European Commission

VALUE CHAIN ANALYSIS FOR DEVELOPMENT

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Maize value chain analysis in Nigeria

Value chain analyses assist in informing policy dialogue and investment operations. They help the understanding of how agricultural development fits within market dynamics. They permit an assessment of the value chains' impact on smallholders, businesses, society and environment.

The European Commission has developed a standardised methodological framework for analysis (https://europa.eu/capacity4dev/value-chain-analysis-for-development-vca4d-/wiki/1-vca4d-methodology). It aims to understand to what extent the value chain allows for inclusive growth and whether it is both socially and environmentally sustainable.

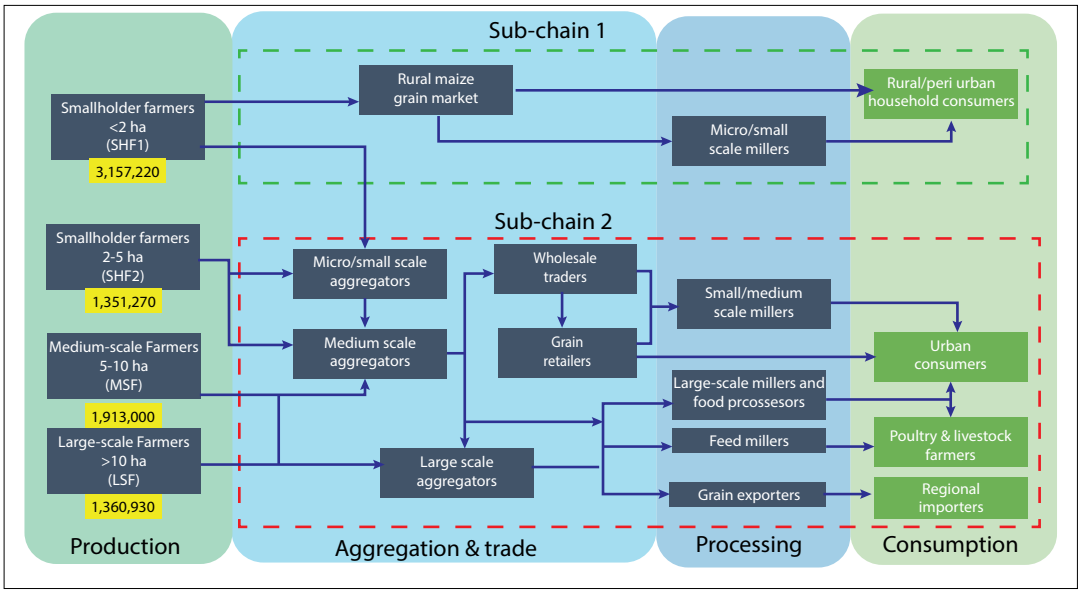
The value chain context

Maize is an important product in Nigeria's farming and food systems. Total maize production in Nigeria reached over 12.5 million t in 2019 and the country emerged as one of the worlds leading maize producers. Nigeria is a leading producer of non-genetically modified (non-GM) white maize that is generally preferred in the food systems in most African countries. Maize production is concentrated in the northern states, which account for about 79% of maize marketed in the country.

The maize value chain (VC) plays a vital role in food security of the country, providing income and food to rural population and smallholder farmers. Being one of the primary food staples, it is consumed widely across the country and among households of different means. In addition the maize VC supplies raw materials to producers of animal feed (for poultry, livestock, aquaculture, etc.) and food processing companies of varying sizes as well as some of the beverages and confectionary industries. As a result, the demand for maize has been growing, sometimes leaving the country with the risk of a supply shortfall.

The European Union intervention

The EU and Nigeria have a longstanding cooperation, focusing particularly on food and nutrition security. Through the EDFI AgriFi project, the EU is supporting investments in the maize VC for up to €5 million to distribute inputs, equipment and services to network of small farmers in the North, with the aim to increase the number of farmers involved and improving their yields.



