Manufacturing Africa – Nigerian Green Manufacturing

June 2022

This programme is funded by UK aid from the UK Government; however, the views expressed do not necessarily reflect the UK government's official policies

Manufacturing Africa aims to attract £1.2bn FDI to the manufacturing sector and create 90,000 jobs by assisting firms to scale

Programme goal
Reduce poverty by supporting the growth of the manufacturing sector and creating 90,000 jobs

Funding
UK Government, Foreign, Commonwealth & Development Office (FCDO)

Duration
7 years (2019-2026)

Focus sector
Manufacturing; all sectors

Stakeholders
Investors, investees, manufacturers, governments, investment promotion agencies

Implementing consortium
McKinsey & Company, BDO, TechnoServe, Reformatics, Steward Redqueen

Assistance offered

- **Fundraising**
- **Capital Structuring**
- **Due diligence**
- **Feasibility studies**
- **Market analysis**
- **Business model design**

Green manufacturing reduces environmental impact through better processes or greener products

Green manufacturing is the **renewal of production processes** and the establishment of **environmentally-friendly operations**[1]

Types of green manufacturing

Green existing industries

Brownfield: Improve resource efficiency of current value chains

Greenfield: Ensure that new investments are as green as possible

Create alternative green industries

New industries: Develop alternative green products or business models

Circular: Leverage waste products and/or by-products to create or upgrade another product (e.g., capture post-consumer clothing waste to produce recycled textiles)

Replacement: Develop a new more sustainable product to replace an existing product completely (e.g., E2W to replace internal combustion engine (ICE) motorbikes)

Examples of going green

- Recycle/upcycle waste streams
- Reduce water consumption in agro-processing activities
- Develop low-carbon transportation systems

1. Use fewer natural resources, reduce pollution and waste, recycle and reuse materials and moderate emissions in their processes

Nigeria has a wide range of public, private and non-government stakeholders that contribute to its green manufacturing ecosystem

NON-EXHAUSTIVE

Nigeria's Green Manufacturing ecosystem

Government

Ministries

- Federal Ministry of Industry, Trade & Investment
- Federal Ministry of Environment
- Federal Ministry of Transportation
- Federal Ministry of Agriculture

Departments & Agencies

- Rural Electrification Agency
- Department of Climate Change, Federal Ministry of Environment, Abuja
- NESREA
- NADDC – National Automotive Design and Development Council
- NITT – Nigerian Institute of Transport Technology
- SON
- PTSS

State Agencies

- LASEPA
- OYSIPA – Oyo State Investment and Public Private Partnership Agency
- OGWAMA – Ogun State Waste Management Authority
- LAWMA

NGOs[1] and industry associations

- MAN – Manufacturers Association of Nigeria
- UNIDO
- Nigeria Alliance for Clean Cookstoves
- The Food & Beverage Recycling Alliance
- epron – Responsible E-Waste Recycling
- iceed – International Centre for Energy, Environment & Development
- Sustainable Energy for All
- Nigeria Climate Innovation Centre
- REEEA-A – Renewable Energy & Energy Efficiency Associations (Alliance)

Development Finance Institutions and donors

- Foreign, Commonwealth & Development Office
- African Development Bank / African Development Fund
- Montreal Protocol
- UKaid from the British people
- PPIAF – Enabling Infrastructure Investment
- IFC – International Finance Corporation, World Bank Group
- Global Energy Alliance for People and Planet
- gef
- UNDP
- Bank of Industry – transforming Nigeria's industrial sector
- DFC
- giz
- AllON
- UN environment programme

Private sector

Multinationals

- Unilever
- Coca-Cola HBC
- LUMOS
- BASF – We create chemistry
- Coca-Cola
- Nestlé
- Dow
- atmosfair – think • go climate conscious
- Hinckley Group
- Bboxx

Local Players

- Nigerian Breweries
- JET
- Onward
- Boulos
- Veggie Victory – Nigeria's First Plant-Based Food Tech Company
- arnergy
- max.ng
- Omnik Limited
- MagProtein – Working with Nature
- weelers
- TechnOil – The Future of Energy
- ALKEM
- Auxano Solar
- Blue Camel Energy
- POWERSTOVE

1. Non-Governmental Organizations

Federal and State Governments have demonstrated support for the green agenda while DFI-supported start-ups embrace new green opportunities

Government

- Signatory to the **Paris Climate Agreement**, planned **20% reduction in** emissions by 2030, **net-zero** by 2060
- Approved the **Nigeria Energy Transition Working Group** to define a **net-zero pathway** and **manage long-term job loss** in the oil sector in the wake of global decarbonisation
- Established the **Nigeria Circular Economy Working Group** to create a robust circular economy pathway
- Launched **Solar Power Naija** through the **Rural Electrification Agency (REA)** to engage the private sector in providing solar power to **5 million off-grid households** and to provide **$340 million low-interest loans** to local solar value-chain players
- Ongoing phased **deregulation of Oil & Gas sector**
- Ongoing development of **carbon credit guidelines** to help achieve Nationally Determined Contributions (NDCs)
- Waste Management Authorities in Lagos, Ogun, and Kwara have initiated programmes to **strengthen their recycling value chains**

Private sector and DFIs

Nigerian solar-energy start-up **Arnergy** raised a **$9m Series A** round in 2019 supported by **Breakthrough Energy Ventures, Norfund, All On,** and **ElectriFI**

The Global Environment Facility, UN Environment, and Nigeria's Federal Government launched a **$15m** programme to kick-off Nigeria's **circular eWaste economy** in 2019

In 2021, **All On**, the **USADF**, and the **Rockefeller Foundation** funded **13 local off-grid energy firms** with **$100k each** to scale innovative energy-access solutions for unconnected Nigerians

BASF has partnered with local waste collection firm **Wecyclers** as part of its **Waste-2-Chemicals pilot** which aims to recycle **plastic waste** into high-quality **chemical products**

Nigeria can use its unique advantages and ride global tailwinds to gain traction in green manufacturing

Government support for green manufacturing

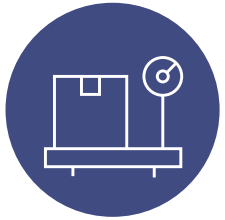
Nigeria is one of only three African countries to commit to net-zero. Numerous policies and programmes are being developed to encourage local manufacturing of clean-tech, including tax rebates, import exemptions, grants, and low-interest loans

Federal system

Nigeria's political structure enables stakeholders to interact with the Government at multiple levels (Federal, State, Local) and provides a level of flexibility for States to pursue specialised green agendas

Advantageous regional and global location

Good geographic position for trade and collaboration with Europe and North America. Nigeria's working day overlaps with the working day of more than 1 billion people in Europe, the north-east corridor of America, and Brazil's future megacities



Economies of scale

Nigeria is home to one in five people in sub-Saharan Africa, providing local companies with the potential to develop economies of scale without having to navigate international barriers. In addition, its membership of ECOWAS offers easy reach to 350 million people

Young population and growing workforce

Nigeria has the 10th-largest workforce globally, and by 2030, the number of Nigerians of working age (15-64 years) is expected to be 50% higher than today. A thriving local manufacturing sector requires a strong labour force and can provide jobs for workers across the skills spectrum

Increasingly attractive business environment

In 2020, the World Bank included Nigeria among the most improved countries in its Ease of Doing Business Index. Nigeria also had the continent's second-highest foreign direct investment (FDI) inflows from 2010-2020 (after Egypt)

Source: McKinsey Global Institute, World Bank Data, expert interviews

We identified the priority green manufacturing opportunities for Nigeria in three steps

PRELIMINARY

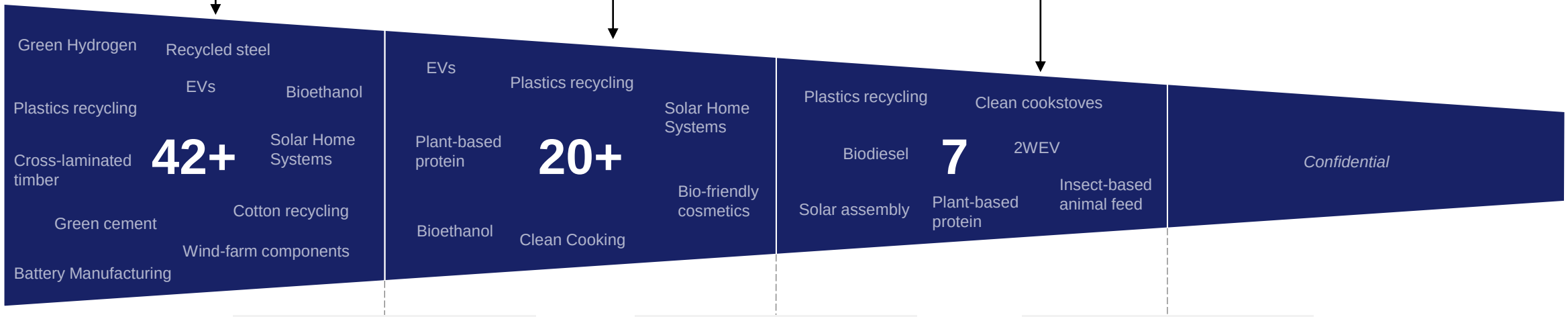
Universe of Green Manufacturing opportunities in Africa

Opportunities to be financed in line with net-zero ambition

1 Long list of 42+ Green Manufacturing opportunities[1]

2 Short-list of 20+ opportunities identified for further assessment

3 Final list of 7 opportunities based on feasibility & impact



High-level assessment of viability & relevance in Nigeria

Detailed assessment of impact and feasibilty[2]

Opportunity deep-dives: Industry assessment, engagement with local players and stakeholders

1 Identified by central Manufacturing Africa (MA) team
2 Including financial, emissions abatement and environmental impact as well as investments, technical capability readiness, etc.

