be fabricated and supplied by the Nigeria Institute for Oil Palm Research within 20 weeks.

2. Product packaging.
-Palm Oil Packaging System……. N15,000,000

Packaging containers and label for palm oil
-2liters containers 100,000units at N700……N70,000,000

3. Packaging containers for Banga sauce
-Retortable pouches 100,000units
Banga pouches/cans each year = N500 per pouch/cans x 100,000 = N50,000,000
-Retortable Aluminium Cans 100,000 units
-Can seamer 3units at N3,000,000 per unit…….N9,000,000
-Pasteurizer 2,000 litres……...N15,000,000
-Pouch sealer 2 units……N2,000,000
-Shrink plastic……..N24,000,000
Total……..N255,000,000

Fresh fruit bunches – 200tonnes will give:
Palm oil –13tonnes
Banga sauce- 50tonnes
Quantity per pouch – 500g
Number of product pouches/month -100,000

Total plantation area required is approximately-250 hectares.
NIFOR has more than 1,000 hectares of marked palms.
Palm oil from this is 14,000Litres
At 2Litres we have 7,300 containers
Revenue: 2Litres at N5,500 X 7,300 = N40,150,000
Banga pouches each year = N500 per pouch x 100,000 = N50,000,000
800g of Banga sauce is currently been sold at $4.99
500g of Banga Sauce is been sold for $3.12 naira equivalent= N4,830
400g of Banga sauce is N4,830
100g is $0.62
Naira equivalent
800g- N15,600
780g-N17,200
400g-N9,400
If 800g is sold for N9,000
It therefore means that Banga sauce 50tonnes will be 50,000kg which is equal to 50,000,000g
50,000,000g will give 62,500 bottles.
At a market price of N9,000 for 800g
62,500 containers will give = N562,500,000

Fixed Assets
-Equipment
-Building
-Vehicle
-Motorcycles
Total amount N50,000,000

Overhead
-Salaries and wages = N100,000 per month x 20 staff =N2,000,000 x 12=N24,000,000
-Taxes from profit later

Variable cost
-Cost of raw materials
Fresh fruit bunches 200tonnes= N120,000 per tonne = N24,000,000
-Utilities such as power, water, diesel and fuel Engine oil =N20,000,000 per month

Production process

The material balance scheme for *Banga* sauce production is shown below:

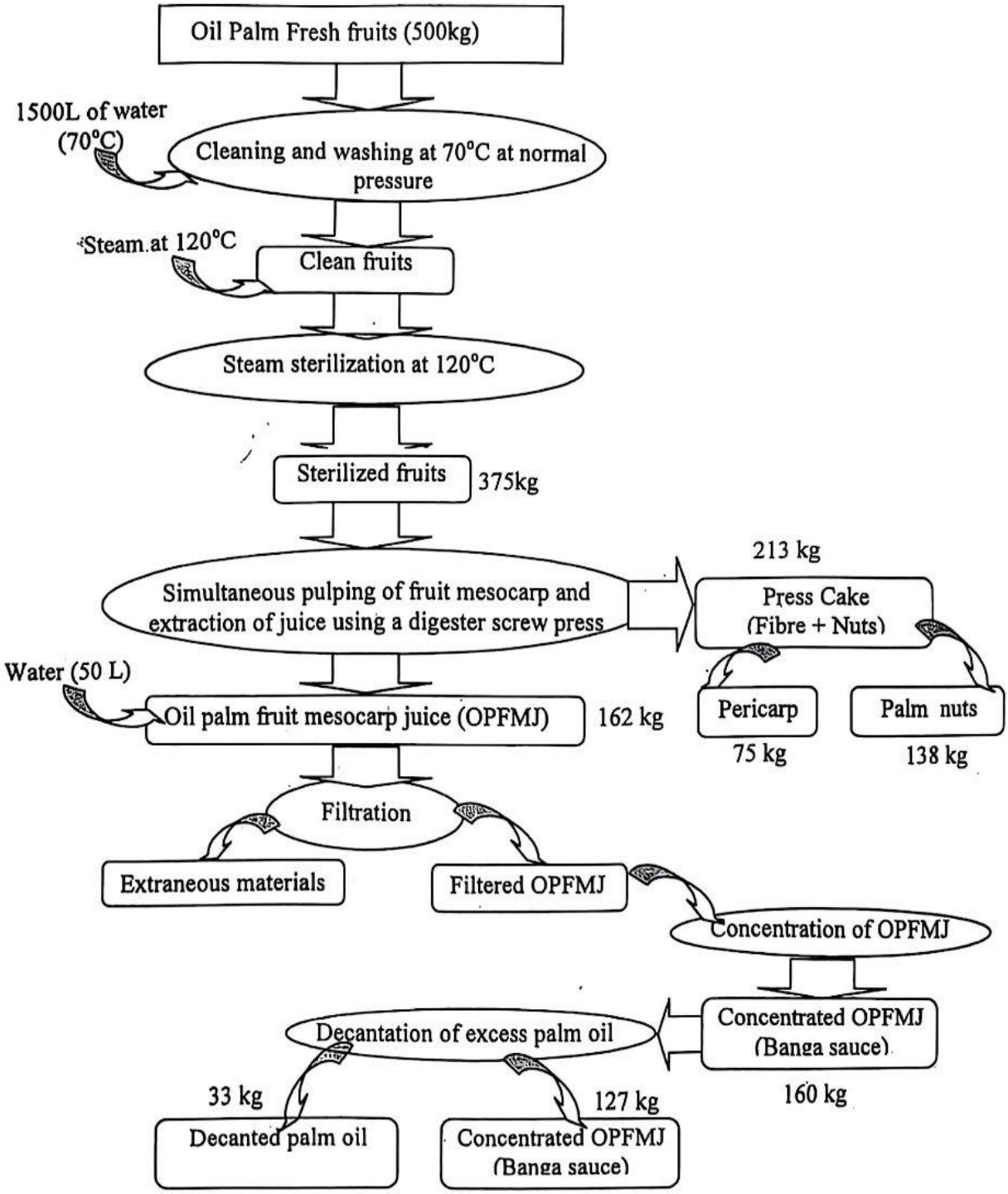

Fig. 1: Material balance for *Banga* sauce production

From the data mass balance above:

Assuming a monthly target of N100,000,000
Tonnage of Banga sauce = 10 tonnes
Fresh fruit bunches = 40tonnes
Palm oil = 2.6tonnes =2600kg =2925Litres
2L containers=N1,462 containers at N5,500: N1,462 containers = N8,043,750

Banga sauce = 10 tonnes = N10,000kg = N10,000,000g
Packaging size = 500g
10 tonnes of Banga sauce =20,000 containers
Each container should be N5,625
At 20% discount 500g = N4,500
Total revenue for 10 tonnes Banga sauce = N90,000,000

Revenue
Step 1
Fresh fruit Bunches = 40tonnes
Will give palm oil of 2.6 tonnes = 2600kg = 2925 litres
Palm oil revenue in 1 month
2 litres containers of 7,000 x N5,500 per 2 Litres = N8,043,750

Banga Sauce = 10tonnes = 10,000kg = 10,000,000g
10 tonnes of Banga Sauce = 20,000 containers
20,000 x500 = N10,000,000
At 20% discount for 500g =N4,500
N4,500 x 20,000 containers =
Banga Sauce total revenue for 1 month from 10 tonnes will be N90,000,000
Total revenue will be N8,043,750+ N90,000,000 = N98,043,750
Total revenue= N98,043,750/ 1 Month

Step 2
Cost breakdown
Fixed Investment
Stainless steel Juice extraction line = N70,000,000
Palm oil packaging system = N15,000,000
Can seamer N9,000,000
Pasteurizer N15,000,000
Pouch sealer N2,000,000
Shrink plastic system N24,000
Containers and Labels: palm oil N70,000,000
Banga pouches and cans N50,000,000
Building, vehicles and Motocycle N50,000,000

Total fixed capital =N281,000,000 This is incurred before revenue starts.

Step 3
Operating cost
Raw material cost
Fresh fruit bunches 200tonnes @ N120,000 per tonnes = N24,000,000

Palm oil is 14,000 litres

At 2 litres, 7,300 containers

2 litres @ N5,500 x7,300= N40,150,000 Banga pouches = N500 per pouch x 20,000 = N10,000,000

Total raw materials= N74,150,000

Step 4

Overhead

Salaries and wages = N100,000 per month X 20 staff = N2,000,000

Utilities include power, water, diesel and fuel Engine oil = N20,000,000 per month

Taxes will be from profit later

Total = N22,000,000 before tax

Step 5

Recurrent

Palm oil containers each month= approx. N40,000,000

Banga pouches per month = N500 per pouch x 20,000= N10,000,000

N50,000,000/ month

Monthly annual operating cost = N50,000,000

Net profit for one year

Revenue = 98,043,750

Operating cost = N50,000,000

Net profit for one month =N48,043,750 x12 =N576,525,000

One year = 576,525,000

Net profit in the next four years will be x4

N576,525,000x4= N2,306,100,000

12.0 Participants and Roles

Team

S/N	Participant	Discipline	Institution	Role
1.	Dr(Mrs) O. B. Imoisi	Food Chemist	NIFOR	Principal investigator
2.	Dr. I. O. Bakare	Analytical Chemist	RRIN	Co- investigator
3.	Mr Asiriuwa U. Nathaniel	Biochemist	NIFOR	Co-investigator
4.	Dr. Peter Ebabhamiegbebho	Food Scientist	UNIBEN	Project Manager
5.	Dr Osar Iyekowa	Organic/Natural product Chemistry	UNIBEN	Project Manager
6.	Dr. B.O.Abikoye	Engineer	University of Cape Town, South African	Engineering design and fabrication.
7.	Dr.E.Ataga	Engineer	NIFOR	
8.	Dr. N. Chidi	Microbiologist	NIFOR	Quality control
8.	Dr.Lucky Igene	Extensionist	NIFOR	Outreach/Communications

Conclusion

This project introduces a transformative, scalable, and sustainable agro-industrial model that redefines the commercialization of oil palm mesocarp juice (Banga sauce). By leveraging locally fabricated equipment, modern pouch packaging. The initiative will empower rural communities, reduce Nigeria's dependence on imports, and strengthen the country's presence in global agro-food markets. The project delivers clear benefits in terms of economic diversification, job creation and food security.

Publication

Gold, I.L.; Okpefa, E.; Enonuya, D.O.M.; Ojomo, E.E.; Bafor, M.E. and Okiy, D.A. (2003): Techno-Economic Analysis of Banga Sauce Production. Journ. Riv. Ital. Sostanze Grasse, LXXX, Sept/October, Pp 329-332.