This is in line with the Agricultural Transformation Agenda (ATA) promoted by the Federal Ministry of Agriculture and Rural Development (FMARD) whose aim is to generate sectorial growth and employment through a commodity value chain approach.

Figure 1: Flow of traded dry maize grain in Nigeria in 2019 (t)

Functional analysis

Typology of farmers and sub-chains

Maize farmers in Nigeria are mainly categorized on the basis of the average farm size (Figure 2): mainstream smallholder farmers (SHF1) who cultivate less than 2 ha and use very little or no yield-enhancing inputs (i.e improved seed, fertiliser and pesticides); smallholders (SHF2) who cultivate between 2-5 ha and receive support under various schemes; medium (MSF) and large-scale farmers (LSF) (9 to 100 ha) that are commercial farmers mostly located in the northern savannah states where they engage in intensive mono-cropping on a large scale.

The maize VC consists of two main sub-chains based on the type of farmers, the end products supplied to consumers and the predominant marketing channel (Figure 1). Sub-chain 1 is dominated by SHF1 farmers who usually sell directly in rural maize grain market. A part of the maize reaching the rural maize market goes to micro/small-scale millers.

Sub-chain 2 include SHF1 farmers whose produce enters this sub-chain through trade, involving micro/small-scale rural aggregators. There are also SHF2 farmers, who are mainly participating in outgrower schemes under which they receive support from the aggregators to whom they are linked. Large-scale aggregators running the outgrower schemes provide inputs on credit to the SHF2 farmers with a commitment to buy grains equivalent to the credit extended. They are also able to buy any extra output the farmers are willing to sell. These schemes have enabled many SHF2 farmers to increase their yield by 15% significantly increasing their maize-derived household income. Their delivery to the large-scale aggregators is through a network of village-based groups, and this shortens the supply chain, making it possible to obtain higher farmgate prices which represent 84% of the final grain market price (compared to 68% for the SHF1). The MSF and LSF farmers in the sub-chain 2 usually market their crops directly to large-scale aggregators. The MSF farmers also supply directly to the wholesalers. They are well equipped compared to small farmers and their post-harvest losses are lower thanks to better storage facilities.

Production, trade and processing

The combined production of maize by SHF1 and SHF2 farmers represents 69% of the total maize output (Figure 2). The MSF and LSF farmers account for 19% and 12% of total output respectively.

Out of total maize produced in the country, about 10% is sold as fresh corn-on-cob which is mainly consumed as a snack in the urban areas. Another 15% is consumed by farm households and an estimated 15% is lost postharvest and is presumed not to be traded. SHF1 and SHF2 contribute close to 58% of total marketed maize output, which includes fresh corn-on-cob while MSF and LSF farmers' share is about 42%. Only a fraction of the total dry maize grain which is traded is sold to rural consumers, the rest being marketed in the urban formal and informal grain markets depicted as Sub-chain 2 (Figure 1).

Grain aggregators in Sub-chain 2 transport maize from the rural areas of production to the major urban and regional export markets. Many of the large-scale aggregators have storage facilities, which ensure year-round availability of supply even though the production is seasonal.

The large-scale millers engaging in feedstock production for poultry and the livestock industries and/or producing food flour for human consumption are dominant but a rapidly growing number of micro/small-scale millers have also entered the Nigerian market, especially in the northern states.

YIELD/ FARMERS	SHF1	SHF2	MSF	LSF
Estimated number of farmers	2,440,000	279,720	73,120	3,467
Average area planted with maize per farm (ha)	1.5	3.5	9.3	100
Total area planted with maize (ha)	3,660,900	985,600	678,800	346,760
Estimated yield per hectare (t)	1.8	2.1	3.5	4.5
Average output per farm (t)	2.7	7.4	32.5	450
Total production of maize grain (t)	6,589,000	2,069,950	2,376,400	1,560,500
Marketed dry maize grain (t)	3,157,220	1,351,270	1,913,000	1,360,930