We compiled a long list of ~40 potential green manufacturing opportunities across seven sectors (1/2)

✓ Prioritised ✗ Not prioritised

Sector	Green manufacturing opportunities	Prioritisation status	Rationale
Agriculture	1 Produce 'blue carbon' offsets from mangrove and seagrass forests	✗	Nascent market, currently in research phase within Nigeria
	2 Produce carbon offsets from reforestation and soil carbon management	✗	Limited activity in the market, not scalable to 'industry'
	3 Convert waste into black soldier fly animal feed (or other insect proteins)	✓	Active players within the market, with potential to scale
	4 Manufacture high-end cosmetic creams using forest-friendly natural products	✓	High potential, with existing active local players
	5 Manufacture biological crop protectors such as bioherbicides, biofungicides and bioinsecticides	✓	High potential, depending on local R & D capabilities
	6 Manufacture green ammonia by replacing grey hydrogen with green hydrogen for use as a fertiliser	✗	German-Nigerian hydrogen partnership as priority hydrogen use-case
	7 Manufacture medicines using biological sources	✗	Nascent market with limited local activity
	8 Manufacture plant-based protein	✓	High potential, given presence of local players and soy availability
Biofuels	9 Produce biofuels at scale from sustainable biomass plantations for transport	✓	High potential, depending on input sustainability – preferably waste
	10 Produce ethanol biofuel for use in clean cookstoves in replacement of firewood and charcoal	✓	Refer to no. 9
	11 Produce biodiesel from used cooking oil to be used as fuel replacement in transport	✓	High opportunity, depending on detailed assessment of scalability
	12 Manufacture clean cookstoves	✓	High opportunity, with opportunity to lower dependence on biomass
Construction materials	13 Use recycled steel in production of new steel	✗	Nascent steel industry, with insufficient technical capabilities
	14 Use recycled CO_2 in production of fresh concrete	✓	High potential, depending on collaboration of key industry players
	15 Manufacture cross-laminated timber (or other alternatives to cement)	✓	Refer to No. 14
	16 Manufacture green steel i.e. replace coking coal with green hydrogen	✗	Refer to No. 13
	17 Create building material from mix of sawdust and concrete to make building bricks and blocks	✓	Refer to No. 14
	18 Create concrete using Energetically Modified Cement (EMC) in cement production	✓	Refer to No. 14
Energy	19 Scale existing geothermal energy production	✗	Nascent market, with no limited activity and infrastructure
	20 Scale existing wind farm capacity (offshore)	✗	Limited scope for long-term viability
	21 Manufacture batteries for solar home systems	✓	High potential, with opportunity to lower SHS costs

Source: Internal and external reports, press scan

We compiled a long list of ~40 potential green manufacturing opportunities across seven sectors (2/2)

✓ Prioritised ✗ Not prioritised

Sector	Green manufacturing opportunities	Prioritisation status	Rationale
Energy	22 Assemble solar-powered water pumps for irrigating crops	✓	High potential to address irrigation needs in unelectrified areas
	23 Assemble solar panels for solar home systems	✓	Refer to No. 21
	24 Assemble solar lamps to substitute demand for kerosene, candles and batteries	✓	High potential, with opportunity to address energy access gap
	25 Manufacture cylinders to store Liquid Petroleum Gas (LPG)	✓	High potential, with abundance of LPG resources in-country
Packaging and plastics	26 Produce bioplastic using agricultural products	✗	Nascent market with limited local activity
	27 Produce paper using Used Beverage Cartons (UBCs)	✓	High potential, with availability of paper waste
	28 Manufacture plastic products from recycled PET and other plastic	✓	High potential, with local value chain
	29 Use recycled aluminium as input to metal packaging (e.g., tins)	✓	High potential, to be validated with local players
	30 Use recycled glass as input for bottles	✗	Limited scope for impact
	31 Develop a pulping plant to produce pulp for use in manufacturing value chains	✗	Nascent market, without active local players and technical capability
	32 Manufacture liquid cartons to reduce reliance on cold chain	✗	Nascent market, still at concept stage
Transport	33 Assemble[1] electric vehicles for personal and commercial uses	✓	High potential, with active local players
	34 Assemble[1] electric motorbikes and other two-wheelers	✓	Refer to No. 33
	35 Assemble[1] electric fishing boats	✗	Decentralized and informal fishing sector, not aggregated at scale
	36 Manufacture storage inputs for electric vehicles and boats	✗	Limited local technical capabilities
	37 Manufacture charging facilities (and local infrastructure) for electric vehicles	✓	High potential, will serve as an enabler for EVs
	38 Use 3-dimensional (3D) printing to manufacture components for vehicles	✗	Limited local OEMs, with more assembly plants
Textiles and apparel	39 Set up integrated mechanical cotton recycling factory with spinning and knitting/weaving capacity	✗	Nascent market, without local activity and technical capabilities
	40 Set up mechanical recycling plant to recycle PET flakes into polyester fibres	✗	Refer to No. 39
	41 Set up an “early-mover” hydrothermal plant to recycle polycotton into polyester and cellulose powder	✗	Refer to No. 39
	42 Manufacture textiles from fruit and vegetable fibres	✗	Limited activity, without scalable local players and capabilities

1. With future potential to manufacture

Source: Expert interviews, interviews with manufacturers, internal and external reports, press scan

We then prioritised ~20 opportunities based on an initial assessment of their viability and relevance in Nigeria (1/2)

Cluster	Manufacturing opportunity	Description	Local players
Biofriendly replacement products	Bio-friendly cosmetics	High-end cosmetic products developed using forest-friendly, non-toxic natural ingredients such as shea butter, African cape chestnut, moringa, jojoba, etc.	Oriki, Arami
	Biopesticides	Pesticides - including herbicides, fungicides, and insecticides - derived from naturally occurring substances for pest control and management	Biocrops
Sustainable protein	Plant-based proteins	Plant-based alternatives - such as soy - to animal-based protein ingredients	VeggieVictory
	Insect-based animal feed	Animal protein feed produced from the conversion of insect waste - such as Black Soldier Fly larvae - into animal feed	MagProtein, Bioloop, Afrimash
Biofuels	Biofuel production	Alternative liquid fuels, derived from biomass - plant material or animal waste - which can be used as a replacement for petroleum, coal, etc. in cooking and transportation	NNPC Biofuels, Kebbi State Government
	Biodiesel production	Renewable, biodegradable fuel manufactured from vegetable oils, animal fats, etc., applicable as a substitute to vehicle fuel	Biofuels Nigeria, Kogi State Government
Sustainable construction	Green cement	Infusion of recycled CO_2 into cast concrete to create solid carbonates that improve the strength of concrete, leading to need for less cement, and reducing related emissions	
	Cross-laminated timber	Wood-panel production from gluing layers of timber to form a single structural unit, providing an alternative to cement in construction	
	Plastic-based ecobricks	Transformation of plastic waste - specifically bottles - into building supplies by collecting and filling bottles with sand, then stacking and binding them together with mud or cement mix, creating strong walls; provides an alternative to cement	
Solar energy	SHS components	Local manufacturing or assembly of Solar Home System (SHS) components - batteries and panels	Blue Camel Energy
	Solar-powered lamps	Assembly of solar lamps to substitute demand for kerosene, candles and batteries	Ibeto Group, Auxano Solar
	Solar-powered irrigation	Clean technology option for irrigation, allowing the use of solar energy for pumping water, replacing fossil fuels as energy source - particularly in unelectrified settlements with high irrigation demand based on farm sizes	SpunVertek

We then prioritised ~20 opportunities based on an initial assessment of their viability and relevance in Nigeria (2/2)

Cluster	Manufacturing opportunity	Description	Local players
Clean cooking	LPG canisters	LPG canister manufacturing to enable deeper penetration and adoption of LPG usage, reducing reliance on emissions-intensive fuels	Techno Oil
	Clean cookstoves	Low-cost and higher-efficiency alternative to traditional cook stoves, open fires and other emissions-intensive cooking methods	NACC
Recycling	Paper recycling	Paper waste recycling, such as Used Beverage Cartons (UBCs) for paper production and other valuable goods	Onward Paper Mill
	Plastic recycling	Local manufacturing of new plastic products (e.g., pellets, water tanks, plastic furniture) from plastic waste	WeCyclers, Omnik
	Metal packaging	Production of metal packaging materials using recycled Omni aluminium	Romco Metals
eMobility	2-wheeler EVs	Assembly of electric motorbikes and other two-wheelers - with future potential for local manufacturing	Max. Siltech
	4-wheeler EV assembly	Assembly of electric vehicles for personal and commercial uses - with future potential for local manufacturing	Stallion Group
	EV charging facilities	Manufacture of charging facilities (and local infrastructure) for electric vehicles	Max, NADDC

Through impact-feasibility analysis, we prioritised seven industries representing a potential $2+ billion in 2030 revenues

	1 PLASTIC RECYCLING	2 SOLAR VALUE CHAIN	3 CLEAN COOKING	4 INSECT-BASED ANIMAL FEEDS	5 ELECTRIC MOTORCYCLES	6 USED COOKING-OIL BIODIESEL	7 PLANT-BASED PROTEINS
Description	Local manufacturing of new plastic products (e.g., pellets, water tanks, plastic furniture) from plastic waste	Local assembly of solar panels and solar pump systems	Assembly of clean cookstoves and LPG canister manufacturing; higher-efficiency alternatives to traditional cookstoves and open fires	Local manufacturing of animal protein feed produced from the conversion of insect waste - such as Black Soldier Fly larvae - into animal feed	Local assembly of electric motorbikes and other two-wheelers - with future potential for local manufacturing	Local manufacturing of biodiesel from used cooking oil as a substitute to fuel-based diesel	Local manufacturing of plant-based alternatives - such as soy - to animal-based protein ingredients
Est. 2030 Revenue ($ million)	**500-600**	**870-1000**	**250-340**	**500-700**	**20-45**	**20**	**16-18**
Est. 2030 GHG impact ($MtCO_2eq$)	**2**	**3-5**	**10-12.5**	**30-60%[1]**	**6-20**	**0.1**	**0.2**
Est. Investment potential ($M)	**100-150**	**60-100**	**160**	**150-200**	**40-80**	**10**	**25-30**

1. Studies show improved GHG emissions, land-use, and energy use when compared to traditional soy and fish feeds, but remain in R&D stages

Plastic recycling: Key insights

Plastic recycling can be the first step to enable circular economy opportunities – including other recycling streams, insect-based animal feeds, biodiesel, clean cookstoves (manufacturing pellets from waste) – because effective recycling **requires an efficient waste collection and segregation process**, providing **readily available feedstock** for related value chains

Multiple players in the value chain are at various levels of operation and formalisation – including state government agencies, private companies and informal waste pickers. However, players **mainly operate in siloes.** Many **private sector players** are exploring opportunities to **vertically integrate along the value chain**

There is an **opportunity for industry-level aggregation to enable efficiency and attract international investments by driving digitisation of the value chain to enable formalisation and real-time tracking of activities**[1] across local value chain players

Impact

~$500-600M

2030 revenue

~2Mt

2030 GHG emissions reduction

~$150M

Investment opportunity

1. Such as volume of waste collected

Source: Nigeria Green Manufacturing Sector Deep-dives

Plastic recycling represents an opportunity of $500-600 million by 2030 for Nigeria

1 Description

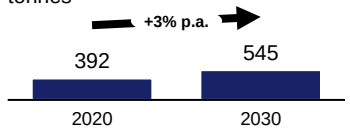
Plastic recycling involves collecting, sorting, aggregating and processing plastic waste into new products that may be used as input in manufacturing other products for residential, commercial or industrial use, e.g., packaging resins, construction materials, chemical feedstock, cushion fibres

2 Global trends

The global plastics market is **expected to double by 2036** based on its **use across industries** because of its health, safety and convenience benefits. Packaging is the largest application, primarily non-durable plastic prone to leakage

Opportunities for circular plastics are emerging as **regulatory pushes for increased sustainability and improved recycling methods** develop