Figure 2: Typology of maize farmers and their contribution to production

Governance

The maize VC has two distinct governance structures based on the co-existence of informal and formal markets. In the informal market, the governance system is trust-based without formal contracts. Most SHF1 and micro/small-scale aggregators who operate in the informal market find it extremely difficult to access the remunerative but quality-sensitive markets dominated by large-scale food processors and feed millers. The formal marketing system centres around major offtakers with significant market power (i.e feed millers, food manufacturers or breweries). The offtakers specify supply terms which include minimum volumes to be delivered, applicable quality parameters and payment terms. Farmers organisations have demonstrated limited capacity in advocacy regarding agricultural sector policies and had marginal involvement in the emerging outgrower schemes.

What is the contribution of the value chain to economic growth?

Financial viability for the actors

The operations of all actors in the maize VC are profitable (Figure 3). Grain is particularly profitable, as the return on turnover (ROT) ranges from 31% for SHF2 to 38% for LSF. The SHF2 have a net operating profit almost 4 times higher than the SHF1 while they have an area planted in maize barely twice as large (Figure 2). As usual, profitability is tighter for traders, where the only operators posting ROT of about 10% are the large-scale aggregators. At the processing level, the ROT is the tightest among the feed millers (16%) which is not surprising as the processing sector is highly competitive.

	Net Operating Profit (in Naira and Euro)	Return on turnover (%)
Large-scale farmer (LSF)	N22,400,000 (€54,600)	38
Smallholder farmer (SHF1)	N68,400 (€170)	34
Smallholder farmer (SHF2)	N252,000 (€614)	32
Medium-scale farmer (MSF)	N1,120,000 (€2,700)	31
Large-scale miller and food processor	N2,791,195,800 (€6,800,000)	23
Small and medium miller	N540,000 (€1,300)	20
Micro/small-scale miller	N 60,000 (€150)	19
Feed miller	N8,009,676,117 (€19,500,000)	16
Large-scale aggregator	N738,500,000 (€1,800,000)	13
Small and medium aggregator	N775,000 (€2,000)	7.7
Wholesaler and grain exporter	N18,500,000 (€45,000)	6
Rural collector and micro/small-scale aggregator	N175,000 (€425)	5.5
Retailer	N66,500 (€160)	4.5

Figure 3: Profitability for individual actors

Net Operating Profit (NOP): Net income of the actor (excluding depreciation)

Return on turnover (ROT): Operating profit/production

Impacts on the national economy

The total value added (VA) generated by the maize VC is estimated at Naira (N) 1,502 billion (€3.66 billion) which corresponds to 83% of the value of the production, thus there are few imports of goods and services for the VC. The **direct VA** by the main actors in the VC accounts for 79.5% of the total VA whilst the remaining 20.5% represents the contribution of suppliers of goods and services (transport and utilities). The **contribution of the VC to the GDP** and **agricultural GDP** is 0.9% and 3.8% respectively, that is quite important.

Maize farmers are the **main contributors to the generation of the total VA** (51%) followed by maize processors (20%), providers of inputs and services (18%) and traders (11%). More than half of the total VA generated is shared among the actors of the VC as net operating profits (Figure 4).

The **contribution of the VC to public finances** is negative, by N5.4 billion (minus €13 million) due to input subsidies from the public purse (but SHF1 farmers have little or no access to the subsidized inputs). The contribution to the balance of trade is also negative as the value of imported intermediate goods and services exceeds exports. The VC is well-integrated into the national economy with a **rate of integration** of 83%, meaning that 83% of the value of production is value added and 17% is imports.