Global plastics production, million tonnes

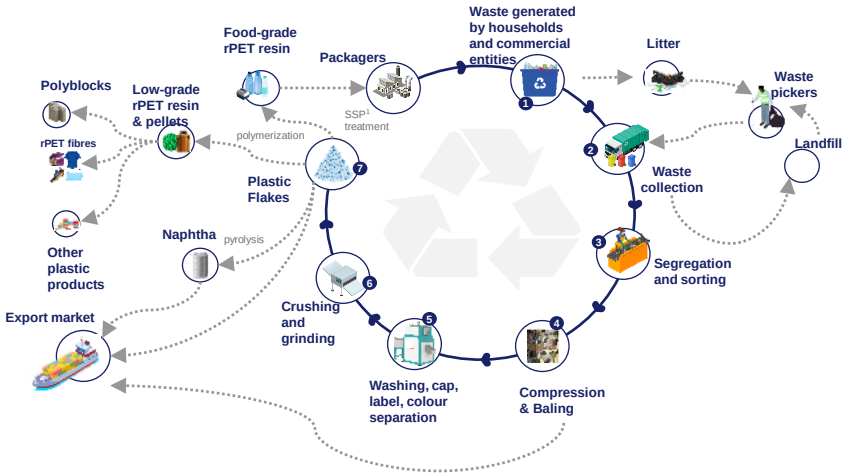


3 Relevance for Nigeria

Nigeria is well-positioned to leverage this opportunity with a large informal waste picker network that does most of the waste collection. There is easy access to large deposits of waste, **plastic waste generation in Nigeria is estimated at ~ 5.96 MT** p.a. output**.** The recycling industry has **multiple players across the value chain** . The Nigerian government is driving an agenda to **increase domestic recycling**

4 Value chain and key stakeholders

Value chain



Stakeholders

The sector is growing with active players across the value chain including **West Africa ENRG** and **RecyclePoints**

DFIs such as the **IFC, AfDB** and the **World Bank** have invested in the sector through various programmes

Public regulators include the Federal Ministry of Environment, LAWMA and OGWAMA. State-level governments are more active in the recycling sector compared to other priority sectors

5 Impact potential

		Key assumptions
Revenue potential, $m 2030	500-600	10-12% plastic recycling rate
Investment size per plant, $m	1-1.5	For one plant recycling 10,000 tonnes of plastic per year
Total FDI potential, $m	100-150	Assuming 100 10kt plants can serve the entire market in 2030

Environmental impact — **90%** GHG emissions reduction; Reduction in pollution of harmful compounds; Reduction in landfill sites

6 Main challenges and potential solutions

Industry-specific	**Lack of formalised waste collection process**	Integrate informal waste pickers into an association/cooperative so they can be formally integrated into the value chain
	Lack of awareness on waste segregation	Develop awareness campaigns to increase knowledge on waste segregation and recycling
	Inadequate sorting and collection facilities	Set up collection and sorting facilities across multiple locations
Macro-level	**Insufficient policy enforcement**	Work with the government to implement existing waste policies and develop informed policies to create an enabling environment
	Lack of accessible and affordable financing	Improve access to finance for recyclers

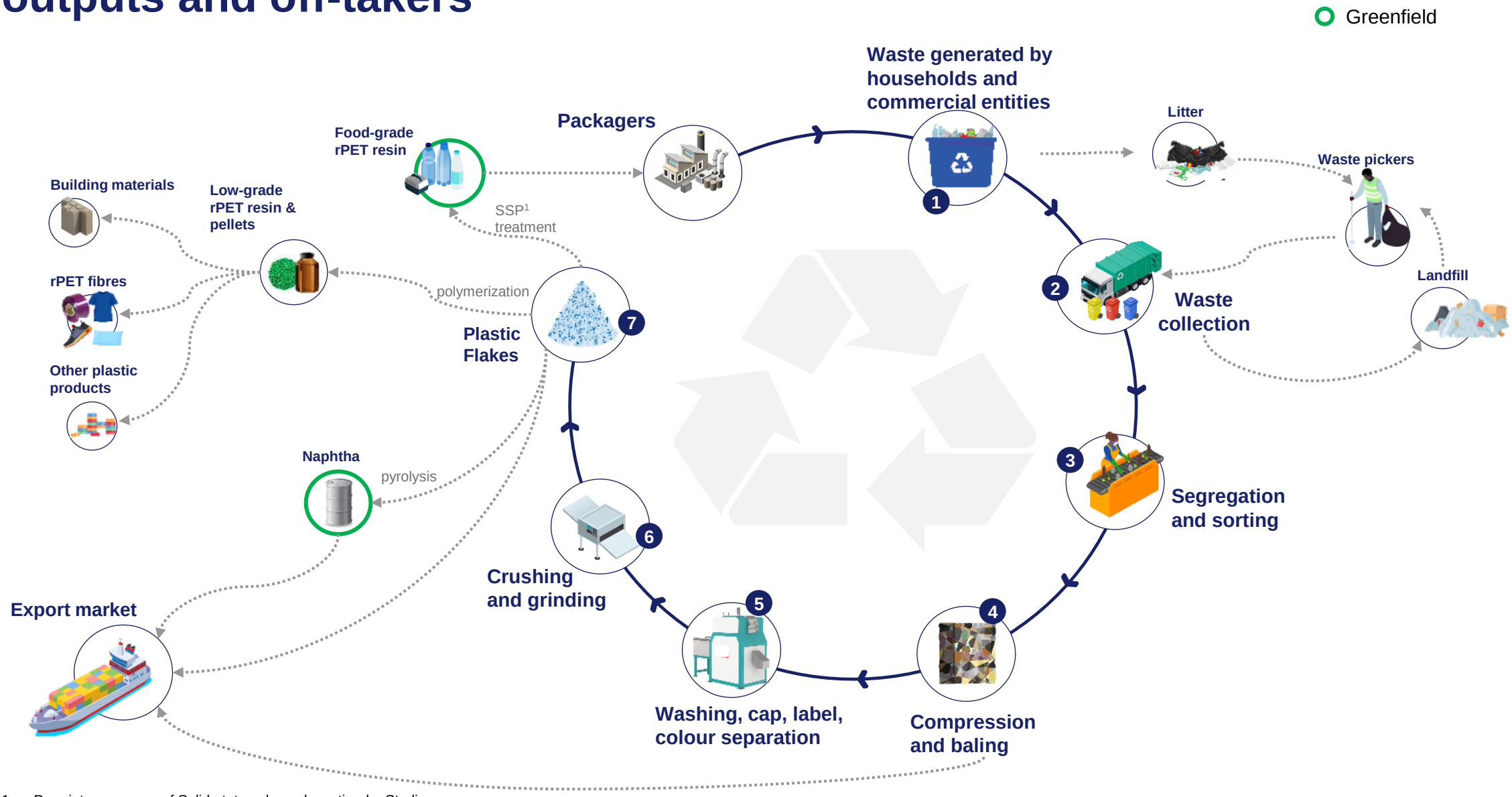
7 Industry case studies

RecyclePoints is a Nigerian player involved in activities across the value chain; collection, sorting, aggregating and processing

Indonesia and Chile have initiatives to improve waste segregation and collection (formalising the informal waste sector)

Source: Expert interviews; Press search; Interview with local players; Clean Cooking Alliance Industry Snapshot 2021

The plastic recycling value chain is diverse and complex with multiple outputs and off-takers



1. Proprietary process of Solid-state polycondensation by Starlinger

Source: Interviews with manufacturers

Solar value chain: Key insights

The solar value chain is a **critical enabler of the broader manufacturing ecosystem** in Nigeria, as **access to power is one of the top challenges** faced by local manufacturers

To strengthen and scale solar component manufacturing in Nigeria – and by extension, energy access – **local firms need to be competitive against cheap product imports**; a key driver could include **import aggregation of manufacturing inputs** that would allow players to **benefit from economies of scale and access to import duty waivers**

Major industry barriers must be unblocked, including the **difficulty of accessing funding** (particularly for upstream players) and the **lack of an in-country solar component global-standard accreditation centre** (under development)

Source: Nigeria Green Manufacturing Sector Deep-dives

Impact

~$870M-1B

2030 Revenue

~3-5Mt

2030 GHG emissions reduction

~$60-160M

Investment opportunity

The solar value chain[1] represents an opportunity of $800+ million by 2030 for Nigeria

1 Description

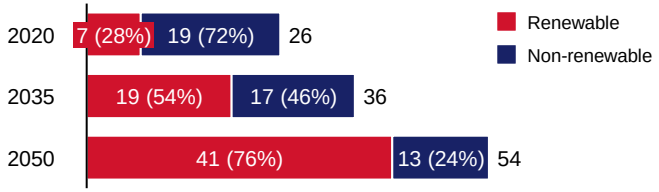
The solar value chain leverages energy from the sun for application in industrial, commercial and household use cases such as lighting heating, cooking, etc.

2 Global trends

Global power consumption is expected to more than double by 2050, increasing demand for sustainable power generation

Renewable energy sources – solar, wind, hydro – are expected to account for an incremental share of global power supply, ramping up to ~50% by 2035

Distribution of global power generation, '000 TWh



3 Relevance for Nigeria

Nigeria presents a high-potential market for the solar value chain, based on factors such as inadequate power generation from the grid, limited coverage of the transmission network, availability of solar irradiation, high dependence on fossil fuels for energy generation, alignment of opportunity with ongoing national electrification and energy transition programmes, and the potential for regional exports based on the country's strategic positioning in ECOWAS

4 Value chain and key stakeholders

Value chain

Upstream **Downstream**

Manufacturers and assemblers[1] → **Retailers** → **Installation** → **After sales companies**

Stakeholders

Nigeria's upstream sector of the solar value chain is nascent, with most players focusing on downstream activities such as retail, installation, and after-sales servicing

International organisations such as the GIZ, RMI, ACE, etc. have contributed to the sector, playing as investors and donors

There is high government involvement in the sector, with active engagement from the REA, and various FGN ministries

5 Impact potential

		Key assumptions
Revenue potential, $**M** 2030	~600 - 800 ~170 - 300	Solar panels: ~25% - 30% of demand met by local manufacturers Solar pumps: 80-90% uptake of pumps among potential buyers
Investment size per plant, $m	5 2-5	Solar panels: For one plant assembly 100MW per year Irrigation pumps: For one plant assembly 50k pumps per year
Total FDI potential, $m	50-100 10	Solar panels: ~10 – 20 plants can serve the market in 2030 Solar pumps: 3-5 plants can serve the market in 2030

Environmental impact[1] **~90%** GHG emissions reduction; Enables sustainable energy generation; Reduction in fossil fuel consumption

6 Main challenges and potential solutions

Industry-specific	**Financing**	Participation of DFIs in defining eligibility requirements for funding Development of offtake agreements to build working capital
	Business capability gap	Development of bankable plans by local manufacturers
	PV testing labs	Establishment of local testing labs to regulate industry standards
	Regulatory environment	Collaboration with relevant stakeholders to ensure adherence to defined policies
	Affordability gap	Development of phased payment plans for end-users
	Market nascency	Provision/stimulation of patient capital for local manufacturers

7 Industry case studies

Auxano Solar – Established local player, mainly involved in solar panel assembly, and post sales services

Tamil Nadu Water and Sanitation Pooled Fund – Case example of special-purpose financing vehicle developed in India to finance small domestic infrastructure investments

1. Including solar panels and solar irrigation pumps

Source: Expert interviews; Press search; Interview with Local players

Most solar system players are specialised along the value chain and fewer players are present upstream

Expected launch of activities

NOT EXHAUSTIVE

Local manufacturers/assemblers that have attained relative scale – e.g., Auxano Solar – can leverage scale to act as “demand aggregators” to negotiate more favourable import rates for smaller players

1. Includes companies who do both full systems and individual components

Source: Lighting global, interviews, press research

Clean cooking: Key insights

Over **170 million** people in Nigeria have no access to clean cooking technologies – the largest deficit globally after India and China. Compared to traditional biomass cooking, clean cooking is **50%-80% more fuel-efficient** and reduces toxic fumes and GHG emissions

Significant **domestic need, government support**, and **multiple existing** local cookstove and LPG canister **manufacturers** looking to scale their operations make this sector a **feasible and impactful** opportunity by 2030

Affordability of improved cook stoves (ICS) is a major challenge in driving market demand. Manufacturers are looking to **drive down costs** through **local material sourcing** (import-heavy industry due to steel requirements), **carbon subsidies**, and achieving **economies of scale**, while introducing innovative **“pay as you cook” financing schemes** for customers

The recently launched **National LPG Expansion Programme** (driven by the Presidency) aims to **dramatically increase access to LPG cylinders** by 2030. **Public-private engagement** on enabling policies that are **practically accessible** for manufacturers will be vital to the programme’s success

Source: Nigeria Green Manufacturing Sector Deep-dives

Impact

$250-300M

2030 Revenue

10-12Mt

2030 GHG emissions reduction

$160M

Investment opportunity

Clean cookstoves (ICS and LPG) and LPG canister manufacturing represent an opportunity of $250-340 million by 2030 for Nigeria

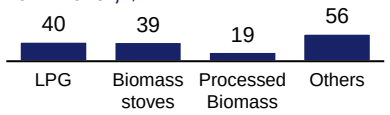
1 Description

Clean cookstoves are designed to be resource-efficient; they reduce toxic emissions and have health and cost benefits for users. Clean cooking technologies include biomass and LPG cookstoves, LPG canisters, biomass pellets, ethanol-powered stoves, biogas, solar cookers, electric cookers

2 Global trends

A high global population has limited access to clean cooking technologies and African countries have lower access rates. To meet this need, annual funding of $4.5B is required and the current annual investment of ~$130M is creating a huge funding gap. There is also an affordability and convenience challenge in converting the need for cookstoves to demand as the market is dominated by the low-income population

Capital raised by fuel and technology 2017-2019[1], $M

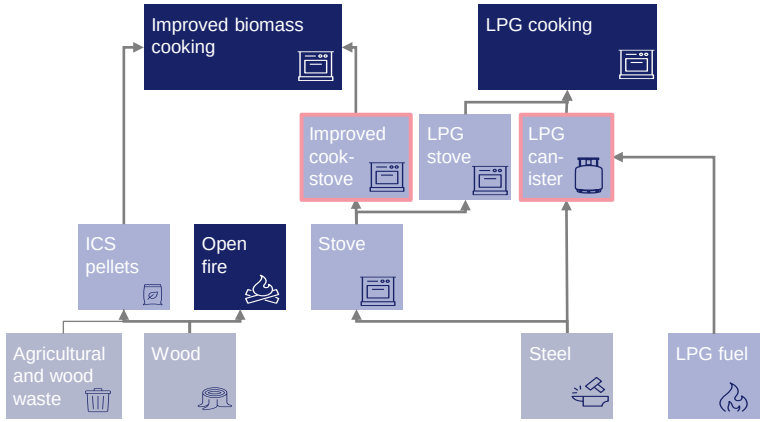


3 Relevance for Nigeria

Nigeria is well-positioned to leverage this opportunity: many people **(~**34 million households) have **limited access to clean cooking.** There is easy access to wood and agricultural waste, making **biomass fuel readily available. Local players exist that can scale production capacity with access to funding and required support**. The Government is driving an agenda to **increase domestic adoption of clean cooking**

4 Value chain and key stakeholders

Value chain



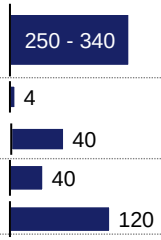
Stakeholders

The sector is nascent with a few industrial-scale players including **PowerStove, Atmosfair, Roshan renewables** (for ICS), and **TechnoOil, Hexagon, Don Mac Ltd** (for LPG canisters)

Some investment has taken place; **Clean Cooking Alliance and AfDB** have invested in the sector through various programmes

The office of the Vice President is overseeing the National LPG Expansion Plan (NLEP) via **DLPGOVP**

5 Impact potential



		Key assumptions
Revenue potential, $m 2030	250 - 340	15% adoption rate of ICS and LPG
Investment size per plant, $m	4	For one manufacturing line producing 300,000 ICS per annum
	40	For one manufacturing line producing 1.2 million canisters per annum
Total FDI potential, $m	40	Assuming 10 ICS plants can serve entire market in 2030
	120	Assuming 3 LPG canister plants can serve entire market in 2030
Environmental impact	**10-12.5MT**	GHG emissions reduction by 2030

6 Main challenges and potential solutions

A	**Low demand for cookstoves**	Stimulate demand through multiple initiatives, including reducing cookstove prices
B	**Cost of end-products**	Investigate option to **source raw materials locally**
C	**Access to skilled labour**	Collaborate with educational institutions to **develop in-house training and apprenticeship** programmes for technicians
D	**Inadequate road infrastructure**	Work with the Government to improve distribution channels to rural areas across the country
E	**Access to capital**	Work with the Government and DFIs to provide **grants and** develop **subsidies schemes**
F	**Access to stable power**	Improve **access to power supply** for local manufacturers
G	**Activity tracking platform**	Create a public tracking platform for NLEP

7 Industry case studies

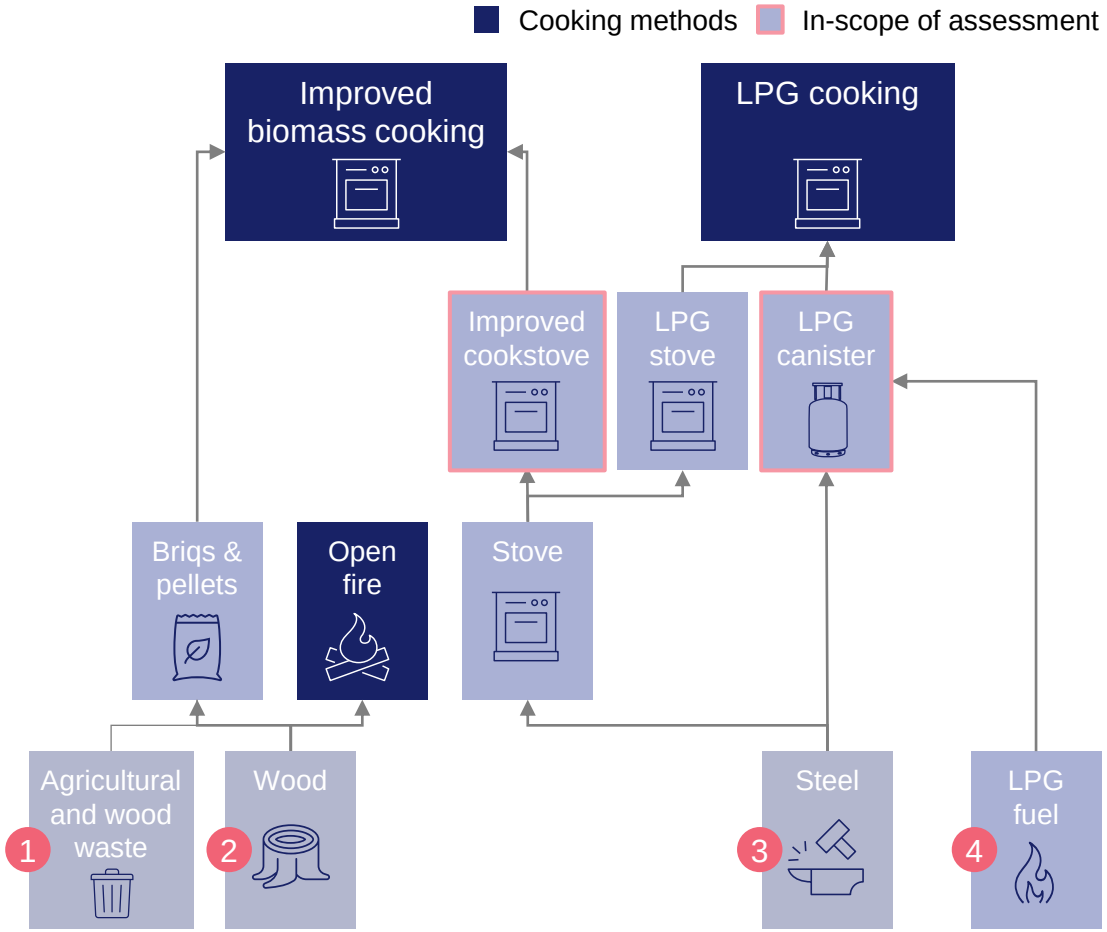
PowerStove– Nigerian player looking to scale operations, utilizing innovative business models to increase access and affordability of cookstoves

LPG Expansion in India – India is the second-biggest domestic LPG market in the world after China with an LPG penetration of 99.5% in 2021

Source: Expert interviews; press search; Interviews with Local players; Clean Cooking Alliance Industry Snapshot 2021

The Nigerian market can support the transition to clean cooking

The value chain for LPG and ICS cooking fuel and equipment has four key inputs[1]



Sector activities are driven by multiple stakeholders

Private stakeholders – producers

LPG canisters

Technoil The Future of Energy · TIANLONG · HEXAGON · DML

Improved cookstoves

POWERSTOVE · ROSHAN Renewables · atmosfair · Nenu Transforming Lives

Investors

CLEAN COOKING ALLIANCE — Catalytic Small Grant program (CSG), launched in 2017

African Development Bank — Sustainable Energy Fund for Africa (SEFA), AfDB — SPARK+ Africa clean cooking fund ("Spark+")[2]

Public stakeholders – regulators/ enablers

DLPGOVP — Coordinating office of the National LPG Expansion Plan (NLEP)

The political economy is largely favourable

LPG expansion plan – The FGN has committed to deepening the penetration of LPG through the National LPG Expansion Plan (NLEP), replacing the use of emissions-intensive cooking fuels

National commitment to reduce emissions – Signatory to the Paris Climate Agreement, with planned 20% reduction in emissions by 2030, net-zero by 2060; necessitating transition to cleaner energy sources

1. Value chain only highlights inputs and outputs for cooking solutions in scope
2. Initiated by the Clean Cooking Alliance (CCA), Enabling Qapital, and Stichting Modern Cooking