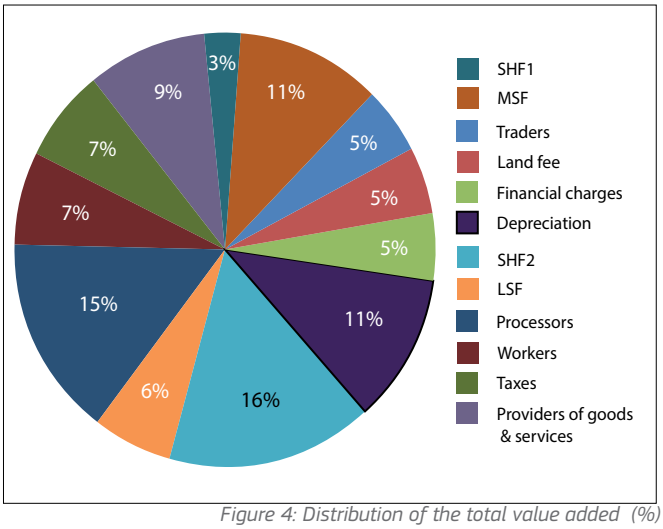


Figure 4: Distribution of the total value added (%)

Viability in the international economy

The Nominal Protection Coefficient (NPC) is 1.09 and indicates that the domestic value is higher than the international market price and local maize farmers benefit from a level of protection. This highlights the need to increase the productivity of local maize farmers if they are to be price competitive. The Domestic Resource Cost (DRC) ratio is below 1 (0.19) meaning that the VC has a comparative advantage and is viable in the international economy.

The maize value chain makes significant contributions to the country's economy. Total value added generated per year is N1,502 billion (€3.66 billion) which correspond to 0.9% of Nigeria's GDP and 3.8% of the country's agricultural GDP. All the actors of the value chain obtain positive net operating profits. However, annual maize-based income for the SHF1 is way below the national poverty line, but they usually allocate less than 20% of their cultivated area to maize production. For SHF2 farmers, the significant increase in maize-based income is not only due to the expansion in area under maize cultivation but also to rising crop yields, lower postharvest losses, and increase in the prices they obtain as a result of selling through a shortened, formal marketing chain.

Is the economic growth inclusive?

Distribution of income among the actors

The VC businesses are the main beneficiaries of the total VA (53%) followed by workers (15%) (Figure 4). Most of the operations at production and processing are labour-intensive. Smallholder farmers (both SHF1 and SHF2) are the main source of wages income in the VC.

At both the grain production and trade level, smallholder farmers and small-scale aggregators are the main recipient of the income generated. However, these actors have limited access to resources (inputs, credit, etc.). It is at the processing level where large-scale actors dominate significantly due to the dominance of the poultry feed milling industry as the feed millers get alone 52% of the profits.

Job creation and employment

The maize VC creates nearly 20 million direct and indirect jobs, at the production level, through, micro/small-scale millers who employ young low-skilled workers and through the service providers who engage a lot of casual labourers. Micro/small-scale millers which process large amounts of maize grain into flour and other products for food create job opportunities to the youth, especially in the north, and also to women, particularly in the south.

The value chain benefits a high number of actors, the majority of which are micro and small- scale. Income obtained by smallholder farmers and micro/small-scale millers and other artisanal processors tends to be invested in the local economy and in children's education, healthcare, housing and other enterprises. However, the small actors have little power to negotiate price and payment terms with the large-scale actors. Transactional relationships between farmers and off-takers needs to be improved to promote inclusion and sustainable growth in the value chain.

Is the value chain socially sustainable?

The following graph and table provide an image of the main social consequences of the VC activities in six strategic domains.