Source: Expert interviews, Press sources, Interview with NLEP

Insect-based feed (IBF): Key insights

Insect-based animal feed manufacturing in Nigeria exists at a small scale, with **local manufacturers producing and retailing ~1kt of feed annually**

This is a **highly feasible and potentially profitable opportunity:** Nigeria's climate is well-suited to production and the **import-heavy animal feed market (2-3Mt annually)** represents the highest share of costs for animal farmers

It provides a **lower-cost, high-quality alternative to traditional feed** and **a productive use of organic waste** as a key feedstock used to rear black soldier fly insects; the process also **contributes to the agricultural value chain as organic crop fertiliser is generated as a by-product** of the feed production process, **critical in the face of rising fertiliser costs**

In addition to the **lack of efficient waste collection and segregation in Nigeria**, IBF manufacturing is constrained by the **lack of dedicated research and development** to improve the manufacturing process, identify potential waste inputs and optimise the process

Source: Nigeria Green Manufacturing Sector Deep-dives

Impact

~$500-700M

2030 Revenue

~30-60%

GHG emissions reduction compared to traditional feed

~$150-200M

Investment opportunity

Insect-based animal feeds and by-products represent an opportunity of $500-700 million by 2030 for Nigeria

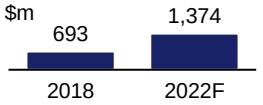
1 Description

Manufacturing of high-protein animal feed **from insects,** particularly **black soldier flies (BSF)**. BSF are **fed on organic waste** (e.g., food or agricultural waste) and **processed** to produce animal feed (particularly for poultry and fish); provides a **sustainable alternative** to fishmeal and soy, as BSFs can be **reared off organic waste,** producing **circular by-products** such as **organic fertiliser**

2 Global trends

From 2018-2022, the insect-based protein global market grew from **$693M to $1.4B**, representing a **CAGR of ~20%. There is growing demand** for insect-based proteins from aquaculture and poultry industries and growing awareness of use-cases and popularity, particularly of BSF that has a lower price point and price stability than other insect-based protein sources[1]

Insect-based protein global market, $m



~**20%** CAGR

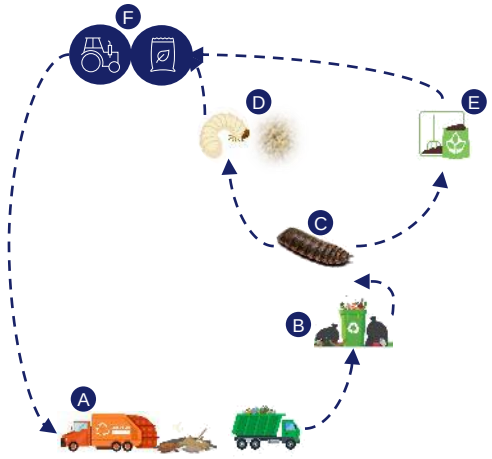
3 Relevance for Nigeria

Nigeria is well-positioned to leverage this opportunity: organic **waste is available**, **operating costs are low**, and there is **significant demand** for animal feeds mostly met with imports. The **labour-intensive** nature of the work is well suited to large, low-skilled, and low-cost workforces. Nigeria's **climate is favourable** and well-suited to raising insects. The Nigerian Government aims to **increase domestic production of livestock**

4 Value chain and key stakeholders

Value chain

- A Agricultural, food, and animal waste aggregated
- B Waste-based feed used to grow BSF larvae
- C Some larvae allowed to reach maturation for egg production
- D Larvae protein produced as fresh, dry, or powdered
- E Frass separated to produce crop fertiliser
- F Fertiliser and insect meal sold to feed producers and farmers, who in turn send waste streams back to BSF producers



Stakeholders

The sector is nascent with a few industrial-scale players including **MagProtein, Bioloop**, and **Unique Biotechnologies**

While no established investors have focused on the sector in Nigeria, **the Bill and Melinda Gates Foundation** has been leading investment in the sector in Africa

Public regulators include the National Agency for Food and Drug Administration and Control (**NAFDAC**) and the **Federal Ministry of Agriculture**

5 Impact potential

		Key assumptions
Revenue potential, $m 2030	500 - 700	~15% of feed protein from BSF
Investment size per plant, $m	15	For one manufacturing line producing 10-50 tonnes of protein per day
Total FDI potential, $m	150-200	Assuming 10 plants can serve the entire market in 2030

Environmental impact[2]

- **98%** Land use reduction
- **30 – 60%** GHG emissions reduction
- **38%** Energy use reduction

6 Main challenges and potential solutions

Industry-specific	**No formal waste collection process**	Formalise **collection** of **organic waste** streams and **pilot** use of **new streams of organic waste**
	Low market awareness	Improve market **awareness** by trialling **insect feeds** with local farmers Drive local adoption through targeted government policies Introduce sale of insect-based animal feed at major animal feed depots
	Insufficient local R&D	Deepen **local expertise and research** with partnerships with universities and research institutes
Macro-level	**Uncertainty on potential policies on the industry**	Work with the Government to improve awareness of the sector and **advocate for enabling policies**
	Lack of accessible and affordable financing	Improve **access to finance** for BSF farmers and manufacturers
	Sub-optimal access to stable power	Improve **access to power supply** for farmers and manufacturers

7 Industry case studies

MagProtein – Nigerian player, West Africa's largest producer of insect-based animal feeds, stabilised waste inputs by achieving scale and engaging with Nigerian breweries

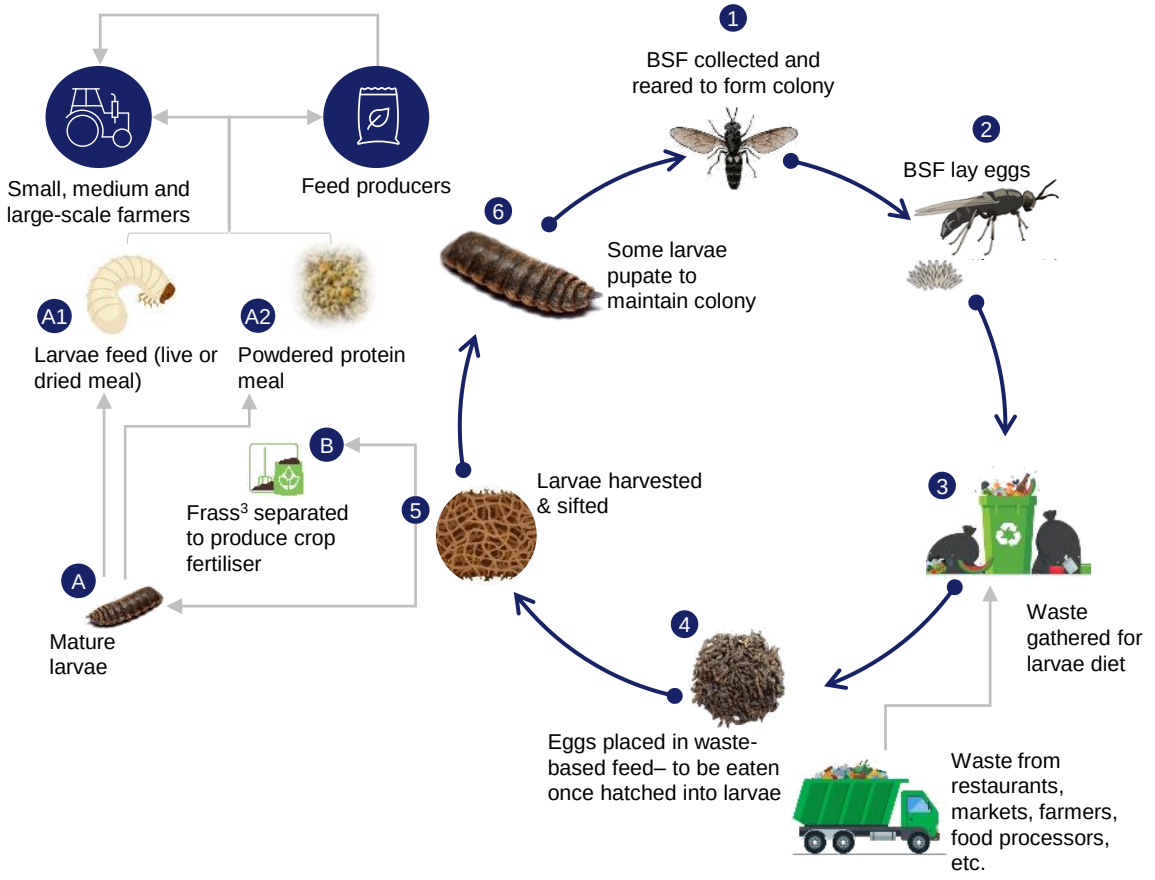
Sanergy – Kenyan regional player, stabilised input waste by working with local municipalities to collect and treat organic faecal waste

1. Such as locusts, crickets and mealworm larvae
2. Compared with a 50:50 mixture of soybean and fishmeal. Waste stream input only.

Source: Expert interviews; Press search; World Bank; IPIFF; Farming insects for food: Opportunities and challenges, AgriFood Tech Investing Report 2018; Press articles; Pitchbook; International Platform of Insects for Food and Feed; Guide on Good Hygiene Practice for European Union Producers of insects as food and feed; Rockefeller Foundation

Current Government regulations are favourable for the insect-based feed sector

The insect-based feed value chain has 7 key stages...



…across multiple stakeholders

Private stakeholders

MagProtein (Working with Nature) · BIOLOOP · afrimash · UNIQUE BIOTECH

Investors[1]

BILL & MELINDA GATES foundation

Public stakeholders – regulators

NAFDAC (National Agency for Food and Drug Administration and Control)

Federal agency[1] responsible for product regulation, including oversight of animal feed product registration

Federal Ministry of Agriculture

Federal Ministry of Agriculture regulates agricultural research, agriculture and natural resources, forestry and veterinary research

…and is influenced by macro factors

Localisation of food value chain: Local, sustainable animal feed production is **aligned with the Government's drive to discourage importation of food items**

Regulatory environment: No regulatory constraints on insect-based animal feed; this offers **lower barriers to market entry** and **higher likelihood of scalability**

1. Investments made in AgriProtein (South Africa) and Sanergy (Kenya), investments yet to be made in local players
2. The National Agency for Food and Drug Administration and Control
3. Excrement and skin shedding of BSF

Source: Expert interviews, Press sources

Electric motorcycles: Key insights

Electric motorcycle manufacturing in Nigeria is nascent with fewer than 5 active local players; the **scalability and environmental impact of these vehicles depends on access to clean, renewable energy sources** such as solar for both manufacturing and vehicle charging

The electric motorcycles manufacturing value chain is import-heavy, particularly for vehicle batteries (70% of vehicle cost) and there is a **need to source locally available inputs or implement measures such as import waivers** for components to **reduce import-dependency and ensure price-competitiveness** for local players

There is **no formal transition plan to phase out internal combustion engine (ICE) motorcycles and vehicles** in Nigeria in favour of Electric Vehicles (EVs), which **could help to create a sense of urgency** among local manufacturers and customers **to drive EV adoption**

Source: Nigeria Green Manufacturing Sector Deep-dives

Impact

~$20-45M

2030 revenue

~7Mt

2030 GHG emissions reduction

~$75M

Investment opportunity

Electric motorcycles represent an opportunity of ~$45 million for local manufacturers by 2030

1 Description

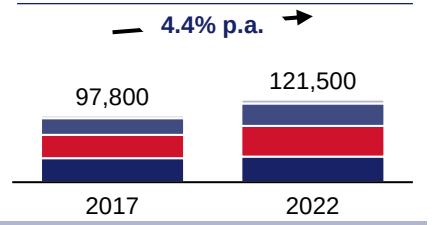
Electric motorcycles are two-wheeled vehicles that run on battery power, as opposed to traditional car fuel or gas. EVs more broadly include all vehicle segments and include battery electric vehicles, plug-in hybrid electric vehicles and vehicles that run off hydrogen fuel cells

2 Global trends

Global transportation is facing significant disruption from e-mobility due to 3 factors: regulation, falling battery costs and growing technology and infrastructure readiness

As a result of favourable regulatory push towards e-mobility, countries and auto-manufacturers have declared commitments for the phase-out of ICE usage and production

Global demand for 2-wheelers



3 Relevance for Nigeria

Nigeria has unique advantages that create an opportunity for the local manufacturing of E2Ws: high dependence on fossil fuels for transportation, robust policy for renewable energy development, large labour force, sub-optimal road conditions and the local availability of raw materials

4 Value chain and key stakeholders

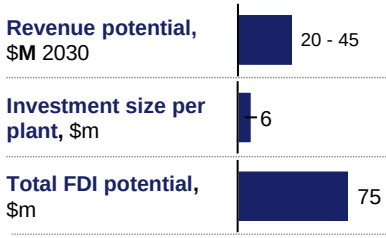
Value chain

Stakeholders

The electric motorcycle landscape is relatively nascent with two main active players – MAX and Siltech. Other established players that have indicated an interest in the industry are yet to enter

The industry is regulated by the Ministry of Transportation, with the National Automotive Design and Development Company (NADDC) more dedicated to stimulating local manufacturing

5 Impact potential



Key assumptions

~25% - 30% of total electric motorcycles sold are assembled by local manufacturers

For one manufacturing line producing 150 – 200 units per month

Assuming 13 plants can serve entire market in 2030

Environmental impact

~90% GHG emissions reduction

Reduction of noise pollution

Reduction of dependency on fossil fuels

6 Main challenges and potential solutions

Industry-specific	Affordability	Introduce subsidies and incentives
	Used ICE cost decline	Improve e-motorbike attractiveness by disincentivizing ICE imports
	Economic dependence on oil	Sensitise key stakeholders on business case for e-motorbikes
	Regulatory support	Introduce and cascade national policy for EV roll-out
	Infrastructure and capability gap	Deploy public charging stations Train maintenance workers
	Electricity supply gap	Build strategic partnerships between solar providers and manufacturers

7 Industry case studies

MAX.NG – Metro Africa Express (MAX) is the pioneer of bike hailing in Nigeria. In addition to selling e-motorbikes it also provides logistics and delivery services

Norway, China and India – Case examples of E2W industry development in countries across the market growth spectrum

Source: Expert interviews; Press search; Interview with local players

Nigeria's E2W space is still nascent with few local manufacturers and assemblers

Expected launch of activities

Stage	Upstream		Midstream	Downstream		Regulators	Investors
	Manufacturing	Assembly	Sales and distribution	Charging infrastructure	Maintenance		
Overview	The upstream market in Nigeria is mostly limited to assembly of imported materials, but local players are increasingly driving local sourcing of material inputs – and developing local manufacturing capabilities		Retail of locally manufactured E2Ws is led by original equipment manufacturers (OEMs) Other midstream players retail imported E2Ws	E2W charging is done via plug-ins or a battery swap model Charging/battery swap locations are deployed by manufacturers in partnership with energy and residential real estate companies	Maintenance of vehicles is managed locally by manufacturers, with free maintenance over warranty period where applicable	The conversation about EVs in Nigeria has been led by the National Automotive Design and Development Company (NADDC)	
Stake-holders	max.ng, SLTECH WORLD, BRIGHTCLOUD		max.ng, SLTECH WORLD, JUMIA	max.ng, SLTECH WORLD, NADDC, arnergy	max.ng, SLTECH WORLD	NADDC, Federal Ministry of Transportation, Nigeria	

- Developing the local E2W value chain would also stimulate the development and adoption of similar value chains such as electric 3- and 4-wheelers.
- From a manufacturing standpoint, E2Ws have the lowest barriers to market entry.

Source: Press search, Interviews with local stakeholders

Biodiesel from used cooking oil: Key insights

The production of biodiesel from used cooking oil (UCO) represents **a low-complexity opportunity for Nigeria to transition to biofuels** as it involves a relatively **simple production process** with an accessible input

Among the potential biofuels – such as bioethanol and biogas – the **simplicity of production, unique waste stream, and availability of input makes biodiesel a more viable fuel for production and scaling in Nigeria**

Unprocessed UCO can be exported internationally on the back of **increasing demand driven by biodiesel adoption requirements in Europe**

The **key barrier to enabling biodiesel production at scale in Nigeria is the collection of used cooking oil from end-users** such as households, food processers, hotels, restaurants, etc. Mega-cities such as **Lagos** could present a unique opportunity

Source: Nigeria Green Manufacturing Sector Deep-dives

Impact

~$20M

2030 revenue

~60-90%

GHG emissions reduction compared to diesel

~$10M

Investment opportunity

Biodiesel represents an opportunity of ~$20 million by 2030 for Nigeria

1 Description

Sustainable fuels are of interest to many countries (e.g., UK, Indonesia) as they strive to meet their sustainability targets. There are several types of sustainable fuels, e.g., **biodiesel which has multiple use cases in cars, gensets, etc**. and three types of biodiesel based on production feedstock and technical considerations

2 Global trends

The global demand for sustainable fuel is **expected to reach $160 bn by 2030 (of which biodiesel accounts for 23%)** due to the higher penetration of drop-in fuels. The demand for biodiesel is expected to grow by 3% CAGR in 2030

Opportunities for biodiesel are expected to increase as **countries** (such as the UK, Indonesia, Brazil) **increase their blending rates to meet their sustainability targets**

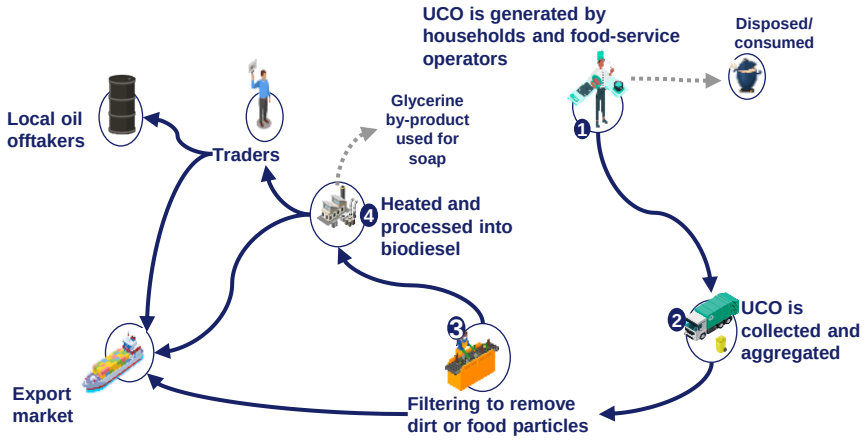
Biodiesel demand by energy carrier, Mta

3 Relevance for Nigeria

Nigeria is well-positioned to leverage this opportunity: it is the largest producer of vegetable oil in Africa – 1.7MT according to FAO. Its large population **also consumes a large amount of cooking oil (3.09Mt)**; **Nigeria has highly populated urban cities,** e.g., Lagos has a population of 14 million people; The low-skill nature of the manufacturing process is well suited to **Nigeria's large, low-skilled, and low-cost workforce**. The manufacturing process does not require sophisticated equipment

4 Value chain and key stakeholders

Value chain



Stakeholders

The sector is a greenfield in Nigeria with no local player. However, potential players could include; **Devon King's, Power oil and Golden oil**

Potential public regulators include the Federal Ministry of Transportation, Federal Ministry of Health, Federal Fire Services

5 Impact potential

		Key assumptions
Revenue potential, $m 2030	~20M	3% biodiesel penetration in Nigeria
Investment size per plant, $m	10M	For one plant producing 30,000 tonnes of biodiesel per year
Total FDI potential, $m	10M	Assuming 1 30kt plant can serve market demand in 2030 – based on estimated penetration of biodiesel

Environmental impact **60-90%** GHG emissions reduction; Reduction of harmful emissions

6 Main challenges and potential solutions

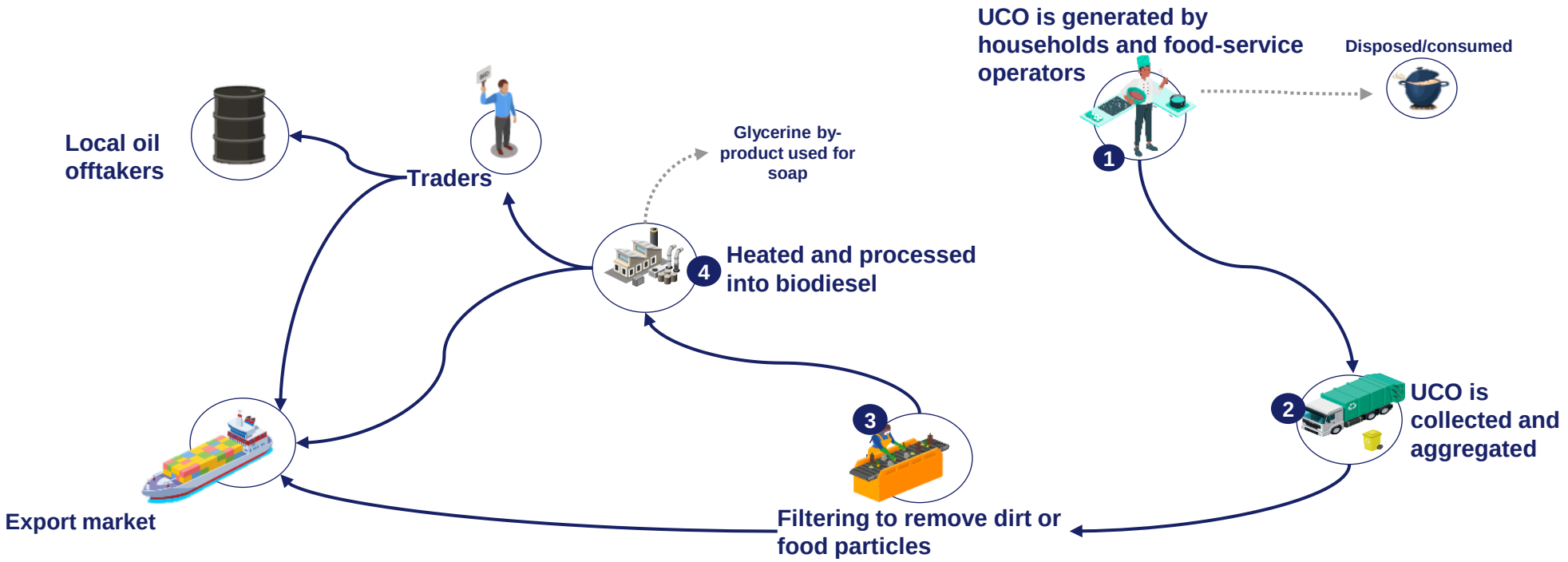
A	**Collection of used cooking oil**	Investigate opportunity **to set up a consolidated collection entity for used cooking oil**
B	**Lack of awareness**	**Generate awareness of biodiesel uses and benefits**
C	**Lack of knowledgeable local expertise**	**Engage with international experts and Nigerian research institutions**