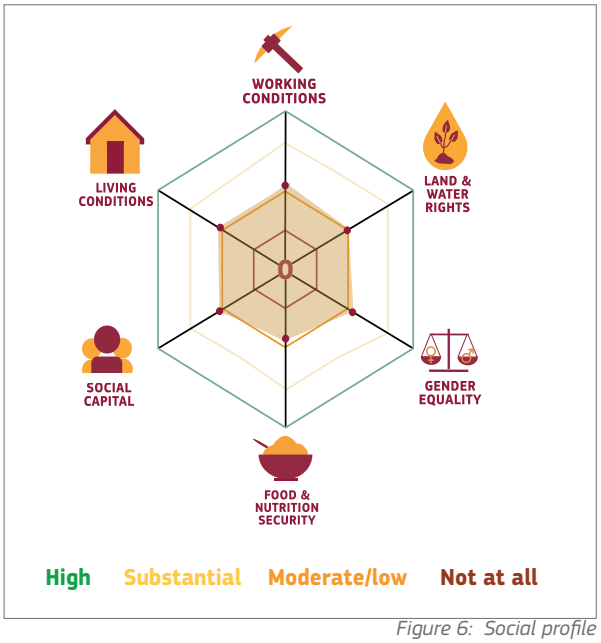


Figure 6: Social profile

Limited access to resources such as credit and inputs for farmers and micro/small-scale processors hamper sustained growth in the value chain. Lack of effective farmer producers' organisations representing interests of smallholder farmers and the inability of smallholders to negotiate price and payment terms with large milling companies and poultry feed factories illustrates the power imbalances between the VC actors.

Working conditions	• Lack of application of minimum wage to agricultural workers (only applied to federal workers in the formal sector) • Unequal wage rates for male and female workers in production • Hazardous working environment for youth in small and medium-scale processing units
Land and water rights	• Customary laws and informal arrangements applied in the governance of landholding; lack of respect of the right to use, control or transfer land for women under customary rights • Fragmentation (due to inheritance) and decreasing productivity of land at smallholders • Lengthy procedures for land title registration, verbal agreements commonly in place
Gender equality	• Less participation of women in downstream activities due to limited education and mobility, weak access to information and credit • Presence of some government or NGO development programmes facilitating women's access to extension services and input supplies • Women's weak control over the income earned from maize production at SHF farmers
Food and nutrition security	• Competition for maize use between its direct consumption in households and as input in the feed industry • Risk of periodic food shortages due to crop failure and unstable market prices • Low maize-based income of SHF1 farmers to reinvest in food production • Limited access of smallholder households to animal protein
Social capital	• Presence of farmer producers' organisations and professional associations at various levels of the VC but highly gendered • Smallholder farmers' limited access to market or technical information • Extension services easily accessible for large-scale farmers and those participating in schemes alongside aggregators
Living conditions	• Very limited access to safely managed drinking water in the major maize-producing states and smallholders • Unequal access to healthcare facilities in rural areas due to distance and cost of treatment

Is the value chain environmentally sustainable?

The environmental impacts of the maize VC are measured through the Life Cycle Assessment (LCA) considering three areas of protection: resource depletion, ecosystem quality and human health. LCA results show also the VC's impact on climate change.

Total impact on the areas of protection

The damage of the Nigerian maize VC on **resource depletion** shows that there is a surplus **cost of N178 billion (€435 million)** for the reference year 2019 due to fossil resource use by the VC activities. This cost is less than 1% of the damage on resource depletion generated by the whole Nigerian population. For the **ecosystem quality**, the maize VC contributes to the loss of **318 species for the reference year** at global level due to emissions released and land use by the VC activities. This loss of species caused by the VC refers to less than 1% of the damage on ecosystems of the total population of Nigeria. Concerning **human health**, diseases or mortalities induced by the VC emissions represent a small contribution (less than 1%) to the overall health impact per year of the total population of Nigeria. The impact of the VC on climate change corresponds to 2% of the total greenhouse gas emissions per year of the total population of Nigeria.

Impact per value chain stages and farm types

The contribution of the different VC stages to the most relevant impact categories per t of maize product shows that **cultivation has the highest contribution in most categories** (Figure 6). About half of the impact on **climate change** is induced by the land use change caused by the VC activities. **Cultivation**, **land use change** and **transport** are the main contributing stages to the environmental damages of Nigerian maize products.

The contribution of the different farm types to the weighted average impacts illustrates that smallholders (SHF1 and SHF2) are the main contributors to land use and climate change due to the large share of smallholders in Nigeria as well as lower yields. The SHF2 and MSF have higher impacts on fossil resource use and particulate matter emissions related to energy and input intensive cultivation.

Critical environmental topics

There are other environmental topics of concern related to the maize VC in Nigeria:

Flooding: serious flooding events cause yield losses and land degradation.