7 Industry case studies

Mahoney Environmental –US player, a leader in the recycling of UCO and involved in the collection, aggregation and processing of UCO into biodiesel

Source: Expert interviews; Press search; Interview with Local players; Clean Cooking Alliance Industry Snapshot 2021

The value chain for biodiesel from UCO is a simple system that can be deployed in Nigeria's cities



Possible players	DEVON KING'S; Power Oil ...For A Healthy Family; Golden Oil Industries Limited	**Possible regulators**	FEDERAL MINISTRY OF TRANSPORTATION, NIGERIA; Federal Ministry of Health; FEDERAL FIRE SERVICE

Source: Press research, Expert interview

Plant-based protein: Key insights

Nigeria is well-positioned to manufacture plant-based protein as the **continent's largest soy producer (**a key plant-based protein source); **the key barrier to driving adoption of alternative proteins is to change the behaviours and palates of consumers** accustomed to animal-based protein

Nigerian plant-based proteins have achieved price parity with traditional animal-based protein – eliminating affordability as a potential barrier to adoption. There is also an opportunity to achieve price competitiveness if production is scaled

Production of soy in Nigeria is mainly done by smallholder farmers and there is room for larger-scale food producers to enter and drive scale or incremental improvements in farming practices such as increased irrigation and fertiliser use

Impact

~$16-18M

2030 revenue

~200kt

2030 GHG emissions reduction

~$25-30M

Investment opportunity

Source: Nigeria Green Manufacturing Sector Deep-dives

Plant-based protein represents an opportunity of $16-18 million by 2030 for Nigeria

1 Description

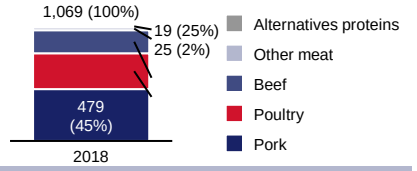
Manufacturing of plant-based protein, **soy** being one of the most popular plant-based protein sources, is common and takes one of three forms: tofu, tempeh, and edamame. It provides a **sustainable alternative** to animal-based protein. Other alternative protein sources include wheat, peas, rice, potato, canola

2 Global trends

The global protein retail market has a **value of ~$1,069B (2018), of which alternative proteins captured ~2%** (~$19B in 2018) and have the strongest growth projection until 2023 (~7% CAGR). Alternative proteins also saw the most recent innovations and growth within the ~$3B ingredient market

Africa's soy protein ingredients market is expected to grow 6.4% (CAGR) (2022-2027) driven by demand for vegan diets, protein cost (e.g., meat), and increasing use of soy protein in a variety of processed foods

Global protein retail market[1,2], in $Bn

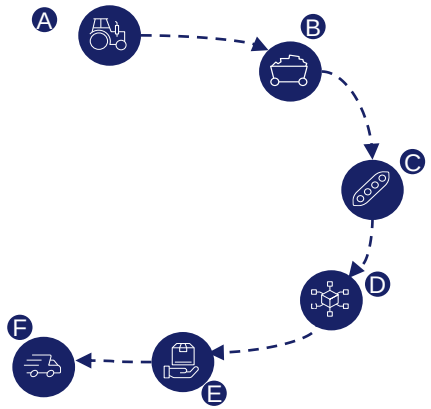


3 Relevance for Nigeria

Nigeria is well-positioned to leverage this opportunity: High protein need (~45% of the population has a protein deficiency). **Textured soy proteins are compatible with Nigeria's local dishes** as shown by a 2019 study. **Access to raw materials -** Nigeria accounts for **~18% of Africa's soy production**. Nigeria also has a **favourable climate for cultivating soy**. The plant-based protein sector is **still nascent with a single local player**

4 Value chain and key stakeholders

Value chain



- A Farming
- B Raw material aggregation and transportation
- C Primary processing
- D Application and Innovation
- E Secondary transformation to finished product
- F Distribution network

Stakeholders

The sector is nascent with a single local industrial-scale player: **VeggieVictory**

VeggieVictory has raised funding from several international investors including **Sustainable Food Ventures (SFV), Capital V, Kale United and Thrive Worldwide**

Public regulators include the National Agency for Food and Drug Administration and Control (**NAFDAC**) and the **Federal Ministry of Agriculture**

1. For human consumption
2. Includes fresh and processed meat

5 Impact potential in Nigeria

		Key assumptions
Revenue potential, $m 2030	16-18	Assuming 30% of processed meat market is captured
Investment size per plant, $m	5-6	For one manufacturing line producing 2-2.5kt of protein per year
Total FDI potential, $m	25-30	Assuming 5 plants can serve entire market in 2030
Environmental impact[1]	**92%** GHG emissions reduction	**75%** Agricultural land use reduction; **51-91%** Water pollution reduction

6 Main challenges and potential solutions

A	**Setting up a reliable distribution network**	Investing in **local production and a wide-spread distribution system** that brings the product directly to the consumer
B	**Driving consumer adoption**	**Using aggressive, grassroots level marketing** that reaches the consumer and is adapted to the consumer's cultural context
C	**Maintaining product innovation and iteration**	Ensuring **continued product iteration from consumer feedback and early innovation**, especially as new players enter the market
D	**Addressing the local consumer needs**	Addressing the **current needs of the consumer** in terms of product price, quality, and function

7 Industry case studies

VeggieVictory – Nigerian player, the first local plant-based food tech company. Its products are available in over 12 Nigerian states

GoodDot – India's largest plant-based alternative meat company with 10 products on the market

Source: Expert interviews, Internal and external reports, Press scan, Good food institute, Our world in data, AlliedMarketResearch, Euromonitor, GrandViewResearch, Markets&Markets, OECD, Press research, Technavio, FAOSTAT, Nigerian Protein Deficiency Awareness Report 2020: Unpacking the Numbers, Exploring the Issues, United States Department of Agriculture, Agriculture Skills Council of India

Two critical clusters were identified that could impact the viability of Green Manufacturing in Nigeria

Of the prioritized sectors, two clusters may play an enabling role for the broader green transition

The Waste Nexus

- The waste-collection and segregation process is relevant to four of the priority sectors: insect-based animal feeds (insect feedstock), plastic recycling, clean cookstoves (material for pellets), and biodiesel
- It is also relevant to sectors such as bioethanol production, paper and aluminium recycling
- International interest in plastic recycling[1] could stimulate support for the broader waste value chain – organics, metals, paper, e-waste, etc.

The Solar Nexus

- Reliable power is the basis of strong manufacturing as opportunities typically involve the use of electricity-powered equipment
- Local solar panel assembly is the first step to enable economies of scale that can push vertically (upstream towards fabrication) and laterally (to other solar components) along the value chain
- It enables sectors such as electric motorcycles, plant-based protein (through solar pumps) and EV charging, solar lamps and batteries

Additionally, learnings on leveraging the green opportunity were identified

There is a need for greater awareness of the dual value of green business among players across manufacturing sectors. For some players, environmental impact is mainly treated as a marketing tool (and at best a DFI attractor) and less as a value-creation mechanism.

Careful consideration should be given to the development of carbon credit policies – while carbon credit guidelines may drive awareness of the Green transition, it could negatively impact businesses already taking advantage of international decarbonization trends; such as selling carbon credits.

1. With programs such as the Global Plastic Action Partnership (GPAP), led by the FCDO

Source: Interviews with local manufacturers

Priority sectors face cross-cutting challenges

1

Infrastructure

Road networks: Lack of access to suitable road networks negatively impacts access to raw materials, constrains value-chain linkages, and limits the distribution of manufactured products to end-users (many of whom are in rural areas)

Power supply: Limited stable power supply hinders manufacturing processes, limits plant capacity and/or makes the business unprofitable. Dependence on gensets volatilises costs and increases GHG impact of end-products

2

Policy implementation

Lack of policy enforcement: Across sectors there are beneficial and progressive policies (e.g., solar import duty waiver) that could unblock major industry challenges but due to limited stakeholder engagement with the agencies responsible for enforcement (e.g., Customs) and misaligned incentives; these policies are not implemented or are inaccessible to most local players. Additionally, global manufacturing standards demanded by these policies are prohibitive due to a lack of local certification capabilities

3

End-user affordability

High prices: Difficulties in reducing or subsidising production costs and finding suitable ways of micro-financing end-users. A large proportion of the population most in need of products (e.g., clean cooking, off-grid solar) fall within the low-income bracket; and manufacturers are unable to convert this need into market demand

4

Accessible financing for manufacturers

Lack of accessible local funding: Manufacturers have limited access to funding, especially from local commercial banks. For sectors with dedicated funds, greenfield manufacturers have difficulty accessing finance due to high working capital requirements and prohibitive interest rates. Local commercial banks are quite risk-averse and require traditional forms of collateral, which greenfield firms typically do not have. DFIs and impact investors are less likely to directly fund due to requirements for larger ticket sizes

Source: Interviews with manufacturers, Expert interview

FCDO is looking to enable initiatives that address the cross-cutting challenges in collaboration with other stakeholders (1/2)

NON-EXHAUSTIVE

Advocacy | Co-ordination | Direct Support

Cross-cutting Challenges	Lever	Proposed solutions	Initiatives	Relevant stakeholders (other than FCDO)
Infrastructure: Road network		Improve road networks across the country	Engage the government to improve road networks to aid effective distribution of goods and services to urban, peri-urban and rural areas	Local manufacturers Manufacturer associations Federal Government
Infrastructure: Power supply		Improve access to off-grid power supply for manufacturers	Provide TF[1] support to green power providers/ developers or large-scale manufacturers in the green manufacturing sector	Solar developers Large-scale manufacturers DFIs
		Create strategic partnerships between solar power providers and manufacturers	Work with solar power providers to develop flexible financing schemes (e.g., rent to own, power as a service) that allow manufacturers to obtain solar systems at affordable rates	Local manufacturers Private solar power producers Relevant Government MDAs
Poor policy enforcement		Work with the Government to improve implementation of existing policies and develop additional policies required to scale sectors	Create awareness and sensitisation programmes to help local manufacturers understand existing policies	Relevant Federal Government MDAs responsible for policy Relevant agencies (e.g., chambers of commerce/industry, industry associations) Other donors' economic development teams Local manufacturers
			Develop continuous engagement among stakeholders to create transparency among on policy compliance and relevance	
			Revise existing policies to ensure clear articulation to minimise grey areas	

1. Transaction Facilitation support under the Manufacturing Africa programme

Source: Interviews with manufacturers, Expert interview

FCDO is looking to enable initiatives that address the cross-cutting challenges in collaboration with other stakeholders (2/2)

NON-EXHAUSTIVE

Advocacy | Co-ordination | Direct Support

Cross-cutting Challenges	Lever	Proposed solutions	Initiatives	Relevant stakeholders (other than FCDO)
End-user Affordability		Explore the use of locally sourced inputs to reduce import dependence	Identify alternative input streams through technical analysis to increase localisation across priority sectors	Local manufacturers Manufacturer associations Donors
		Leverage carbon credits to subsidise production costs	Advocate private sector input to carbon market policy and ensure ability to access international carbon markets	Federal Government Donors and DFIs with interest in carbon markets
			Train manufacturers to leverage sale of carbon credits from local use of eco-friendly inputs to subsidise final purchase cost for end-users	Local manufacturers Manufacturer associations
Lack of accessible funding for local manufacturers		DFI participation in requirements strategy to create an enabling environment for manufacturers to access finance	Collaborate with commercial banks and DFIs to develop effective requirements for existing funds, accounting for local market maturity and bank profitability and create intervention funds for sectors without specialised funds	Local manufacturers Local commercial banks Federal Government DFIs Central Bank of Nigeria
			Make working capital available to local manufacturers by facilitating offtake agreements; aggregating small players and creating dedicated funding facilities	Local manufacturers DFIs
		Create a public tracking platform for the green manufacturing funding and monitor funding gaps	Develop project delivery trackers across priority sectors to monitor disbursement of funds under existing financing projects	DFIs Fund managers

Source: Interviews with manufacturers, Expert interview

FCDO is also looking to enable initiatives that address identified sector-specific challenges in collaboration with other stakeholders

NON-EXHAUSTIVE

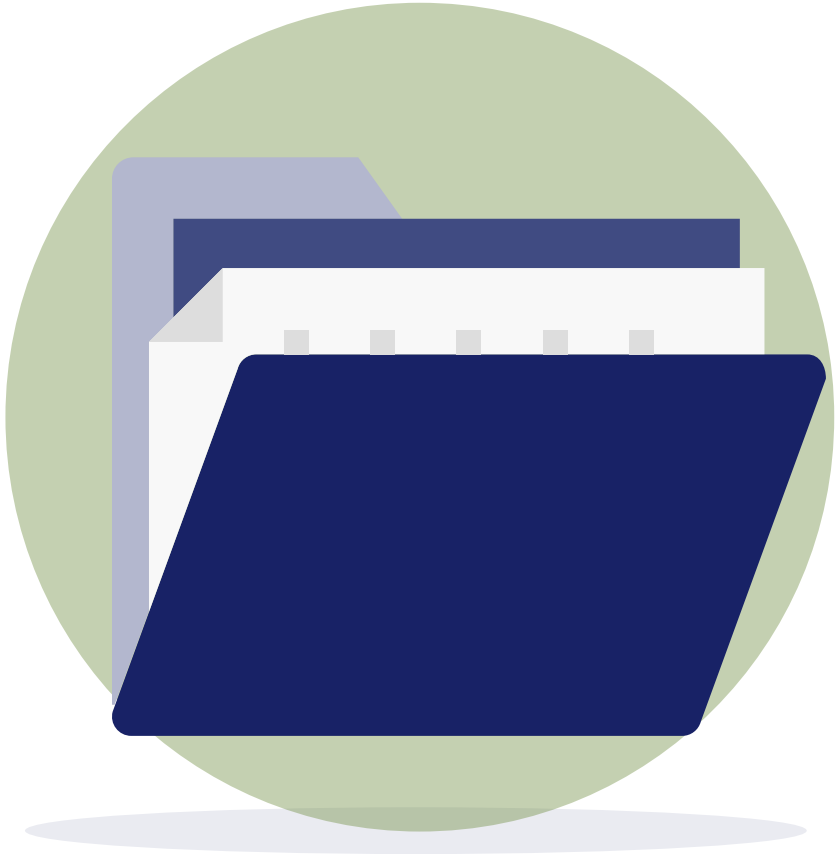
Advocacy | Co-ordination | Direct Support

Sector	Lever	Challenges	Proposed solutions	Initiatives	Relevant stakeholders (other than FCDO)
Plastic recycling		Informal waste collection process[1]	Integrate informal waste pickers into associations/cooperatives to create a structure for waste collection, bolster the supply-chain and improve working conditions	Support existing informal waste pickers association in Lagos State on their formalisation journey and replicate model across other states	Recyclers Association(s) Waste Management Authorities Federal Government Local players (recyclers) Donors
				Engage the Government (at state and federal level) to revise Extended Producer Responsibility (EPR) policies to recognise informal waste pickers and encourage the creation of waste collectors' associations	
		Awareness of waste segregation	Develop awareness campaigns to increase knowledge of waste segregation and recycling	Create campaigns to educate and enable households and companies to properly segregate waste and support local recycling	Recyclers Association(s) Waste management Authorities Local players (recyclers) Donors NGOs and CSOs[2]
				Leverage associations of informal waste pickers (initiative D) to promote effective waste collection practices	
Solar value chain		Business capability gap	Support local solar manufacturers to develop bankable plans for funding proposals	Develop FCDO-led capability building for smaller businesses on expansion targets, strategies and building compelling business plans to enable investor/donor buy-in	Smaller-scale solar manufacturers
		Absence of accredited PV testing labs	Introduce local certification to control local production quality, market sentiment and overcome international standards barriers	Support local manufacturing certification dialogues between SON, local manufacturing stakeholders, and advisory NGOs (e.g. CLASP)	SON CLASP - FCDO REA Local manufacturers
				Work with SON to improve testing throughput capacity of local labs that support the increased needs of local manufacturers	

1. Also relevant to Insect-based animal feed and other waste streams
2. Non-Governmental Organizations & Civic Society Organizations

Source: Interviews with manufacturers, Expert interview

Appendix



Through impact-feasibility analysis, we prioritised seven industries representing a potential $2+ billion in 2030 revenues (1/2)

	01 Plastic recycling	02 Solar value chain	03 Clean cooking value chain
Description	• Local manufacturing of new plastic products (e.g., pellets, water tanks, plastic furniture) from plastic waste	• Local assembly of solar panels and solar pump systems (for irrigation)	• Assembly of clean cookstoves and LPG canister manufacturing; higher-efficiency alternatives to traditional cookstoves and open fires
Impact assessment	• Market potential of $500-600M • Estimated 2Mt reduction in GHG emission compared to the traditional manufacturing method by 2030 • Reduces plastic waste and leads to a cleaner environment	• Combined market potential of $870M -1B • Estimated 3-5Mt reduction in GHG emission through genset replacement by 2030 • Reduced strain on finite energy resources and use of harmful by-products of kerosene lamp combustion	• Market potential of $250-340M • Estimated 10-12.5Mt reduction in GHG emission by 2030 • Reduced harvesting of biomass for cooking, reduction in harmful emissions of particulate matter and black carbon
Feasibility assessment	• Investment of $1-1.5M required to build a plant with a capacity of 10,000 tons/year and a total FDI potential of $100 - $150M • Plastic waste is locally sourced • Technology has been developed and deployed locally	• Solar panels: Investment of $5M to build an assembly plant with a capacity of 100MW/year and a total FDI potential of $50-$100M • Solar pumps: Investment of $5M to build an assembly plant with a capacity of 50,000 pumps/year with a total FDI potential of $10M • Although inputs are imported, skills required are readily available • Assembly processes exist locally, but local fabrication is not yet available	• Clean cookstoves: Investment size of $4M to build a manufacturing plant with a capacity of 300,000 ICS per annum and a total FDI potential of $40M • LPG canisters: Investment size of $40M to build a manufacturing plant with a capacity of 1.2million canisters per annum and a total FDI potential of $120M • Cookstoves: Production is not complex and exists in Nigeria but finishing happens in China • Canisters: Local manufacturing exists although required equipment is imported

$2B+

Revenue potential by 2030 based on expected market growth and adoption rates

$600M+

Investment opportunity based on plant set-up costs for required production capacity by 2030

20Mt+

Potential carbon savings based on expected environmental impact **representing 5-8% of Nigeria's current GHG emissions**

Source: Expert interviews, interviews with manufacturers, internal and external reports, press scan

Through impact-feasibility analysis, we prioritised seven industries representing a potential $2+ billion in 2030 revenues (2/2)

	04 Insect-based animal feed	05 2-wheeler EV assembly	06 Used cooking-oil biodiesel	07 Plant-based proteins
Description	• Local manufacturing of animal protein feed produced from the conversion of insect waste - such as Black Soldier Fly (BSF) larvae - into animal feed	• Local assembly of electric motorbikes and other two-wheelers - with future potential for local manufacturing	• Local manufacturing of biodiesel from used cooking oil as a substitute for fossil fuel-based diesel	• Local manufacturing of plant-based alternatives - such as soy - to animal-based protein ingredients
Impact assessment	• Market potential of $500-700M • Manufacturing of BSF animal feed provides a use for agricultural waste products and creates organic fertilizer, a valuable by-product that also leads to improved soil health • Increased circularity and reduction in the use of water and land in the production of animal feed	• Market potential of up to $45M • Estimated 6Mt GHG reduction in base-case and 20Mt reduction in aggressive case by 2030 • Reduces emissions of exhaust fumes • Reduces fossil fuel dependency	• Market potential of $20M • Potential 100kt+ reduction in GHG emissions by 2030 • Reduction in wastewater and hazardous waste by up to 79% and 96% respectively	• Market potential of $16-18M • Estimated 200kt reduction in GHG emissions by 2030 • Reduced waste from the meat and dairy industries
Feasibility assessment[1]	• Investment of $15M to build manufacturing plants with a capacity of 10-50 tons/day and a total FDI of $150-$200M • Agricultural waste is locally sourced • Technology has been developed and deployed locally	• Investment of $6M to build a manufacturing plant with a capacity of 150 - 200 units per month and a total FDI potential of $78M • Inputs are to be imported • Assembly process has been developed and deployed in Nigeria	• Investment of $10M to build a manufacturing plant with a capacity of 10,000 tons/year and a total FDI potential of $10M • Used cooking oil is readily available locally, however, there is no collection mechanism in place • Production process is not complex and can be deployed easily	• Investment of $5-6M to build a manufacturing plant with a capacity of 2,000-2,500 tons/year of TSP and a total FDI potential of $25-30M • Soy is available locally on a large scale • Production process does not require sophisticated technology

Source: Expert interviews, interviews with manufacturers, internal and external reports, press scan