Changing rainfall patterns: causing increasing risks of pests and weeds that hamper the growth of the maize plants and grains.

Low soil fertility: inadequate soil management, soil erosion, and run-off cause low soil quality and yield.

Food loss: significant losses observed during drying/storage of the maize grains (around 1-2% at warehouses and 4.5-5.5% at household level).

Deforestation: demand for fuel wood and increased use of land for maize cultivation and other agricultural activities causing deforestation and thus loss of biodiversity, land degradation and large amounts of greenhouse gas emissions.

Fossil energy use and emissions: significant impact of the combustion of diesel and natural gas used for maize cultivation, post-harvest handling, processing and transport.

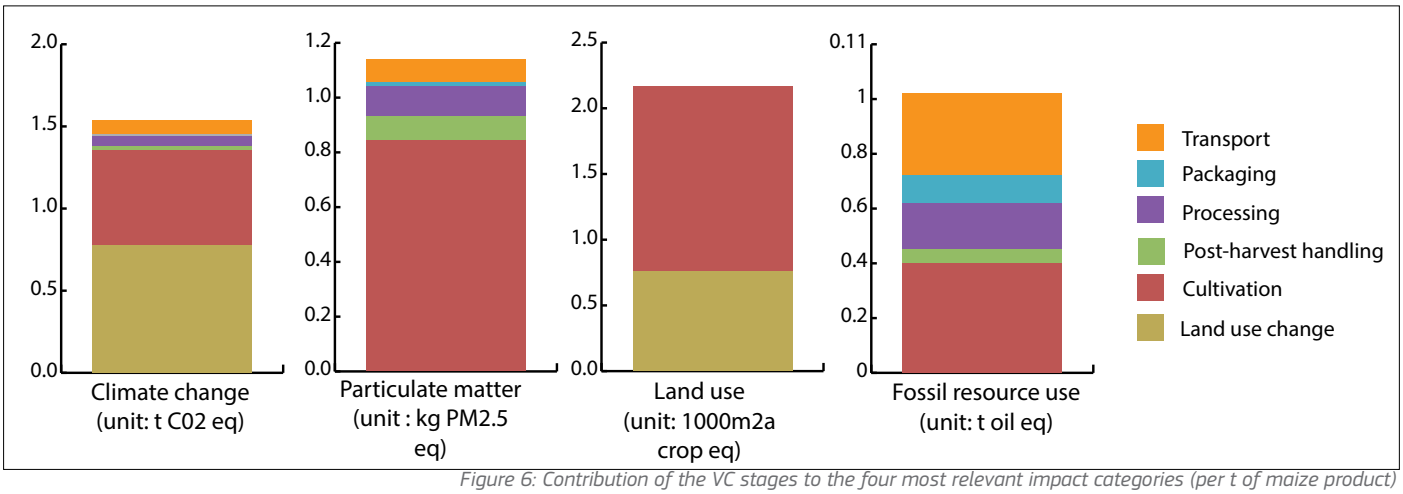


Figure 6: Contribution of the VC stages to the four most relevant impact categories (per t of maize product)

Climate change and land use impacts are strongly related to the yield per hectare and food losses throughout the value chain. Better agronomic practices according to agroecology such as the use of improved/hybrid seeds, improvement of soil fertility (composting/green manures, conservation tillage) and fertiliser use, agroforestry, diversification of crop rotation including nitrogen fixing crops (legumes), flood and pest management (biological pest control) should be considered given the different environmental conditions in Nigeria. This will not only increase yields, but it will also make the crop production more resilient to climate change, less dependent on agrochemicals, and improve the ecosystems quality. Improvement of logistics, storage, and processing also can enable to attain further increase of yields and reduce food losses. The highest potential for environmental damage reduction is the transition from SHF1 to SHF2, given the high number of actors involved.

Main findings

The maize VC in Nigeria makes significant contribution to the country's economy. The country has a comparative advantage, in particular in the production of non-GM white maize. Public sector investments promoting adoption of higher-yielding varieties and uptake of fertiliser and other inputs by some farmers are combined with a market-driven pull by private feed milling and food processing companies to help the VC make strides. The emergence of large-scale aggregators, who are running outgrower schemes has contributed to this by enabling smallholder farmers to overcome some resource constraints and take advantage of opportunities to optimize earnings by trading into a shortened, potentially more remunerative formal markets. There exists potential to increase national production of maize in an inclusive way considering the performance of SHF2 producers that have ties with the private grain aggregators and service providers.

Strengths, weakness, opportunities, threats

STRENGTHS	WEAKNESS
• Leading non-GM maize producer in Africa • Suitable conditions (land and climate) to grow maize in all parts of the country • Importance of maize production for food security and poultry, aquaculture, and livestock subsectors • Capacity to increase production and processing to satisfy the local market through public and private interventions and create employment for women and youth	• Low soil fertility and yields compared to other large maize producing countries • No steady production/supply over the years • Limited access to public extension services and finance • High postharvest losses and other challenges • Deforestation, erratic rainfalls and other climate change effects • Lack of capacity of representative organisations to address key challenges facing VC actors
OPPORTUNITIES	**THREATS**
• Major regional exporter of non-GMO maize varieties • Availability of maize varieties rich in vitamin A and Aflatoxin resistant • Potential roles of farmers' associations to improve yields and reduce postharvest losses through extension services and access to finance • Increased investment opportunities across the maize VC through private initiatives (i.e outgrower schemes) and public programmes (i.e. Nigeria Incentive-based Risk Sharing Agricultural Lending).	• Natural risks (i.e drought, floods, erratic rainfall, and hailstorms, crop and livestock diseases and pests) • Market and policy risks (uncertainty of access to inputs and remunerative markets, variability in inputs quality, volatility in input and output prices, macroeconomic policies) • Production risks (instability over the years, domestic shortages) • Health and security risks (endemic diseases, epidemics, civil strife, breakdown in law, etc.)

Recommendations

Strengthening and upscaling of the outgrower schemes developed by private large-scale aggregation companies. The case of SHF2 farmers shows that large-scale aggregation companies are well-placed to improve access to inputs and services for smallholders. SHF2 farmers can obtain higher yield. This generate economic, social and environmental benefits, including significant increase in household income, which can take smallholders out of poverty.

Promoting better agricultural practices as part of extension system and outgrower schemes. Higher yields can increase farmers' income and food access (i.e. case of SHF2) whilst helping to reduce adverse environmental impacts from farming (driven by greenhouse gas emissions, land use and deforestation). For sustained yield growth, farmers need extension services on sustainable agroecological and postharvest handling practices which foster soil quality and resilient farming systems.

Investing in aggregation facilities to enable smallholders to bulk and deliver their grains to commercially-run storage facilities (i.e. under a regulated warehouse receipt system - WRS). Nigeria has the key technical prerequisites for setting this system up but some key policy-related bottlenecks need to be addressed. Presence of strong farmers organisations is needed.

Value Chain Analysis for Development (VCA4D) is a tool funded by the European Commission / INTPA and is implemented in partnership with Agrinatura.

Agrinatura (http://agrinatura-eu.eu) is the European Alliance of Universities and Research Centers involved in agricultural research and capacity building for development.

The information and knowledge produced through the value chain studies are intended to support **the Delegations of the European Union** and their partners in improving policy dialogue, investing in value chains and better understanding the changes linked to their actions. VCA4D uses a systematic methodological framework for analysing value chains in agriculture, livestock, fishery, aquaculture and agroforestry. More information including reports and communication material can be found at: https://europa.eu/capacity4dev/value-chain-analysis-for-development-vca4d-

This document is based on the report "Maize Value Chain Analysis in Nigeria" 2022, by Gideon Onumah (NRI), Thomas Ponsioen, Mona Dhamankar (KIT), and Muhammad Bello. Only the original report binds the authors.